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PRODUCTIVITY PERFORMANCE IN THE OECD AREA: AN INTERNATIONAL PERSPECTIVE

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Dirk Pilat, OECD[1]

1. Senior Economist, Economic Analysis and Statistics Division, Directorate for Science, Technology and Industry. This paper reflects the views of the author and not necessarily those of the organisation or its member countries. The findings of this paper draw on work of many colleagues at the OECD, as cited in the bibliography; their contributions are gratefully acknowledged; errors or misinterpretations in reflecting their work in this paper are my responsibility. Participants at workshops organised by the Federal Reserve Board, Banque de France, CEPII, IFO, New Zealand Treasury and the Bank of Canada provided useful comments on previous drafts of this paper. Contact: dirk.pilat@oecd.org

PRODUCTIVITY PERFORMANCE IN THE OECD AREA: AN INTERNATIONAL PERSPECTIVE

I. Introduction

The promotion of growth and productivity are on the policy agenda in most OECD countries, as governments seek to address problems related to sluggish growth, such as low employment growth, high unemployment or fiscal deficits. This agenda has also affected the work of the OECD. A comprehensive study of growth performance in the OECD area, including a set of policy recommendations, was presented to the OECD Ministerial meeting in May 2001 (OECD, 2001*a*). Further empirical findings and policy recommendations, focusing on the role of firm dynamics, regulatory factors and information and communications technology (ICT), were released in 2003 and 2004 (OECD, 2003*a*; 2003*b*; 2004*a*).

This paper returns to the findings of these OECD studies and presents new empirical evidence on economic growth and productivity and its key drivers at the aggregate, industry and firm level. It particularly focuses on the different growth experience of the main OECD regions, notably Europe, the United States and Japan. The next section discusses aggregate growth patterns in the OECD area, including the measurement problems that affect productivity comparisons. It also examines the main drivers of productivity and discusses some of the factors that influence the impact of these drivers on growth performance as well as the policies that may help strengthen growth. The third section focuses on multi-factor productivity (MFP) growth, or the overall efficiency of labour and capital, and some of the factors that may have influenced the pick-up in MFP growth in certain OECD countries, such as investment in R&D and more rapid innovation, as well as the impacts of ICT use and firm turnover. The final section draws some conclusions.

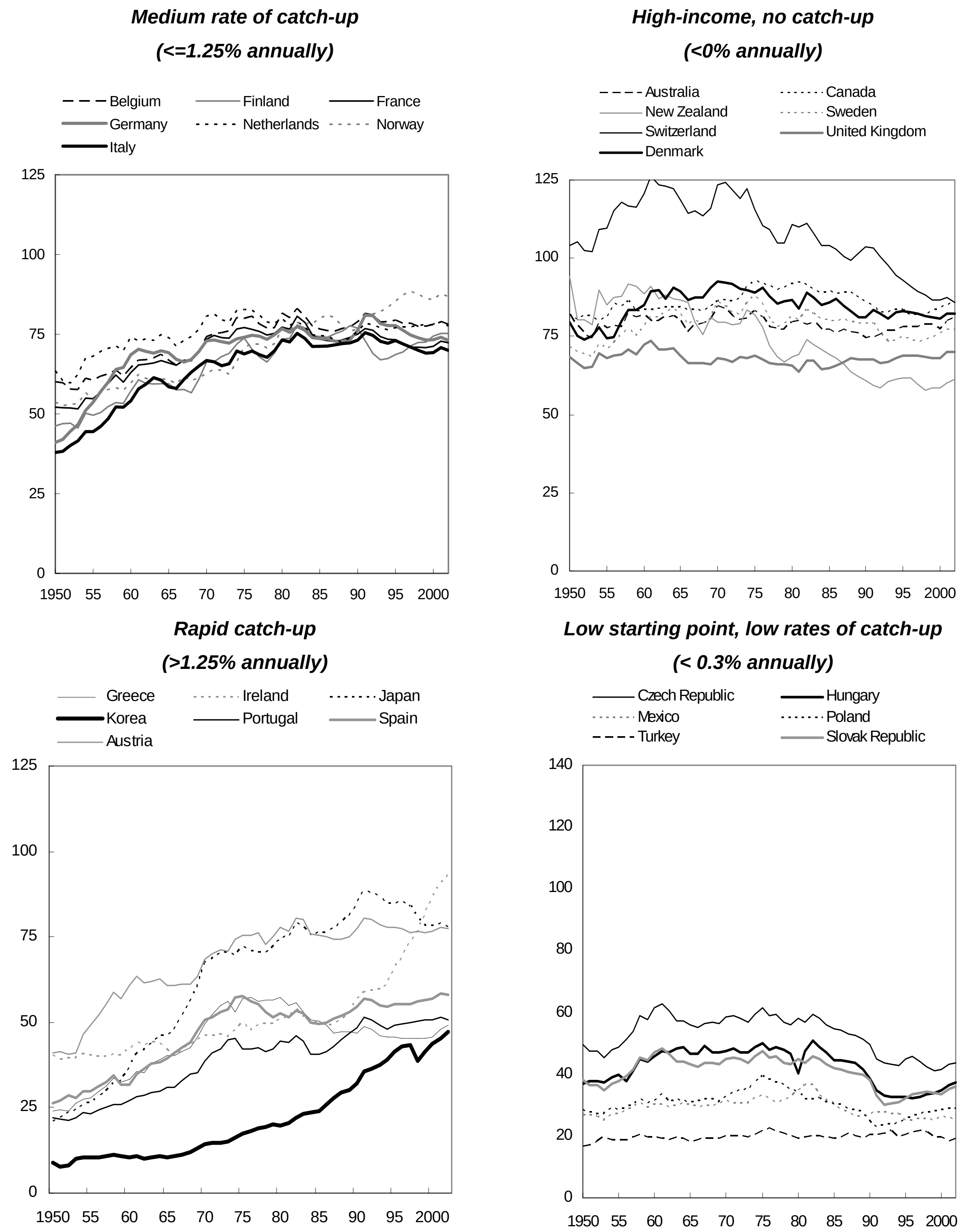
II. Growth patterns in the OECD area

II.1 Growth diverged in the OECD area

The interest of many OECD countries in economic growth over the past years was linked to the strong performance of the United States over the second half of the 1990s and the reversal of the catch-up pattern that had characterised the OECD area over the 1950s and the 1960s. During much of the early post-war period, most OECD countries grew rapidly as they recovered from the war and applied US technology and knowledge to upgrade their economies. For most OECD countries, this catch-up period came to a halt in the 1970s; average growth rates of GDP per capita over the 1973-92 period for much of the OECD area were only half that of the preceding period, and many OECD countries no longer grew faster than the United States (Maddison, 2001).

During the 1990s, a different pattern emerged. Even though the United States already had the highest level of GDP per capita in the OECD area at the beginning of the decade, it expanded its lead on many of the other major OECD countries during the second half of the 1990s. A few other OECD countries, including Australia, Canada, Finland, Greece, Ireland, Portugal and Sweden, also registered markedly stronger growth of GDP per capita over the 1995-2002 period compared with the 1980-1995 period (OECD, 2003a; De Serres, 2003). Some of these countries continued to catch up with the United States in the second half of the 1990s. In contrast, the increase in GDP per capita in several other OECD countries, including Japan, Germany and Italy, slowed sharply over the second half of the 1990s, leading to a divergence with the United States (Figure 1).

Figure 1: **Catch-up and convergence in OECD income levels, 1950-2002, United States = 100**



Source: OECD (2003*c*), Science, Technology and Industry Scoreboard 2003, OECD, Paris.

Even though US growth performance is no longer considered to be as exceptional as was claimed during the "new economy" hype, its strong performance over the second half of the 1990s has increased interest in the analysis of economic growth and the sources of growth differentials across countries. The

OECD work suggests that the divergence in growth performance in the OECD area is not due to only one cause, but that it reflects a wide range of factors. These are discussed below in more detail. Differences in the measurement of growth and productivity might also be contributing to the observed variation in performance. A recent OECD study (Ahmad, *et al*, 2003) suggest that such differences do play a role, but that they probably only account for a small part of the variation in growth performance (Box 1).

Box 1. **Some measurement problems for the analysis of productivity growth**

Recent OECD work has examined how measurement problems affect international comparisons of labour productivity (Ahmad, *et. al.*, 2003). It suggests that these measurement problems do not significantly affect the assessment of aggregate productivity patterns in the OECD area. However, they do influence the more detailed assessment of productivity growth, notably the role of specific sectors and demand components in aggregate performance.

The work shows that there are a number of significant problems regarding the comparability of nominal GDP across OECD countries. One problem concerns expenditure on military equipment. The United States capitalises expenditures on military equipment (aircraft, ships, missiles) that are not considered assets by the System of National Accounts (SNA). The national accounts in Europe, Canada and Asia strictly follow the SNA in this matter; they only capitalise (and depreciate) military expenditures that can be also used for civilian purposes. Over the past decade, inclusion of this factor in US GDP has implied that growth was 0.03 percentage points per year less than it would have been if the United States had used the same approach as European countries or Japan.

A second difference concerns financial intermediation service indirectly measured (FISIM) It is relatively straightforward to recognise and estimate FISIM. The key problem is breaking it down between final consumers (households) and intermediate consumers (businesses). Only the first part has an overall impact on GDP. In the United States, Canada and Australia, such a breakdown has been estimated in the national accounts for some time, in accordance with the recommendations in the SNA. In Europe and Japan, despite the recommendation of the SNA 93, the implementation of a breakdown between final and intermediate consumers has been delayed, since there was, until recently, no internationally-agreed statistical method of allocation between final and intermediate consumers. If the US national accounts had used the same method as the European countries and Japan, US GDP growth would have been less by 0.1%, both in 2000 and 2001. In principle, this difference in methodology should be largely reduced in 2005.

The third factor concerns differences in the measurement of software. The 1993 SNA recommended that purchases of software (and any own-account production) should be treated as investment as long as the acquisition satisfied conventional asset requirements. This change added about 1% to GDP in most OECD economies in the mid-1990s. However, the range of the adjustments to GDP differs substantially across OECD countries, since software investment is currently underestimated to a significant degree in several OECD countries. Improved measures of software investment may increase GDP growth in some countries (*e.g.* Japan and the United Kingdom) by up to 0.2 - 0.3% over the second half of the 1990s. In all cases, these measurement problems are more prevalent when comparing GDP levels than for comparisons of GDP growth rates.

Measurement differences for real GDP are also important, although several of these factors have impacts that work in different directions. Moreover, several of the measurement problems primarily affect the distribution of total GDP across different expenditure categories and across different activities, not necessarily GDP growth. For example, improving the output measurement of service sector deliveries to intermediate demand will primarily affect the contribution of these services to aggregate growth at the cost of other sectors; it will not necessarily affect total GDP growth. No definite assessment of the size of the differences due to mis-measurement of real GDP can therefore be provided, although some best practices can be derived. For example, the use of hedonic price measures to reflect rapid quality change will simultaneously require the use of chain-weighted indices. Using hedonic prices in combination with fixed weights will lead to an overstatement of GDP growth and reduced international comparability. Efforts in this area to spread the use of hedonic price measures across countries, to move towards chain-weighted indices and to improve output measurement in services should help address some of the key problems involved.

The measurement of labour input is the third major factor that determines comparability of labour productivity estimates. The choice of employment series for productivity analysis can have a substantial impact on the resulting estimates, as can the estimate of hours worked. A key challenge in deriving comparisons of productivity growth across OECD countries lies in ensuring that estimates of labour input are consistent with the GDP information and that the components of labour input, hours worked and employment are internally consistent. The combination of inconsistent series of employment and annual hours worked can lead to biased estimates of labour productivity growth. To address this problem, OECD has developed a reference database on productivity at the aggregate level (Box 2).

To reduce the uncertainty of empirical analysis related to the choice of data, OECD has developed a new Productivity Database, which is used in this paper (Box 2). This database is still under development and further methodological adjustments to enhance comparability of productivity estimates will be incorporated in due course.

Box 2. **The OECD Productivity Database**

Productivity comparisons constitute an important focus of OECD work. It includes both efforts to improve the measurement of productivity growth, and efforts to improve the understanding of the drivers of productivity performance and the policies that governments could undertake to strengthen productivity performance. Such analysis reflects a strong interest in many OECD Member countries. The OECD Productivity Database aims at meeting the demand of inside and outside users of OECD statistics by bringing together those series that are judged best suited for productivity analysis. Where possible, data has been complemented with methodological information to facilitate an assessment of its quality and its international comparability.

The productivity database has been developed in co-operation between several parts of the organization to streamline efforts and to bring together relevant expertise. At this point, and concerning measures of *productivity growth*, the database comprises the following series: (i) Measures of output growth (GDP); (ii) labour input growth (index of total hours worked); (iii) labour productivity growth (index of GDP per hour worked); (iv) capital services growth; (v) growth of combined labour and capital inputs; (vi) cost shares of inputs; (vi) multi-factor productivity growth.

Presently, these data are only available at the level of the total economy. Estimates for the business sector are under development, but these are faced with large-cross country differences in the roles of the market and non-market sector across OECD economies and with data constraints, notably for the estimation of capital services. The productivity estimates for the total economy cover about 28 countries for measures of labour productivity and about 18 OECD countries, including the G7 countries, for capital services and multi-factor productivity. The data for labour productivity typically cover the period 1970-2002, whereas those for capital services and MFP are available for the period 1985-2002 (or the latest year available).

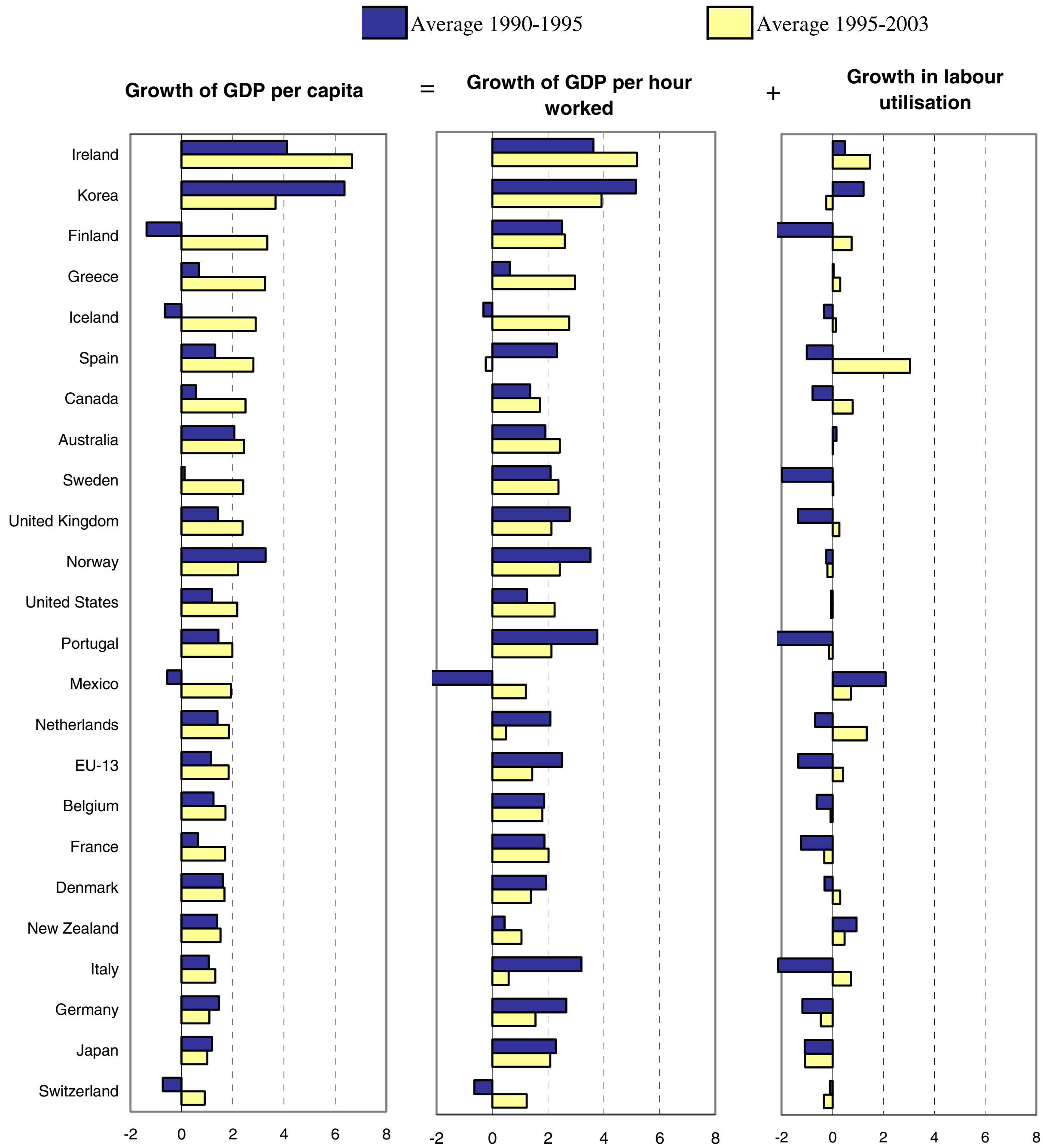
The Productivity database can be accessed from the Statistics Portal of the OECD web pages (http://www.oecd.org/statistics/productivity/). More methodological detail is also available there.

II.2 Labour utilisation plays a key role

The first factor affecting growth differences concerns labour utilisation (Figure 2). In the first half of the 1990s, most OECD countries, in particular many European countries were characterised by a combination of high labour productivity growth and declining labour utilisation. The high productivity growth of these EU countries may thus have been achieved by a greater use of capital or by dismissing (or not employing) low-productivity workers. In contrast, the United States, Australia, Ireland, New Zealand and the Netherlands experienced a combination of productivity growth and stable or growing labour utilisation. In the second half of the 1990s, many European countries improved their performance in terms of labour utilisation, as unemployment rates fell and labour participation increased. However, this was accompanied by a sharp decline in labour productivity growth. In contrast, some other OECD countries, such as Canada, Ireland and the United States experienced a pick-up in both labour utilisation and labour productivity growth from 1990-95 to 1995-2002, showing that there need not be a trade-off between labour productivity growth and increased use of labour.[2]

2 . The estimates shown in Figure 2 are not adjusted for the business cycle. Trend-adjusted estimates prepared by the OECD Economics Department broadly confirm the findings of Figure 2. They suggest that the United States had slightly more rapid growth of GDP per capita than the European Union over the 1990s and that the difference in labour productivity growth between the two regions is relatively small. The bulk of the difference in growth performance between the two regions is therefore explained by labour utilisation, where the United States experienced stronger performance than the European Union.

Figure 2: **Changes in labour utilisation contribute to growth in GDP per capita**
Percentage change at annual rates, 1990-95 and 1995-2003

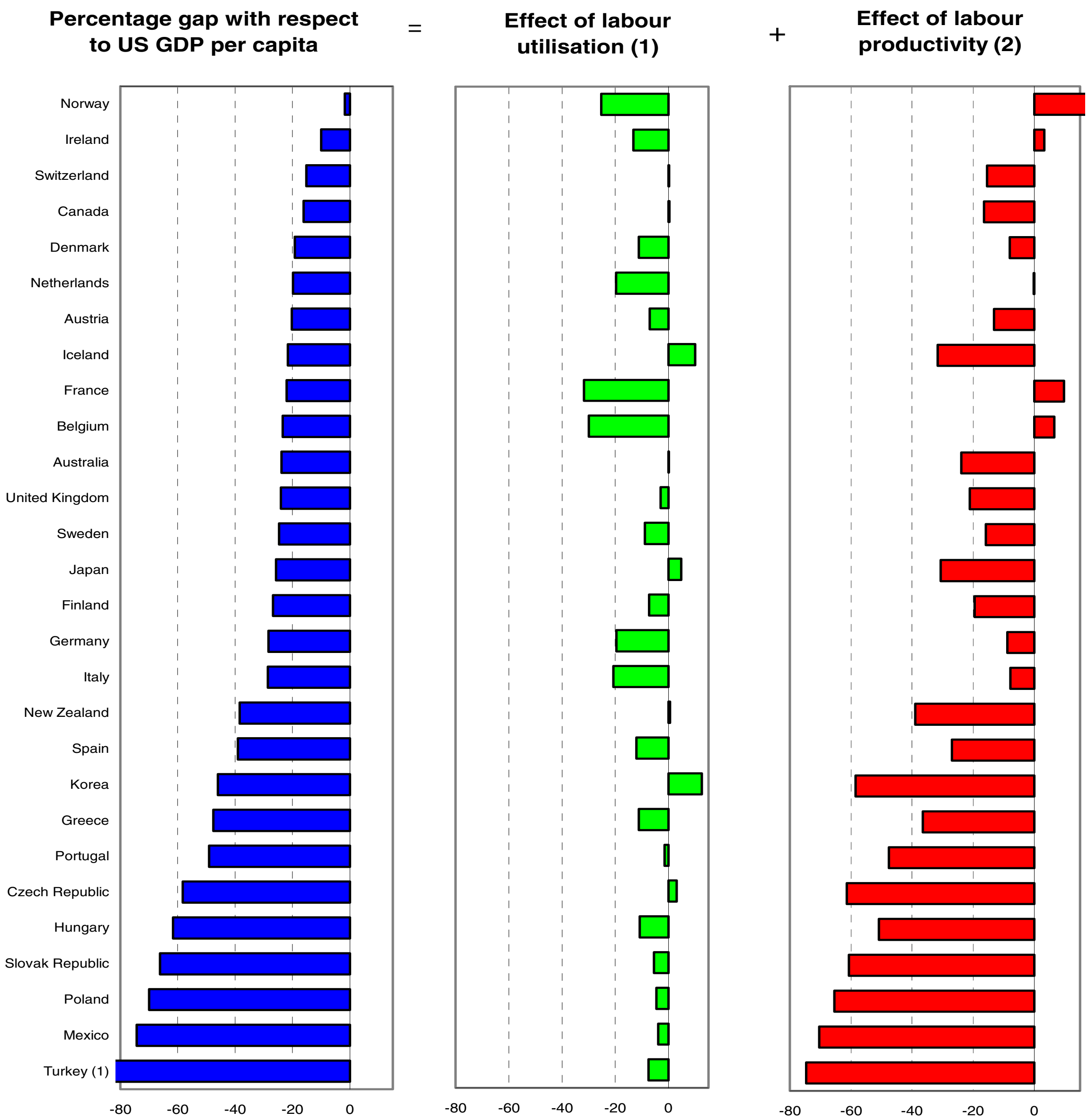


EU-11: Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the United Kingdom.
Source: OECD, Productivity Database, September 2004, see De Serres (2003) for cyclically adjusted estimates.

Achieving a combination of labour productivity growth and growing labour utilisation requires well-functioning labour markets that permit and enable reallocation of workers. This is particularly important during times of rapid technological change. Labour market institutions have to ensure that affected workers are given the support and the incentives they need to find new jobs and possibly to retrain. In many countries, institutions and regulations hinder the mobility of workers and prevent the rapid and efficient reallocation of labour resources (OECD, 1999). In most of the countries characterised by a combination of increased labour utilisation and labour productivity, reforms over the 1980s and 1990s improved the functioning of labour markets, effectively enabling more rapid growth. Despite the progress in enhancing labour utilisation that has been made in many OECD countries over the 1990s, further improvements will be needed, in particular as the population in many OECD countries is ageing rapidly. Moreover, for several OECD countries, notably many European countries, there is still a large scope for improvement in labour utilisation, as it accounts for the bulk of the gap in GDP per capita with the United States (Figure 3).

Figure 3: **Income and productivity levels, 2002**

Percentage point differences with respect to the United States



1. Based on hours worked per capita.
2. GDP per hour worked.
3. GDP estimates for Turkey are based on the 1968 System of National Accounts (SNA).

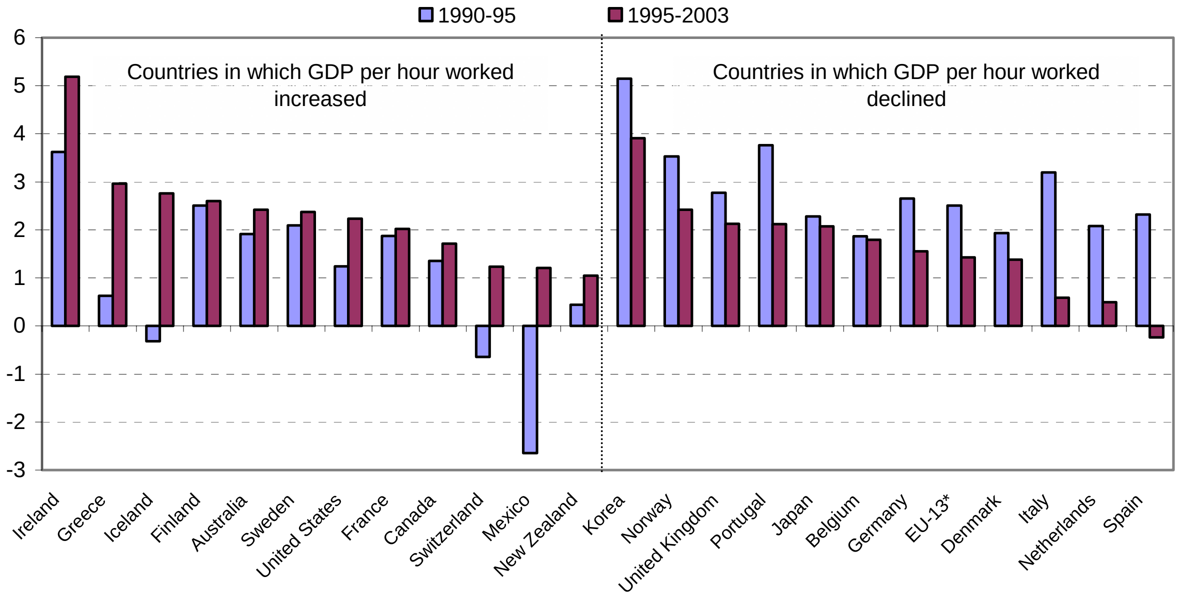
Source: OECD estimates, September 2004. See www.oecd.org/statistics/productivity for methodological details.

A range of policies may be beneficial to increase labour utilisation, and should not just focus on reducing unemployment, but also on increasing participation in the labour force, notably from women and older workers (De Serres, 2003; OECD, 2003*d*). The key influences on labour utilisation include tax and benefit systems as well as regulations in labour and product markets (OECD, 2003*e*). Reform in these areas may help enhance both the incentives for firms to hire workers and for would-be workers to take up work. Efforts to enhance labour utilisation should also include policies to make work pay. For example, schemes under which in-work benefits such as tax reductions are conditional on employment, or where employers are exempt from social security charges if they hire low-skilled workers have been effective when properly targeted (OECD, 2003*d*). It is also important to increase the opportunities for women to participate in the labour market, for example by enhancing access to child-care facilities and enabling greater flexibility in working time for family workers. Improving prospects for older workers will also require a range of measures, including the removal of incentives for early retirement.

II.3 Labour productivity

Labour productivity is the other main driver of GDP per capita shown in Figure 2. It is also the key determinant of the gap in income levels between the United States and other OECD countries (Figure 3).[3] As shown above, labour productivity growth accelerated in a number of OECD countries in the second half of the 1990s; including Australia, Canada, Greece, Ireland and the United States (Figure 4). In contrast, it declined in a large number of other OECD countries. With the slowdown of the world economy since 2000, most OECD countries have experienced a marked slowdown in labour productivity growth, Australia, Korea, the United States and some small European countries being the main exceptions (Figure 5).

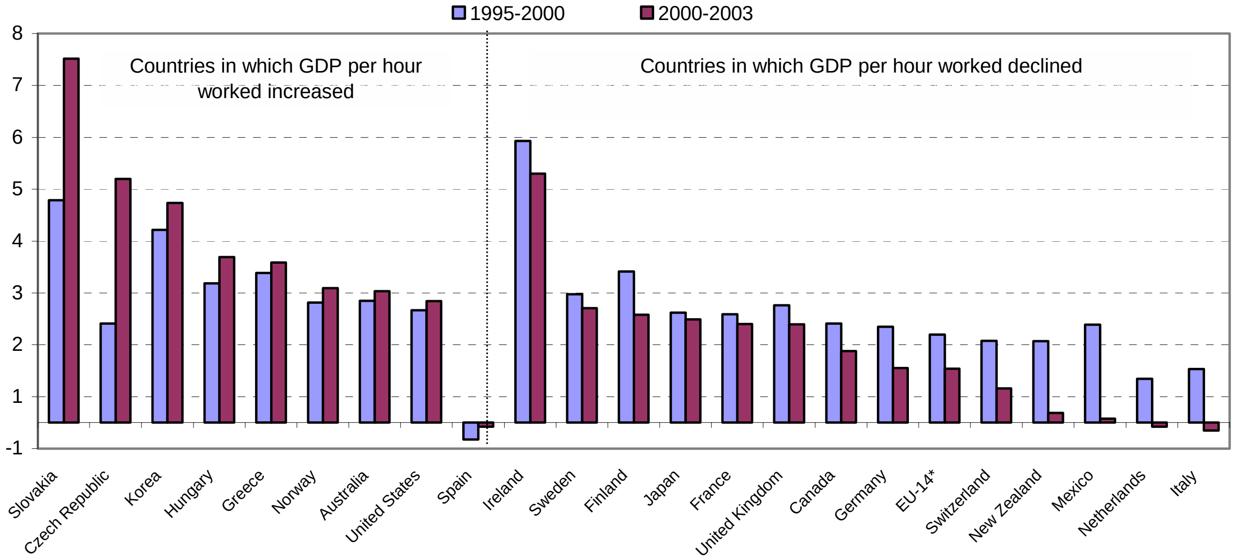
Figure 4: **Growth in GDP per hour worked, 1990-95 and 1995-2003**
(annual compound growth rates, in per cent)



Source: OECD, Productivity Database, September 2004.

3. Estimates of productivity levels are more uncertain that estimates of productivity growth. Several measurement problems related to GDP, such as the measurement of software or the informal economy, have larger impacts on the level of GDP than on its growth rate. Moreover, level estimates are influenced by uncertainties related to PPP measures. See: www.oecd.org/statistics/productivity for further detail.

Figure 5: **Growth in GDP per hour worked, 1995-2000 and 2000-2003**
(annual compound growth rates, in per cent)

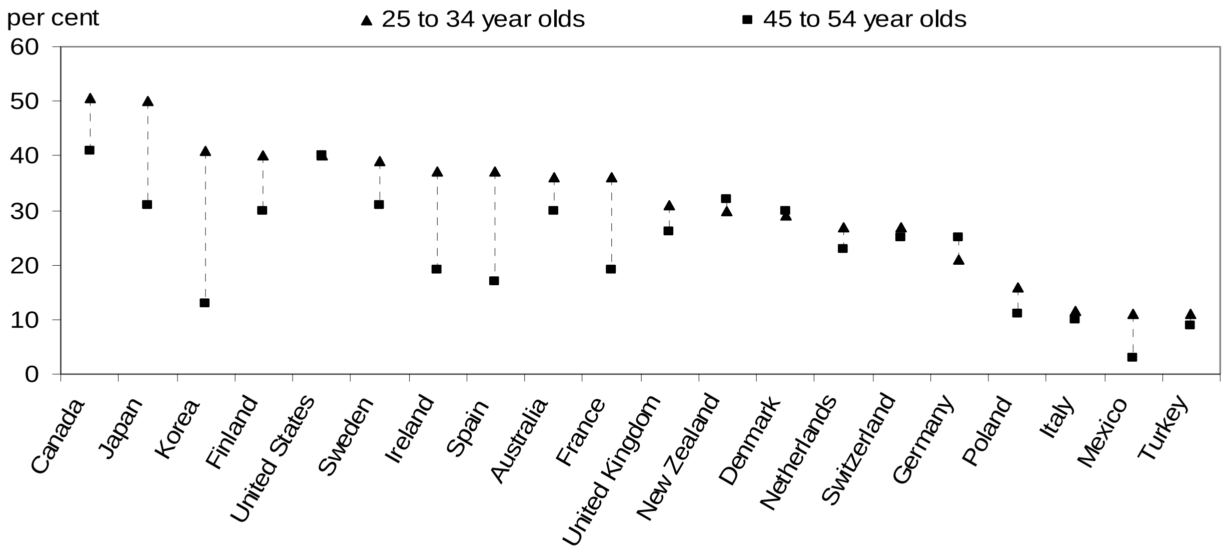


Source: OECD, Productivity Database, September 2004.

II.4 The impact of human capital

Labour productivity growth can be increased in several ways: by improving the quality of labour used in the production process, increasing the use of capital and improving its quality, and attaining higher multi factor productivity (MFP). The quality of labour is the first of these, and plays a key role in labour productivity growth. This is partly because in all OECD countries, educational policies have ensured that young entrants on the jobs market are better educated and trained on average than those who are retiring from it. For example, in most OECD countries, more 25-34 year olds have attained tertiary education than 45 to 54 year olds (Figure 6).

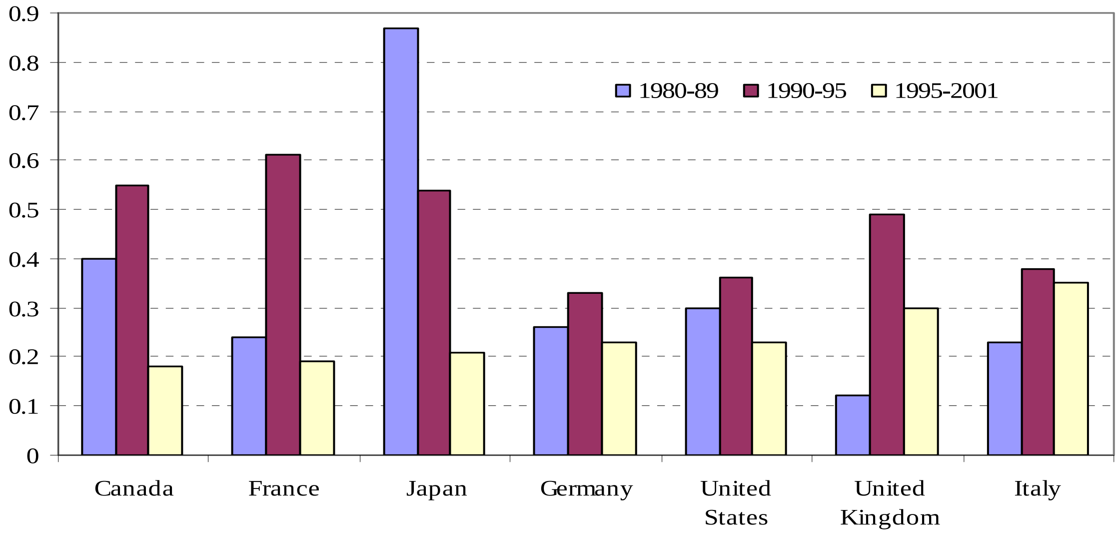
Figure 6: **Percentage of the population that has attained tertiary level education, 2002**
(percentage points)



Source: OECD, Education at a Glance, 2004.

The available empirical evidence suggests that improvements in the quality of labour have directly contributed to labour productivity growth in virtually all OECD countries (Bassanini and Scarpetta, 2001; Jorgenson, 2003). The OECD Productivity Database does not yet include estimates of labour quality, although their inclusion is planned for the future. Estimates of labour quality for the G7 countries are included in a recent study by Prof. Dale Jorgenson, however (Jorgenson, 2003; Colecchia, forthcoming; Figure 7). These suggest that the contribution of labour quality to labour productivity growth has declined in most G7 countries over the second half of the 1990s, Italy being the only exception. This can partly be attributed to the large number of low-skilled workers that were integrated in the labour force in several OECD countries over the second half of the 1990s. Moreover, the contribution of labour quality has also declined over time since the gap in education levels between cohorts of new and retiring workers has become smaller over time.

Figure 7: **Contribution of labour quality to labour productivity growth, percentage points**



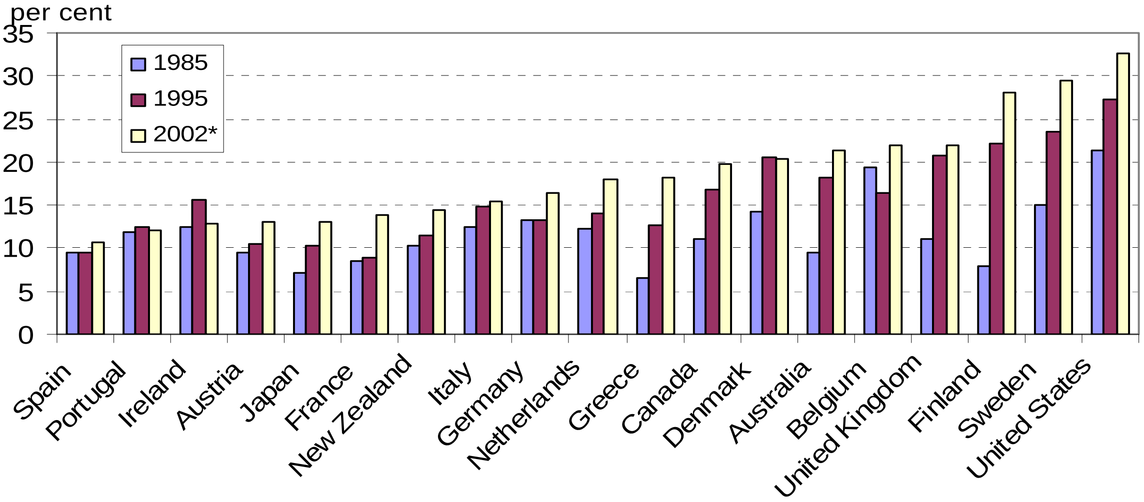
Source: Jorgenson (2003), Table 16, December 2003.

Growth accounting estimates, such as those presented by Dale Jorgenson, point to the important contribution of human capital to economic growth. They typically only take account of changes in educational attainment, however; increases in the level of post-educational skills may also help enhance labour quality, but few hard measures are available.

II.5 The role of investment in fixed capital

Investment in physical capital is the second factor that plays an important role in labour productivity growth. Capital deepening expands and renews the existing capital stock and enables new technologies to enter the production process. While some countries have experienced an overall increase in the contribution of capital to growth over the past decade, ICT has typically been the most dynamic area of investment. This reflects rapid technological progress and strong competitive pressure in the production of ICT goods and services and a consequent steep decline in prices. This fall, together with the growing scope for application of ICT (including the impact of Y2K), has encouraged investment in ICT, at times shifting investment away from other assets. The available data show that ICT investment rose from less than 15 per cent of total non-residential investment in the business sector in the early 1980s, to between 15 and 30 per cent in 2002 (OECD, 2003*b*; Figure 8).

Figure 8. **ICT investment in selected OECD countries, 1985-2002**
(As a percentage of non-residential gross fixed capital formation, total economy)



* 2002 for Australia, Canada, France, Germany, Japan, New Zealand and the United States, 2001 for other countries.
Note: Estimates of ICT investment are not yet fully standardised across countries, mainly due to differences in the capitalisation of software in different countries. See Ahmad (2003).
Source: OECD, Database on capital services, July 2004.

Box 3: **Capital input in the OECD Productivity Database**

The appropriate measure for capital input within the growth accounting framework is the flow of productive services that can be drawn from the cumulative stock of past investments in capital assets (see OECD, 2001*b*). These services are approximated by the rate of change of the 'productive capital stock' – a measure that takes account of wear and tear, retirements and other sources of reduction of the productive capacity of fixed assets. Flows of productive services of an office building, for instance, are the protection against rain or the comfort and storage services that the building provides to personnel during a given period (Schreyer *et al.*, 2003). The price of capital services per asset is measured as their rental price. If there are markets for capital services, as is the case for office buildings, for instance, rental prices could be directly observed. For most assets, however, rental prices have to be imputed. The implicit rent that capital good owners 'pay' themselves contributes to the terminology 'user costs of capital'.

Capital input (S) is measured as the volume of capital services, assumed to be in a fixed proportion to the productive capital stock (see Schreyer, *et al.*, 2003 for a more extensive explanation and for details of the computation of capital services). The productivity database publishes capital services data with calculations based on the perpetual inventory method (PIM) The PIM calculations are carried out by OECD, using service lives for different assets that are common across countries and correcting for differences in deflators for information and communication technology assets. Sources for the investment series by type of asset underlying the capital services series are national statistical offices[4] and the *Groningen Growth and Development Centre Total Economy Growth Accounting Database*[5] (http://www.ggdc.net).

While ICT investment accelerated in most OECD countries, the pace of that investment and its impact on growth differed widely (Box 3). For the G7 countries and Australia, ICT investment accounted for between 0.3 and 0.85 percentage points of growth in GDP per capita over the 1995-2002 period (Table 1).[6]

4 For Australia, Canada, France, Japan, Italy, Germany, New Zealand, United States.

5 For Austria, Belgium, Denmark, Finland, Greece, Ireland, Netherlands, Portugal, Spain, Sweden, United Kingdom.

6 . These estimates are based on official data on ICT investment from individual countries' national accounts. They are based on a harmonised deflator for ICT investment, which adjusts for cross-country differences in the measurement of ICT prices (see Colecchia and Schreyer, 2001 and Schreyer, *et al.* 2003). Methodological differences in the measurement of software investment may affect the results, however (Ahmad, 2003), and are particularly likely to affect the results for Japan and the United Kingdom.

The United States and the United Kingdom received the largest boost; Australia and Canada a sizeable one; and Germany, France and Italy a much smaller one (OECD, 2003*b*).

Table 1: **Contributions of growth to GDP, 1990-95 and 1995-2002[1]**
In percentage points, based on cost shares and harmonised hedonic prices

	Australia	Canada	France	Germany	Italy	Japan	United Kingdom	United States
1990-95								
Labour input	0.82%	0.27%	-0.54%	-0.71%	-1.39%	-0.55%	-0.79%	0.88%
ICT capital, of which	0.36%	0.33%	0.13%	0.26%	0.13%	0.31%	0.38%	0.51%
ICT hardware	*0.22%*	*0.17%*	*0.07%*	*0.16%*	*0.08%*	*0.21%*	*0.22%*	*0.25%*
Software	*0.11%*	*0.11%*	*0.03%*	*0.05%*	*0.00%*	*0.06%*	*0.14%*	*0.18%*
Communications equipment	*0.03%*	*0.05%*	*0.03%*	*0.05%*	*0.05%*	*0.04%*	*0.03%*	*0.08%*
Non-ICT capital	0.26%	0.63%	0.69%	0.65%	0.58%	0.92%	0.59%	0.22%
MFP	1.76%	0.47%	0.77%	1.09%	1.94%	0.82%	1.46%	0.75%
GDP growth	3.20%	1.70%	1.06%	1.29%	1.26%	1.50%	1.65%	2.36%
1995-2002[1]								
Labour input	0.79%	1.40%	0.23%	-0.16%	0.67%	-0.67%	0.61%	0.92%
ICT capital, of which	0.61%	0.60%	0.31%	0.36%	0.43%	0.52%	0.72%	0.84%
ICT hardware	*0.39%*	*0.37%*	*0.15%*	*0.25%*	*0.22%*	*0.34%*	*0.47%*	*0.43%*
Software	*0.14%*	*0.15%*	*0.11%*	*0.07%*	*0.10%*	*0.11%*	*0.17%*	*0.26%*
Communications equipment	*0.08%*	*0.08%*	*0.05%*	*0.04%*	*0.11%*	*0.07%*	*0.08%*	*0.15%*
Non-ICT capital	0.17%	0.61%	0.46%	0.46%	0.63%	0.55%	0.61%	0.36%
MFP	2.07%	1.03%	1.35%	0.76%	0.14%	0.60%	0.99%	1.11%
GDP growth	3.64%	3.64%	2.36%	1.42%	1.88%	1.00%	2.92%	3.22%
Change 1990-95 to 1995-2002[1]								
Labour input	-0.03%	1.13%	0.77%	0.54%	2.06%	-0.13%	1.39%	0.04%
ICT capital, of which	0.25%	0.27%	0.18%	0.11%	0.29%	0.21%	0.34%	0.33%
ICT hardware	*0.18%*	*0.21%*	*0.08%*	*0.09%*	*0.14%*	*0.13%*	*0.26%*	*0.18%*
Software	*0.03%*	*0.03%*	*0.08%*	*0.02%*	*0.09%*	*0.05%*	*0.03%*	*0.08%*
Communications equipment	*0.05%*	*0.03%*	*0.02%*	*-0.01%*	*0.06%*	*0.03%*	*0.05%*	*0.06%*
Non-ICT capital	-0.09%	-0.02%	-0.23%	-0.19%	0.05%	-0.37%	0.01%	0.14%
MFP	0.31%	0.56%	0.58%	-0.33%	-1.80%	-0.22%	-0.47%	0.35%
GDP growth	0.44%	1.94%	1.30%	0.13%	0.61%	-0.50%	1.27%	0.86%

(1) Or latest available year, i.e. 2001 for Italy and the United Kingdom.
Source: OECD, Productivity Database and Database on Capital Services, September 2004.

In some OECD countries, *e.g.* Australia, France, Germany and Japan, the growing contribution of ICT capital was accompanied by a decline in the contribution of non-ICT capital (Table 1). In these countries, ICT investment partly substituted for investment in other assets. In the United Kingdom and the United States, on the other hand, capital deepening in the 1990s was a broad phenomenon as the contribution of non-ICT capital increased too. For France, Germany and Japan, the declining contribution of non-ICT capital has been attributed to weaknesses in domestic demand (Jorgenson, 2003).

One important difference between OECD countries is thus the extent to which countries have invested in ICT (Figure 8). A range of indicators on ICT use show that the highest rate of uptake of ICT can typically be observed in the United States, Canada, New Zealand, Australia, the Nordic countries and the Netherlands (OECD, 2003*c*). The question that follows concerns the reason why the diffusion of ICT is so different across OECD countries. All countries have been faced with a rapid decline in ICT prices and with growing opportunities for efficiency-enhancing investment in ICT. A number of reasons can be noted. In the first place, firms in countries with higher levels of income and productivity typically have greater incentives to invest in efficiency-enhancing technologies than countries at lower levels of income, since they are typically faced with higher labour costs. High-income economies have therefore invested significantly more in ICT than OECD economies at lower levels of income. Moreover, the structure of economies may affect overall investment in ICT; countries with a larger service sector or with a large average firm size are likely to have greater investment in ICT.

More specifically, the decision of a firm to adopt ICT depends on the balance of costs and benefits that may be associated with the technology. There is a large range of factors that affect this decision (OECD, 2003*b*; OECD, 2004). This includes the direct costs of ICT, *e.g.* the costs of ICT equipment, telecommunications or the installation of an e-commerce system. Considerable differences in the costs of ICT persist across OECD countries, despite strong international trade and the liberalisation of the telecommunications industry in OECD countries. Moreover, costs and implementation barriers related to the ability of the firm to absorb new technologies are also important. This includes the availability of know-how and qualified personnel, the scope for organisational change and the capability of a firm to innovate. In addition, competition and regulatory factors are of key importance. A competitive environment is more likely to lead a firm to invest in ICT, as a way to strengthen performance and survive, than a more sheltered environment. Moreover, excessive regulation in product and labour markets may make it difficult for firms to draw benefits from investment in ICT and may thus hold back such spending. These issues will be further discussed below, as they also affect the returns to ICT that have thus far become visible in ICT-using industries, including service industries such as wholesale and retail trade.

As ICT investment has played an important role in recent years, it is important to reiterate that investment primarily relies on good fundamentals. Stable macroeconomic policies are critical. Evidence for a wide range of OECD countries shows that fiscal discipline, low inflation rates and the reduction in the variability of inflation over the 1990s have helped to boost national savings, reducing uncertainty and enhancing the efficiency of the price mechanisms in allocating resources (OECD, 2001). This has resulted in an improved environment for decision making and has unleashed resources for private investment.

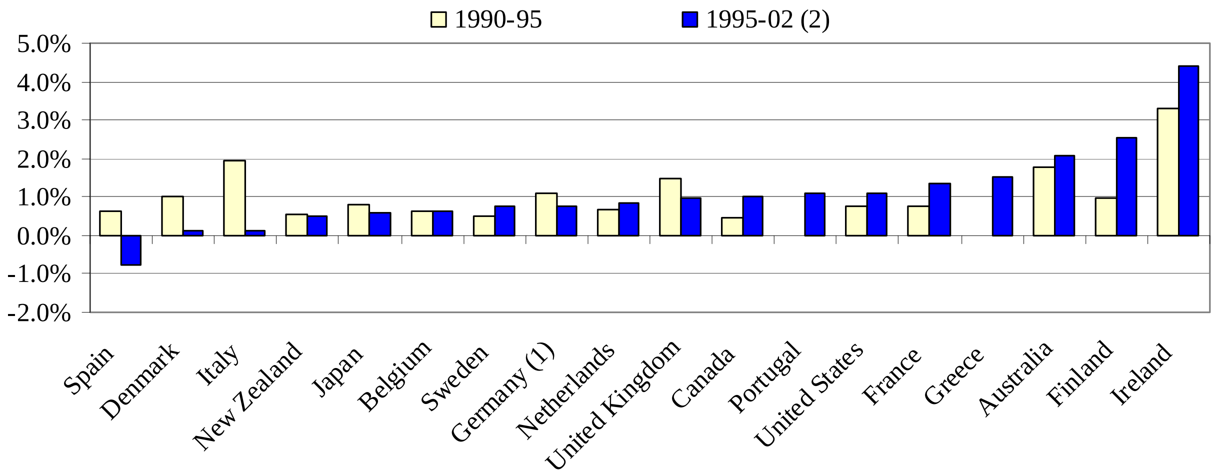
At the same time, the way public finances are improved influences growth. In particular, government is a direct investor in the economy. Although the volume of this investment may be small compared with that of the private sector, it can be a crucial importance. For example, public investment in R&D, transport, communication and infrastructure, to the extent it is of high quality and generates high economic and social returns, can help to create an environment conducive to entrepreneurship, innovation and private sector activity. Similarly, efficient government spending on education should improve the stock of human capital. The pursuit of fiscal consolidation should of course remain a priority in many OECD countries, particularly in view of population ageing, but neglecting public spending in high-return physical and human capital investments can lead to negative economic effects in the medium- term. Investment in these areas should thus be given due consideration in public budgets.

III. Strengthening MFP growth

The final component that accounts for some of the pick-up in labour productivity growth in the 1990s in certain OECD countries is the acceleration in multi factor productivity (MFP) growth (Figure 9). MFP growth rose particularly in Australia, Canada, Finland, France, Greece, Ireland, and the United States. In other countries, including Germany, Italy, Japan, the United Kingdom, Denmark and Spain, MFP growth slowed down over the 1990s.[7]

7. The MFP estimates in Figure 9 are not adjusted for labour quality (see Figure 7). Moreover, for some countries, software investment may be underestimated (Ahmad, 2003). Adjusting for both factors would lead to a smaller contribution of MFP to total GDP growth in OECD countries.

Figure 9: **MFP growth, 1990-95 and 1995-2002**[2]
Total economy, in percentage points



(1) 1992-1995 instead of 1990-95. (2) Or latest available year, i.e. 2001 for Spain, Denmark, Italy, Belgium, Sweden, United Kingdom, Netherlands, Portugal, Greece, Finland and Ireland.
Source: OECD Productivity Database, September 2004.

The improvement in MFP in some countries reflects a break with slow MFP growth in the 1970s and 1980s and may be due to several sources. Better skills and better technology may have caused the blend of labour and capital to produce more efficiently, organisational and managerial changes may have helped to improve operations, and innovation may have led to more valuable output being produced with a given combination of capital and labour. MFP growth is measured as a residual, however, and it is difficult to provide evidence on such factors. Some is available, though, and is discussed in the remainder of this section.

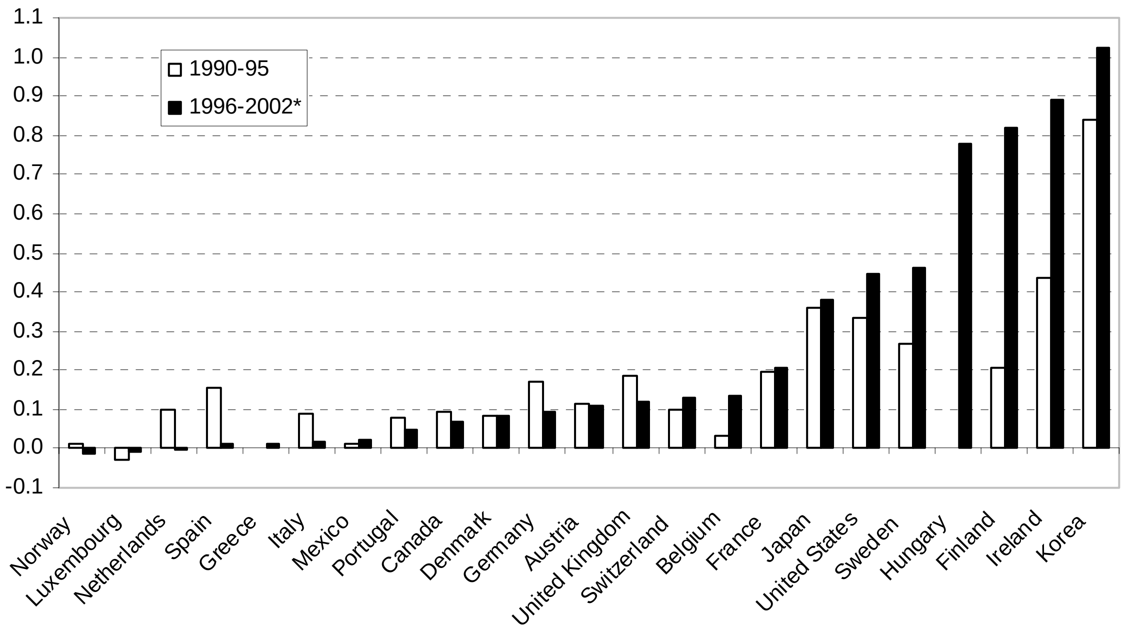
III.1 Production of ICT – a boon to MFP growth in some countries

First, in some OECD countries, MFP reflects rapid technological progress in the production of ICT. Technological progress at Intel, for instance, has enabled the amount of transistors packed on a microprocessor to double every 18 months since 1965, and even more rapidly between 1995 and 1999. While the ICT manufacturing sector is relatively small in most OECD countries, it can make a large contribution to growth if it expands much more rapidly than other sectors. Some OECD countries, such as Finland, Hungary, Ireland, Korea and the United States, benefited from rapid productivity growth in the ICT-producing sector in the 1990s (Pilat and Wölfl, 2004; Figure 10).[8] In most OECD countries, ICT manufacturing is of little importance for aggregate productivity growth, however.

8 . Figure 10 shows the contribution of these sectors to labour productivity growth, since data for capital input by industry are only available for some OECD countries. However, the contribution of the ICT-producing sector to MFP growth is also very large in some countries where data are available, e.g. Finland, Japan and the United States (Pilat and Wölfl, 2004).

Figure 10: **Contribution of ICT manufacturing to aggregate labour productivity growth**

(Total economy, value added per person employed, contribution in percentage points)



Note: 1991-1995 for Germany; 1992-95 for France and Italy and 1993-1995 for Korea; 1996-99 for Korea and Portugal; 1996-2000 for Ireland, Spain and Switzerland, 1996-2001 for France, Germany, Hungary, Japan, Mexico, the Netherlands, Norway, Sweden, the United Kingdom and the United States.

Source: Estimates on the basis of the OECD STAN database, September 2004.

The ICT-producing services sector, notably the telecommunications sector, also made an important contribution to aggregate productivity growth in certain OECD countries over the second half of the 1990s (OECD, 2003*b*; Pilat and Wölfl, 2004). Partly, this is linked to the liberalisation of telecommunications markets and the high speed of technological change in this market. Some of the growth in ICT-producing services is also due to the emergence of the computer services industry, which has accompanied the diffusion of ICT in OECD countries. The ICT-producing sector should continue to contribute to aggregate productivity growth in several OECD countries, given ongoing technological progress in this area. Further efforts to strengthen competition in this sector will be needed, however, as liberalisation has been an important driver of technological progress in this sector and has allowed its benefits to be diffused across the economy.

III.2 A high level of firm dynamics can boost productivity growth

MFP also reflects the effects of competition. Analysis of productivity growth at the firm level shows that the impacts of competition, such as the entry and exit of firms and changes in market shares are important drivers of productivity growth (OECD, 2003*a*). New firms may use a more efficient mix of labour, capital and technology than existing firms, which in the long term has a positive effect on MFP growth. This is particularly true of industries that have grown rapidly in response to the new technological opportunities, such as the ICT sector, where new firms play a key role (Brandt, 2004). In contrast, growth in mature industries is typically driven by productivity growth within existing firms or by the exit of obsolete firms.

This factor might potentially also help explain low MFP growth in certain OECD countries. Some evidence is available on this issue, both from previous OECD work (OECD, 2003*a*), from more recent

OECD work, based on a new dataset from Eurostat (Brandt, 2004), and from a recent study by Bartelsman and De Groot (2004). The first two studies suggest that rates of firm creation and destruction in OECD countries are fairly similar, in particular after they have been adjusted for differences in the composition of the economy. Moreover, the available estimates show that the entry and exit of firms made a sizeable contribution to MFP growth in the early 1990s (OECD, 2003*a*). Evidence for Canadian manufacturing, using a slightly different breakdown of productivity growth, shows that plant turnover accounts for half of total productivity growth (Baldwin and Gu, 2004).

While firm creation as such does not appear to be a problem for MFP growth in many OECD countries, the growth of firms once they have been created appears problematic in many European countries. Compared with the European Union, the United States appears to be characterised by: *i*) a smaller (relative to the industry average) size of entering firms; *ii*) a lower labour productivity level of entrants relative to the average incumbent; and *iii*) a much stronger (employment) expansion of successful entrants in the initial years which enable them to reach a higher average size (OECD, 2003*a*). These differences in firms' performance can only partly be explained by statistical factors or differences in the business cycle (OECD, 2003*a*; Brandt, 2004), and seem to indicate a greater degree of experimentation amongst entering firms in the United States. US firms take higher risks in adopting new technology and opt for potentially higher results, whereas European firms take fewer risks and opt for more predictable outcomes. This is likely related to differences in the business environment between the two regions; the US business environment permits greater experimentation partly because barriers to entry and exit are relatively low, in contrast to many European countries.

Recent studies by Bartelsman and De Groot (2004) and by the Netherlands Ministry of Economic Affairs (2004) provide further insights in the role of firm dynamics. Bartelsman and De Groot point to a number of differences in manufacturing productivity between the United States and several European countries, notably Finland, France, the Netherlands and the United Kingdom:

- First, in some manufacturing industries, these European countries are ahead of the United States in terms of average labour productivity levels. In general, the gap in productivity levels between these countries is from 0 to 20 per cent.

- Second, on the basis of firm-level data, the authors show that top-performing manufacturing firms in the United States (the top quartile of firms) outperform the average manufacturing firms in the same industries by a ratio of 1.8 to 2.5. In the European countries, these ratios are lower, with France (ratios of 1.5 to 1.9) and the Netherlands (1.4 to 2.0) having the lowest ratios.

- Third, productivity in the top-quartile of firms is highest in the United States, which suggests that the potential for catch-up between European manufacturing firms and the best performing US firms is substantially higher than suggested by comparisons of average productivity levels.

The paper by the Netherlands Ministry of Economic Affairs (2004), drawing on further work by Eric Bartelsman, further adds to this evidence. It finds that the top US performers are not only more productive than equivalent European firms, but also that they account for a larger share of total employment, and thus contribute to a substantial part of the overall productivity difference. This top quartile of US firms also grows faster than other quartiles, and than the top European quartile. Moreover, the United States manufacturing sector is characterised by negative employment growth in the bottom quartile of the productivity distribution, which implies that its least productive companies are losing resources. In contrast, the EU countries are characterised by positive employment growth in the bottom quartile.

These findings demonstrate once more that a dynamic business environment, *i.e.* one that fosters firm creation and efficient resource reallocation, is important for good growth performance. A striking feature of the US economy in the 1990s was the large number of new firms that was created. In conditions of rapid technological change, such firms have an advantage in that they can come on to the market with the latest technology and hope to benefit from both the cost advantage that this gives them, and strongly rising demand in the early phases of the product cycle. There are risks as well as benefits, of course, as high entry rates go hand-in-hand with high exit rates. But provided that the barriers to both entry and exit are low, that innovation is rewarded and that displaced human and capital resources can be quickly re-allocated, this continuing process of creative destruction brings strong productivity gains. In turn, this requires both a social culture in which entrepreneurship is respected and encouraged. The ease and speed with which new firms can be created varies strikingly between OECD countries, while bankruptcy legislation can have an important impact on the speed with which resources can be re-allocated as well as on the willingness of managers to invest in risky but possibly very rewarding projects (OECD, 2001*a*; Brandt, 2004).

III.3 Making innovation more effective

Innovation is the third important driver of MFP growth (Guellec and Van Pottelsberghe, 2001; Donselaar, *et al.*, 2004). Foreign research and development (R&D) is particularly important for most OECD countries (the United States being an exception), since the bulk of innovation and technological change in small countries is based on R&D that is performed abroad.[9] But domestic R&D, *i.e.* business, government and university research, is also an important driver of MFP growth. It is also the key in tapping into foreign knowledge; countries that invest in their own R&D appear to benefit most from foreign R&D as they are better able to absorb foreign knowledge.[10] R&D thus plays an important role as an input for technological progress and MFP growth. OECD countries and regions have had different experiences in the role of R&D over the past decade, however (Figure 11; OECD, 2004*b*).

In the United States, R&D spending declined in the first half of the 1990s but increased considerably over the second half of the 1990s, both in absolute terms and as a share in GDP. In Japan, R&D intensity increased, but this was mainly due to a slow GDP growth as absolute spending on R&D changed only little. In the European Union, the R&D intensity increased in the second half of the 1990s following a slowdown in the early 1990s, but remains at a much lower level than in the United States. These R&D patterns mainly reflect the development of business R&D; in the EU and the United States, government R&D declined over the past decade, mainly due to lower spending on defence R&D, while it increased only slightly in Japan.

Changes in business R&D are affected by a broad range of factors (Guellec and Ioannides, 1997); including growth in business GDP, changes in interest rates as well changes in government funding of business R&D. Structural factors also play a role for total R&D spending, notably the contribution of high-technology sectors, such as the ICT-producing sector. The average size of firms in different economies also plays a role; large firms typically account for the bulk of business R&D. In countries such as Finland, Japan, Korea, Sweden and the United States, firms with other 500 employees account for over 80% of total business R&D (OECD, forthcoming). The differences in business R&D of the main regions should therefore be seen in the light of such structural differences and broader economic developments (Sheehan and Wyckoff, 2003).

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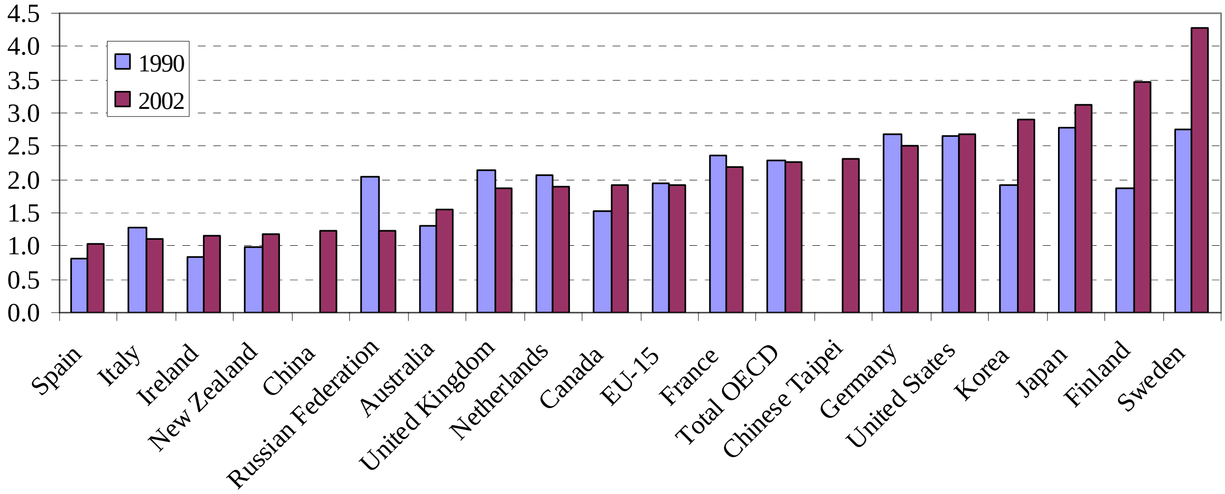
9. OECD estimates suggest that a 1 per cent increase in the global stock of R&D increases MFP growth by 0.4-0.5 per cent; a 1 percent increase in business R&D increases MFP by 0.13 per cent; and 1 per cent increase in government and university performed R&D increased MFP by 0.2%. Embodied technology has only a small impact on MFP: a 1 per cent increase leads to a 0.02 per cent increase in MFP. See Guellec and Van Pottelsberghe (2001) for more detail.

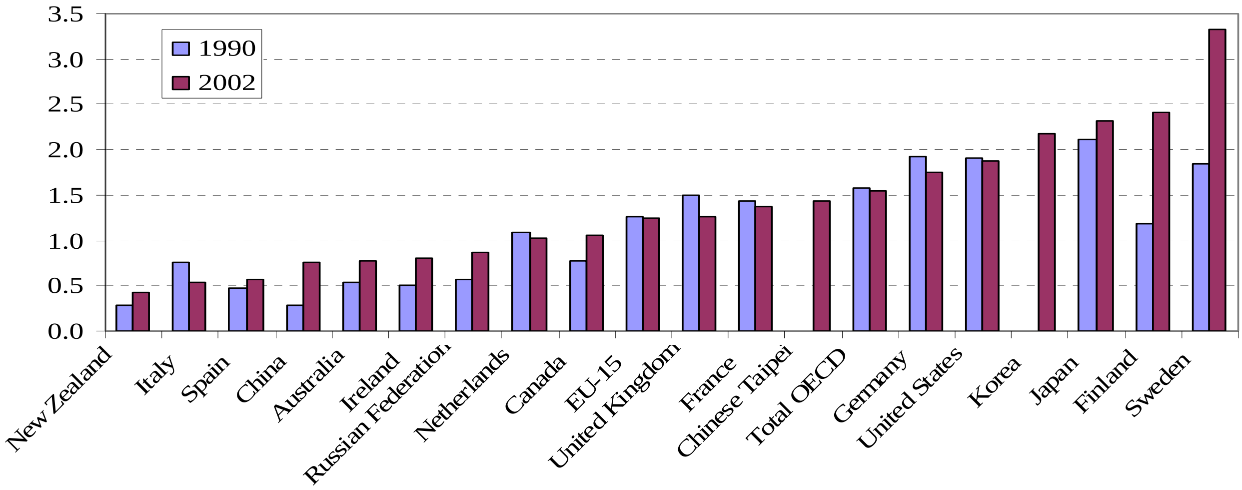
10. There is also some evidence that the threshold for countries to benefit from foreign R&D has increased, due to the growing complexity of the innovation process. This might imply that countries now require more investment in domestic R&D than before (see Donselaar, *et al.*, 2004 and Verspagen, 2001).

Figure 11: **R&D intensity by country and main OECD region, 1990-2002**[1]

(Gross domestic expenditure on R&D as a % of GDP)



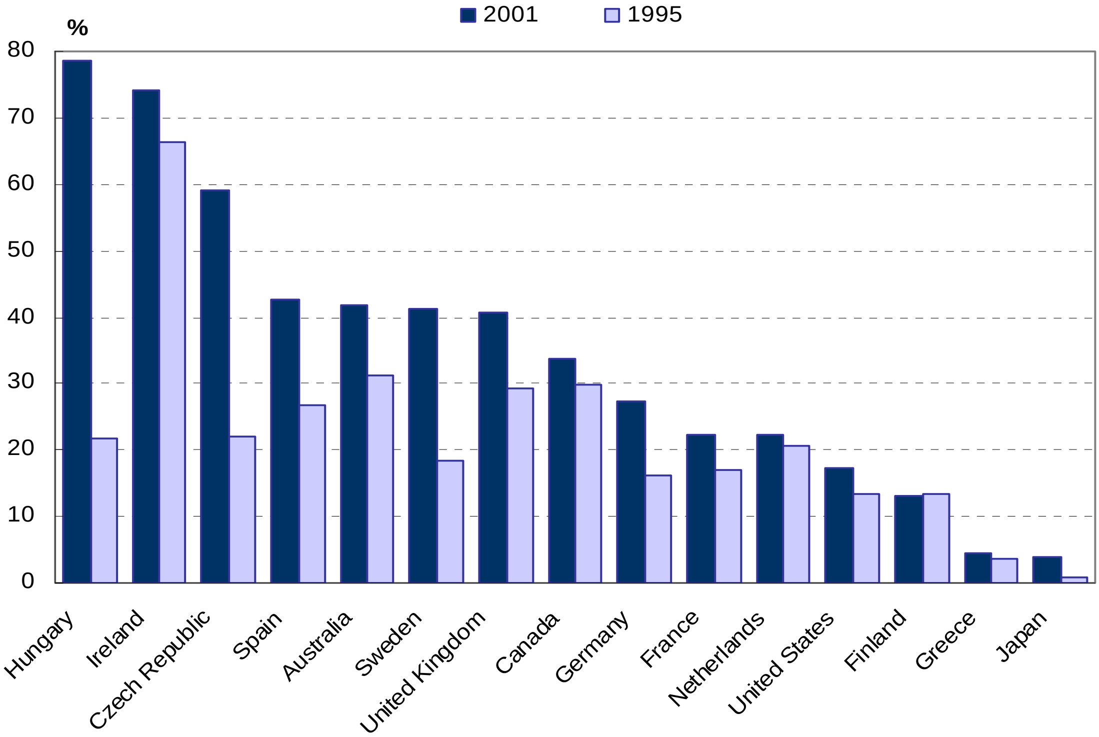
(Business expenditure on R&D as a % of GDP)



1. Or nearest available year, see source for details.
Source: OECD (2004), *Main Science and Technology Indicators 2004-1*, July 2004.

In their drive to boost innovation, several OECD countries, including the European Union, have introduced formal R&D targets over the past decade (Sheehan and Wyckoff, 2003). As shown in Figure 11, achieving such targets typically requires a substantial increase in business R&D. Indeed, in most of the countries with high R&D intensities, the business sector is the main source of R&D, with much of this concentrated in a number of high-technology sectors and in a number of large, often multinational, firms. Increasing business R&D thus has close links with broader structural changes in economies, and is not an objective that can be achieved in isolation from other structural policies. For example, R&D targets may have important implications on human resource policies for researchers, as wages account for the bulk of R&D costs. Cultivating, attracting and retaining high-skilled workers is therefore closely linked to achieving higher R&D spending, as are policies to make a country more attractive for foreign direct investment (Sheehan and Wyckoff, 2003). In some OECD countries, R&D by foreign affiliates accounts for over 70% of total business expenditure on R&D. These shares have risen most noticeably in the Czech Republic, Hungary, Sweden and the United Kingdom, and have remained relatively constant or increased only slowly in most other countries, suggesting that foreign affiliate R&D has increased roughly as fast as domestic R&D (Figure 12).

Figure 12: **R&D investment by foreign affiliates, 1995-2001**
As % of R&D expenditure by enterprises



Note: Or nearest available years. 1995-99 for Australia, Germany, Greece, Hungary; 1995-2000 for Japan, Sweden; 1995-2002 for the United Kingdom; 1997-2002 for the Czech Republic; 1997-2001 for Finland; 1997-2000 for the Netherlands.
Source: OECD, AFA Database, May 2004; OECD Science, Technology and Industry Outlook 2004, forthcoming.

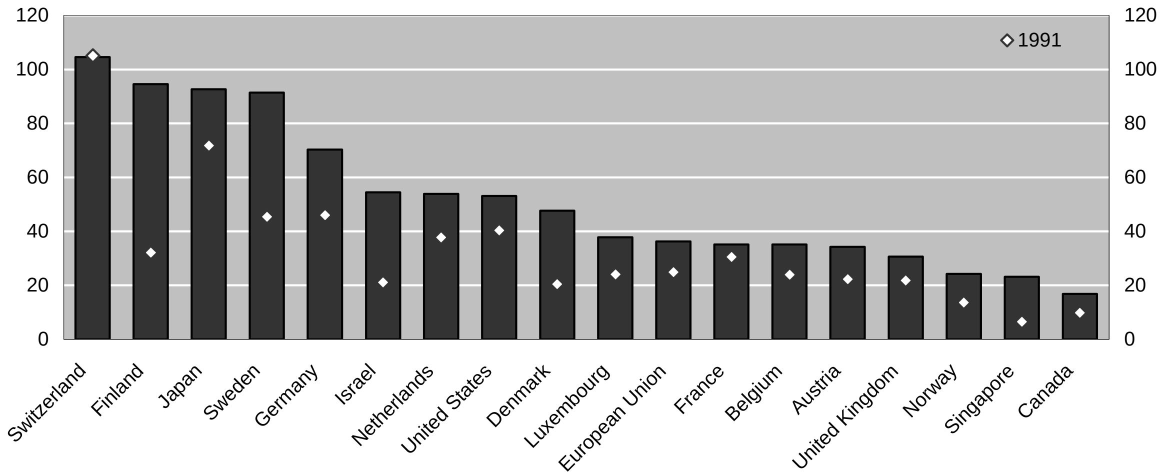
Providing a good climate for innovation also requires sufficient public funding for basic research. This is also the case in smaller countries, as the benefits from foreign sources of knowledge are higher in countries that also invest in their own scientific efforts. Clearly, governments cannot fund all efforts equally, they should therefore complement funding of scientific research with more focused efforts to build capacity, e.g. by creating “centres of excellence”. Aside from the direct creation of scientific knowledge and innovation, the creation of world class research centres plays an important role in the formation of research networks. They can help establish a collaborative environment between industry and university researchers and provide a critical mass of researchers who can extend research further and diffuse the resulting technology.

Apart from science and high-risk research, most OECD governments encourage R&D and innovation in the private sector. Such support typically takes the form of grants, subsidies, loans or tax credits. Direct support instruments, such as grants, are more selective and can potentially be channelled to areas with high potential returns in a way that tax credits cannot. Empirical research of such programmes provides a few lessons (Guellec and Van Pottelsberghe, 2000). First, government support does lead to additional private funding, although there is also some crowding out. Second, the level of funding is important: a low level has only little impact on overall business funding, whereas a high level may substitute for private R&D. Support for defence R&D, in particular, tends to crowd out civilian R&D in the business sector. Third, support is more effective in generating additional private funding if policies are relatively stable over time. And finally, the interaction between the different types of support is important.

Supporting business R&D can be expensive and governments should continually monitor the costs of such support against the would-be benefits. In principle, government should support innovation in areas where there are large spill-overs and where the private sector would not get involved on its own (Stiglitz, 1999). Public-private partnerships can help to share risks and costs and may increase the leverage of government funding. Competitive procedures are important in implementing such partnerships while the use of consortia may prevent governments from only supporting one firm as the "winner". Governments should be vigilant against serving vested interests, however. Support programmes can lead to the growth of powerful lobbies with an interest in prolonging support, even after the social returns of those programmes have disappeared.

The input into innovation, notably in R&D, is also reflected in patenting. Figure 13 shows different OECD countries perform in terms of triadic patents, *i.e.* patents to protect a single invention that are taken in the three main patent offices, notably the European Patent Office (EPO), the US Patent and Trademark Office (USPTO) and the Japanese Patent Office (JPO). The graph shows that most OECD countries have experienced a growth in innovation according to this indicator over the 1990s.

Figure 13: **Number of triadic patent families[1] per million population**
according to the residence of the inventors, for priority year 2000
Leading patenting countries

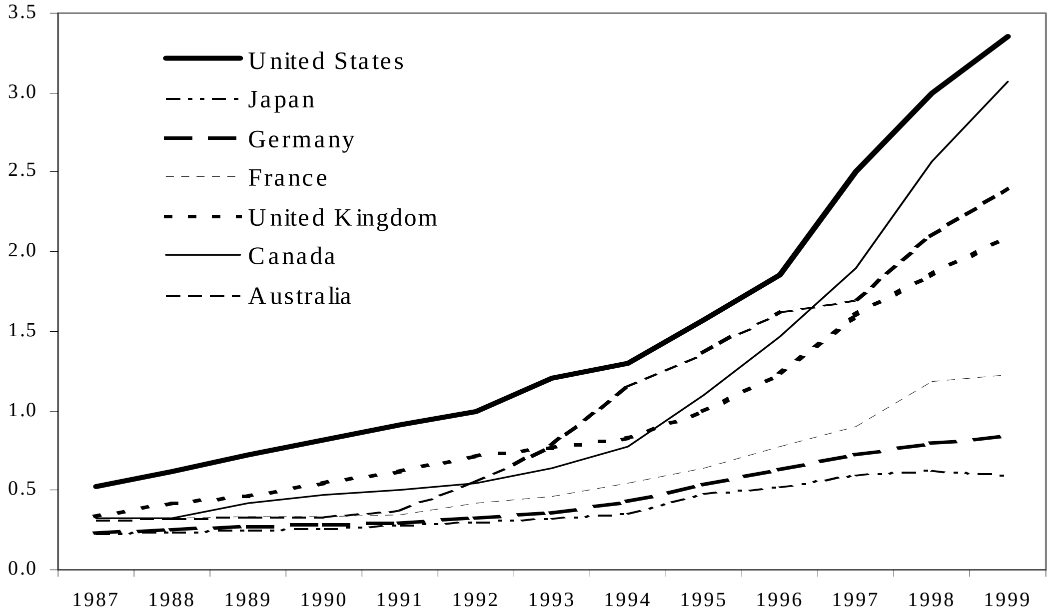


1. Patents all applied for at the EPO, USPTO and JPO. 2000 figures are estimates.

Source: OECD, Patent Database, July 2004.

Innovation is not just about R&D and much innovation is of a non-technological nature. Such innovation is particularly important in the services sector and lack of innovation in the services sector can contribute to low MFP growth. For example, turning investment in fixed capital, such as ICT, into more rapid productivity growth appears to be associated with innovation in products and processes (OECD, 2003). Regulatory barriers and lack of international trade in services are particularly important constraints for innovation in services, as competition can provide powerful incentives for firms to enhance performance and gain an edge on other firms. Several OECD governments are currently considering whether and how they can broaden their innovation policies to incorporate innovation in services.

Figure 14: **Science-innovation links have developed rapidly in some OECD countries**
Average number of scientific papers cited in patents taken in the US, by country of origin



Note: The graph shows that patents increasingly cite the findings of scientific research as an important ingredient for new innovations. Language is not the explanation for these differences; innovation in non-English speaking countries such as Finland, the Netherlands and Sweden also draws increasingly on scientific research carried out inside the country. The graph is based on US patents, since the estimates are not available for European and Japanese patents.
Source: CHI Research, http://www.chiresearch.com; see also OECD (2002).

Insufficiently developed links between science and industry are another factor limiting innovation in several OECD countries. Innovation in key sectors such as biotechnology, in particular, is closely linked to advances in basic science. Interaction within the innovation system, notably between science and industry, has grown in recent years. Nevertheless, there are considerable differences among OECD countries in the extent to which innovation draws on science. The growth in science-industry links over the 1990s, as measured by patent citations has been much more rapid in the United States, Canada, the United Kingdom and Australia than in France, Germany or Japan (OECD, 2002; Figure 14). Policy plays a role in explaining these cross-country differences. In the United States, for example, the linkages have been strengthened by initiatives in the 1980s and 1990s, like the extension of patent protection to publicly funded research, and the introduction of co-operative research and development agreements to facilitate technology transfer from the public sector to private industry.

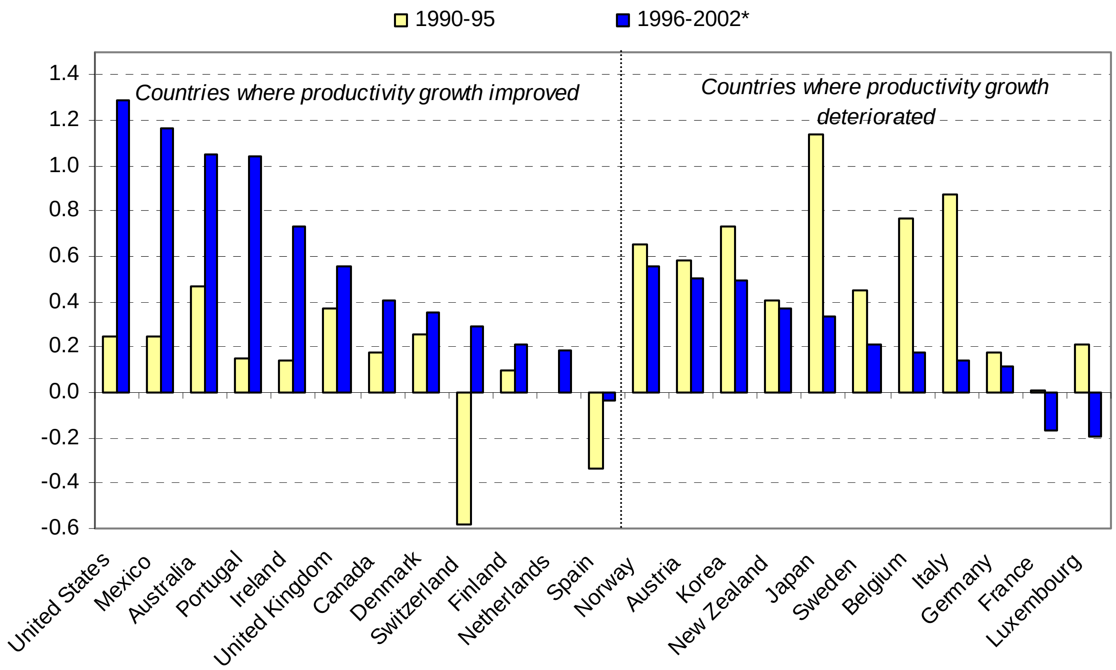
III.4 Seizing greater benefits from the use of ICT

The fourth driver of MFP that can be identified is the use of ICT in the production process. This effect can be interpreted in several ways. For example, ICT may help firms gain market share at the cost of less productive firms, which could raise overall productivity. In addition, the use of ICT may help firms to expand their product range, to customise the services offered, to respond better to client demand, or in short, to innovate. Moreover, ICT may help reduce inefficiency in the use of capital and labour, *e.g.* by reducing inventories. The diffusion of ICT may also help establish ICT networks, which can give rise to spill-over effects. These effects have proven difficult to identify over the past decade, even though ICT has diffused rapidly.

In recent years more evidence has emerged that ICT use can indeed help raise MFP growth. First, certain ICT-intensive services, such as wholesale and retail trade and finance, have experienced an above-average pick-up in labour productivity growth in recent years, *e.g.* in the United States, Canada and Australia (Pilat, Lee and Van Ark, 2002; Figure 15). Second, there is growing evidence at the firm level from a wide range of studies in many OECD countries that ICT can help to improve the overall efficiency of capital and labour (OECD, 2003*b*; OECD, 2004). Third, there is evidence for a few countries, notably Australia and the United States that certain ICT-using industries have indeed benefited from the efficiency-enhancing impacts of ICT (Gretton, *et al.*, 2004; Bosworth and Triplett, 2003).

Figure 15: **Contribution of ICT-using services to aggregate labour productivity growth, 1990-95 and 1996-2002**

(Total economy, value added per person employed, contributions in percentage points)



Note: See Figure 10 for period coverage. Data for Australia and New Zealand are for 1996-2001.

Source: Estimates on the basis of the OECD STAN database, September 2004.

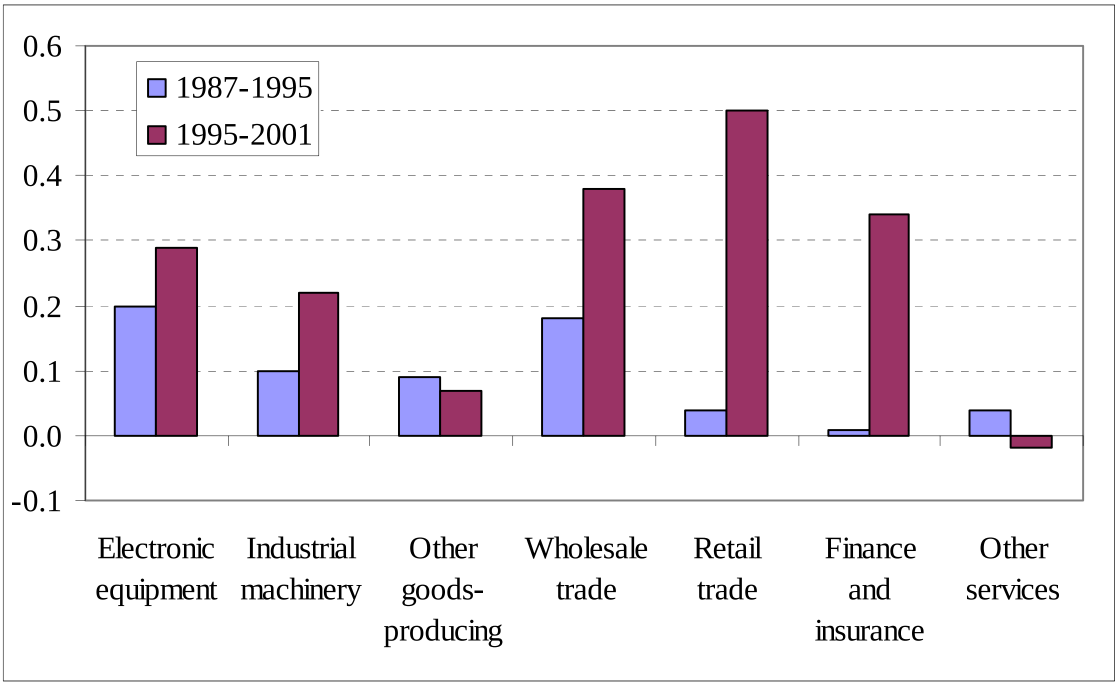
If ICT were to have effects on productivity growth over and above its contribution to capital deepening, MFP in sectors that are intensive users of ICT would need to increase as well. Previous OECD estimates suggest that the contribution of ICT-using services to aggregate MFP growth slightly increased in Canada and Denmark over the second half of the 1990s, and substantially in Finland (Pilat and Wölfl, 2004). In several other countries for which estimates of capital stock at the industry level are available (Belgium, France, Germany, Italy and Japan), MFP growth in the ICT-using services was zero or negative over the 1990s, suggesting that there appear to be no additional effects of ICT use in these sectors above those due to capital deepening. This may also be because some of the productivity changes in these sectors are not sufficiently picked up in the statistics, or because the adjustments that may be required to make ICT work have actually led to a (often temporary) drop in productivity growth (see also OECD, 2003*b*; OECD, 2004). A recent study at the industry level (Inklaar, *et al.*, 2003) looks in more detail at the industry-level productivity experience of a few OECD countries, notably France, Germany, the Netherlands, the United Kingdom and the United States. It confirms the results above and finds no evidence for more rapid MFP growth in ICT-using industries in the European countries.

This contrasts with the US experience. Inklaar, *et al.* (2003) finds that the ICT-using industries experienced a rapid acceleration in MFP growth in the United States over the 1995-2000 period.[11] Other studies also provide estimates of the sectoral contributions to US MFP growth, showing considerable variation. For example, Oliner and Sichel (2002) found no contribution of non-ICT producing industries to MFP growth; Gordon (2002) and Jorgenson, Ho and Stiroh (2002) found a relatively small contribution, while Baily (2002) and the US Council of Economic Advisors (2001) found a much more substantive contribution.[12] The problem with some of these studies (*e.g.* Oliner and Sichel, 2002 and Gordon, 2002) is that all non-ICT producing sectors are combined, and the contribution of the non ICT-producing sector to aggregate MFP growth is calculated as a residual.

More detailed examination for the United States provides a different perspective (Bosworth and Triplett, 2003). This study finds, for example, that MFP growth in wholesale trade accelerated from 1.5% annually to 3.1% annually from 1987-95 to 1995-2001. In retail trade, the jump was from 0.2% annually to 2.9%, and in securities the acceleration was from 3.1% to 6.6%. Several other service sectors also experienced an increase in productivity growth over this period. On average, Bosworth and Triplett estimate that the contribution of service producing industries to aggregate MFP growth increased from 0.27% over the 1987-95 period to 1.2% over the 1995-2001 period, with the largest contributions coming from the sectors mentioned above (Figure 16).

Figure 16: **Contribution of key industries to US MFP growth**

(trend-adjusted, in percentage points, based on Domar weights)



Source: Bosworth and Triplett (2003).

There is therefore good evidence for strong MFP growth in the United States in ICT-using services. More detailed studies suggest how these productivity changes due to ICT use in the United States could be

11 . The OECD STAN database does not yet include data on capital stock for the United States.

12. The differences between the various US studies are partly due to the data sources and methodology used, as well as the timing of various studies.

interpreted. First, a considerable part of the pick-up in productivity growth can be attributed to retail trade, where firms such as Wal-Mart used innovative practices, such as the appropriate use of ICT, to gain market share from its competitors (McKinsey, 2001). The larger market share for Wal-Mart and other productive firms raised average productivity and also forced Wal-Mart's competitors to improve their own performance. Among the other ICT-using services, securities account also for a large part of the pick-up in productivity growth in the 1990s. Its strong performance has been attributed to a combination of buoyant financial markets (*i.e.* large trading volumes), effective use of ICT (mainly in automating trading processes) and stronger competition (McKinsey, 2001; Baily, 2002). These impacts of ICT on MFP are therefore primarily due to efficient use of labour and capital linked to the use of ICT in the production process. They are not necessarily due to network effects, where one firms' use of ICT has positive spill-overs on the economy as a whole.

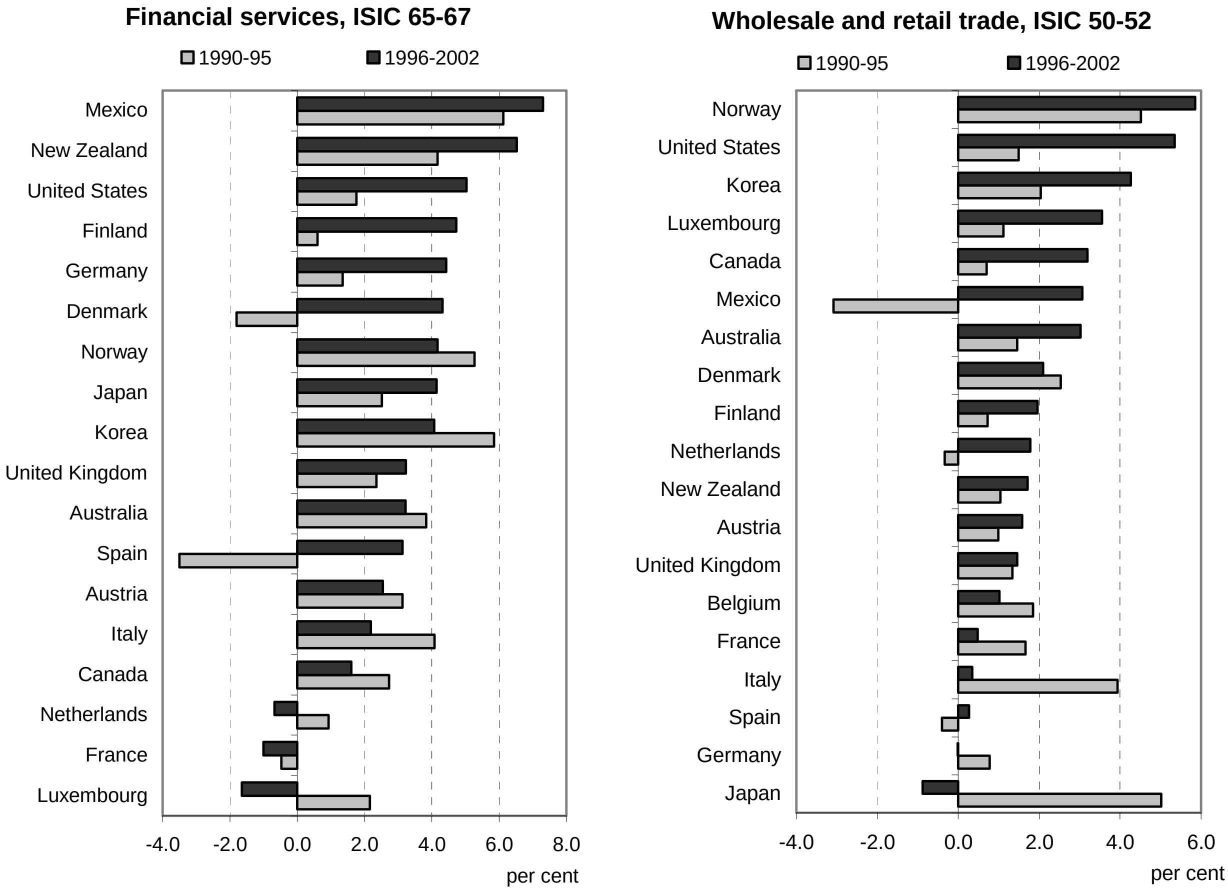
For many other OECD countries, firm-level studies have also shown that ICT use can have positive effects on productivity (OECD, 2003*b*). However, in most of these countries, these benefits are not yet very visible at the sectoral level, which suggests that some of the conditions for this investment to become effective in improving aggregate productivity growth may not yet have been fully established. In fact, productivity growth in the United States in financial services and wholesale and retail trade has outperformed almost all other OECD countries (Figure 17). There are several reasons why productivity in ICT-using services has not increased in many other OECD countries. First, ICT networks in many OECD countries may not yet have been sufficiently diffused, or for a sufficiently long period, and companies may therefore not yet have been able to achieve productivity returns from their investments. Given the relatively high rate of diffusion of ICT networks at this time (see OECD, 2003*c*); this explanation would imply that the returns of ICT investment on productivity might still emerge in the near future.

However, this is not the only possible explanation. There is some evidence from cross-country comparisons of the productivity impacts of ICT that the firm-level impacts of ICT may be smaller in European countries such as Germany, than in the United States (Haltiwanger, *et al.*, 2003). Productivity gains in ICT-using services might be smaller since the necessary complementary investments, e.g. in organisational change, skills and innovation, have not occurred to a sufficient degree. The lack of such changes in many OECD countries could be due to difficulties in changing organisational set-ups linked to relatively strict employment protection legislation, in particular for regular employment (De Serres, 2003). Another factor limiting the gains from ICT, already discussed above, may be lack of complementary process innovation in the service sector (OECD, 2003*b*). Innovation is important since users of ICT often help make their investments more valuable through their own experimentation and innovation, *e.g.* the introduction of new processes, products and applications. Without this process of "co-invention", which often has a slower pace than technological innovation, the economic impact of ICT could be more limited.

The aggregate impacts of ICT might also be smaller in Europe if firms that succeed in increasing productivity thanks to their investment in ICT do not grow sufficiently to gain market share. The US-Germany comparison highlighted above suggested that US firms had much greater variation in their productivity outcomes than German firms with some US firms experiencing very strong productivity gains from ICT (Haltiwanger, *et al.*, 2003). This may be because US firms engage in much more experimentation than their German counterparts; they take greater risks and opt for potentially higher outcomes. Lack of competition and lack of new firm creation in ICT-using services may also play a role. Competition is important in spurring ICT investment as it forces firms to seek ways to strengthen performance relative to competitors. In addition, newly created firms are often the first to take up new technologies; a lack of new firm creation and a lack of subsequent growth of these firms may therefore also be linked to poor performance in turning ICT investment into productivity gains.

Figure 17. **Labour productivity growth in selected ICT-using services, 1990-95 and 1996-2002**

(Value added per person employed, annual average growth rates in per cent)



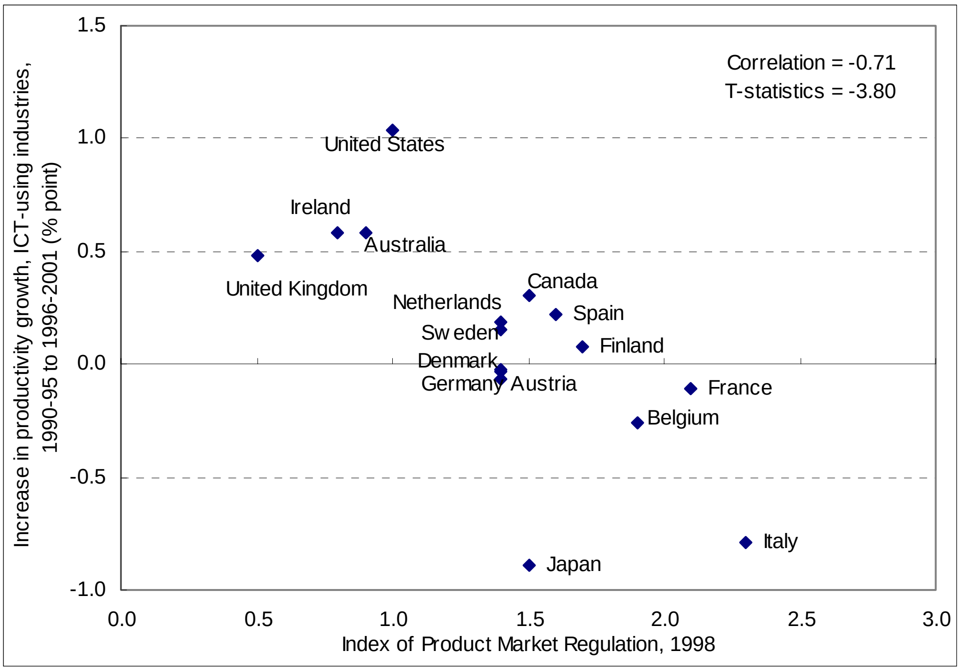
Notes: See Figure 15 for period coverage. Wholesale and retail trade includes hotels and restaurants for Japan.

Source: Estimates on the basis of the OECD STAN database, September 2004.

Product market regulations may also play a role as they can limit firms in the ways that they can extract benefits from their use of ICT and reduce the incentives for firms to innovate and develop new ICT applications. For example, product market regulations may limit firms' ability to extend beyond traditional industry boundaries. The impact of product market regulations on ICT investment is confirmed by several studies. For example, OECD countries that had a high level of regulation in 1998 have had lower shares of investment in ICT than countries with low degrees of product market regulation (Gust and Marquez, 2002; OECD, 2003*b*). Moreover, countries with a high degree or product market regulation have not seen the same pick-up in productivity growth in ICT-using services than countries with low levels of regulation (Figure 18).

Spill-over effects may also play a role, as ICT investment started earlier, and was stronger, in the United States than in most OECD countries (Colecchia and Schreyer, 2001; OECD, 2003*b*). Moreover, previous OECD work has pointed out that the US economy might be able to achieve greater benefits from ICT since it got its fundamentals right before many other OECD countries (OECD, 2001). Indeed, the United States may have benefited first from ICT investment ahead of other OECD countries, as it already had a high level of competition in the 1980s, which it strengthened through regulatory reforms in the 1980s and 1990s. For example, early and far-reaching liberalisation of the telecommunications sector boosted competition in dynamic segments of the ICT market. The combination of sound macroeconomic policies, well-functioning institutions and markets, and a competitive economic environment may thus be at the core of the US success.

Figure 18. **Relationship between growth in the contribution of ICT-using services to aggregate productivity growth and the state of product market regulation**



Source: OECD (2003), ICT and Economic Growth: Evidence from OECD Countries, Industries and Firms.

The United States is not the only country where ICT use may already have had impacts on MFP growth. Studies for Australia (Gretton *et al.*, 2004), suggest that a range of structural reforms have been important in driving the strong uptake of ICT by firms and have enabled these investments to be used in ways that generate productivity gains. This is particularly evident in wholesale and retail trade and in financial intermediation, where most of the Australian productivity gains in the second half of the 1990s have occurred. In some other countries, including Canada and the United Kingdom, there is evidence that certain ICT-using industries have experienced a pick-up in labour productivity growth, though not in MFP growth. But for most other OECD countries, there is little evidence that ICT-using industries are experiencing an improvement in labour productivity growth, let alone any change in MFP growth.

Seizing the benefits from ICT therefore crucially depends on complementary investments in organisational change, skills and innovation (OECD, 2003b). These investments and changes, in turn, require a business environment that is sufficient flexible for firms to make the necessary changes. Many OECD countries still require further reform of product and labour markets to foster such an environment.

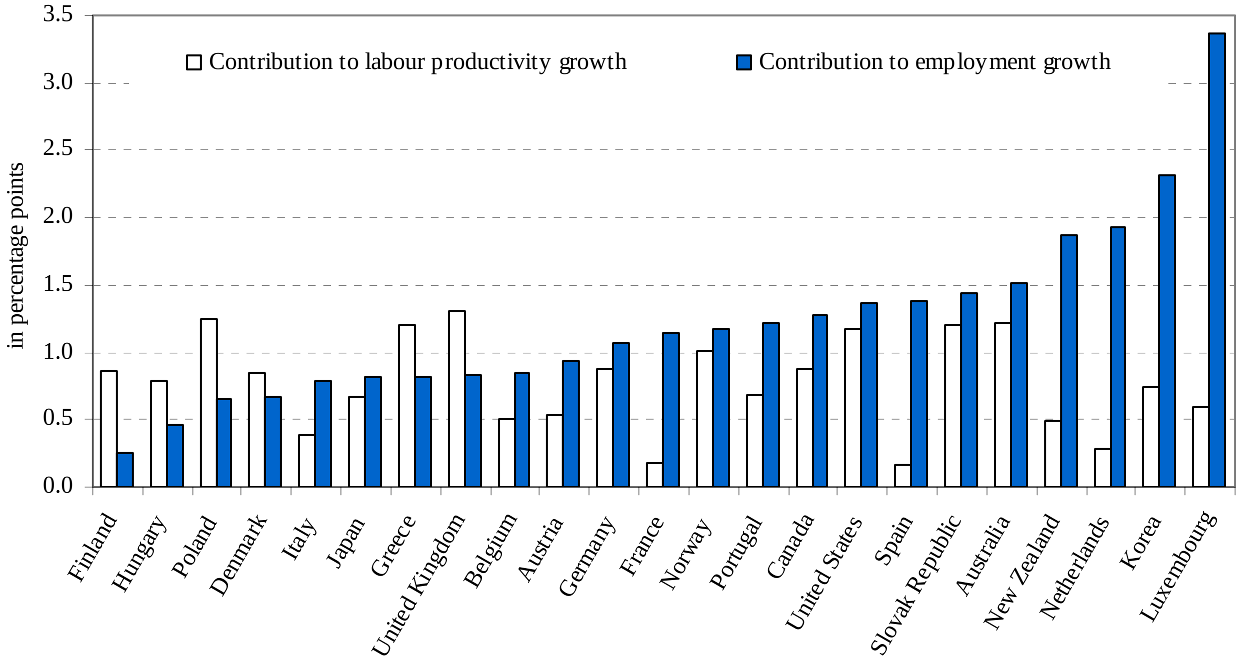
III.5 The role of services

OECD countries have very different experiences as regards the contribution of services to employment and labour productivity growth (Figure 19). In certain countries, such as Korea, New Zealand and the Netherlands, services have made an important contribution to employment growth over the past decade, but a relatively small contribution to productivity growth. In a few others, such as Greece, Poland and the United Kingdom, the contribution of services to productivity growth has been larger than their contribution to employment growth. In yet another group of countries, including Australia, Canada, the Slovak

Republic and the United States, services have made important contributions to both employment and productivity growth.

Figure 19. **Contribution to aggregate productivity and employment growth of the services sector, 1990-2002[1]**

Average annual contribution in percentage points



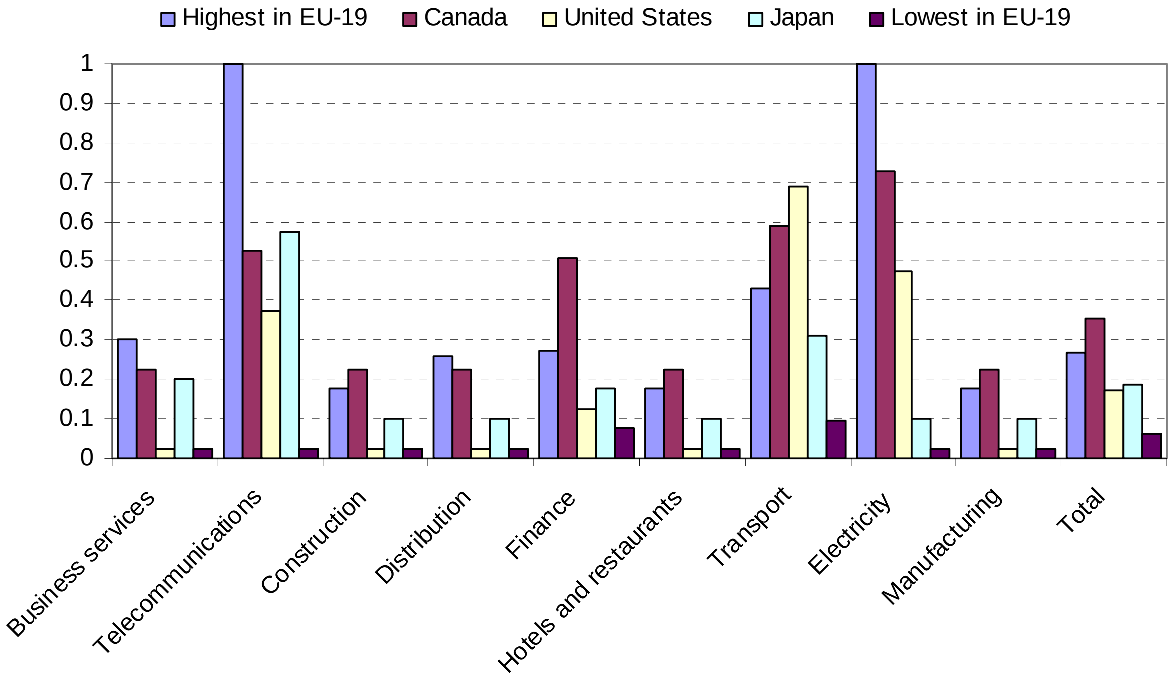
Source: OECD STAN database, 2004.

Over time, the contribution of services will have to grow in many OECD countries, as the manufacturing sector will decline and manufacturing firms will slowly be turned into services firms. Moreover, a productive and competitive services sector is also important to underpin the performance of the manufacturing sector. The growing importance of services makes it important to implement policies that take account of the growing contribution of this sector to aggregate performance. Regulatory reform and openness to trade and foreign direct investment in services are of great importance in this regard, as the services sector is traditionally less exposed to competitive pressure than the manufacturing sector. Restrictions on FDI in the services sector differ considerable across OECD countries, with some countries having very severe restrictions on FDI in certain services sectors (Figure 20).

Better product market regulation and a more competitive environment can speed up the adoption of new technologies in the services sector and, more generally, the process of innovation and growth. It is also important to consider whether existing policies may have an implicit policy bias against services. For example, government policies for R&D and technology diffusion are often primarily focused on the manufacturing sector and do not always address the specific needs of the services sector.

Enhancing the understanding of the services sector is important since the recent experience of countries such as the United States and Australia shows that this sector can be a dynamic source of growth, notably through the effective application of ICT, organisational change and upgrading of skills. Moreover, with the slow decline of the manufacturing sector throughout the OECD area, the services sector becomes increasingly important for aggregate employment and productivity growth. To address these issues, the OECD has recently launched a new project on the economic performance of the services sector, and the policies that can help foster growth of employment and productivity. The results of this work will be presented to the 2005 OECD Ministerial meeting, and will provide a synthesis of our understanding of the growing service economy and of the policies best suited to promote productivity, growth and employment in this sector throughout OECD countries.

Figure 20: **Restrictions on FDI in selected OECD countries, 1998, by industry**



Source: OECD, 2004.

IV. Concluding remarks

This paper updates some of the previous OECD work on economic growth and brings together some of the recent evidence at the aggregate, industry and firm level. It also points to some of the factors that have influenced the diversity in growth performance of OECD countries over the past years. There are obviously other factors that may have contributed to higher growth in the 1990s, and it will take further research to understand better why the United States and some other countries did so well over this period. One important driving factor may have been the increased level of competition in many OECD countries, due to regulatory reform and greater openness to international trade and investment. This has likely increased the incentives for firms to increase overall efficiency, and may also have facilitated the diffusion of new technologies and knowledge. The available evidence suggests that regulatory reform has indeed improved productivity, in particular in services sectors such as distribution, financial services, transport and telecommunications.

The paper also demonstrates that in several countries with strong growth in the 1990s, ICT investment has been important. This has led to a rapid diffusion of ICT, which has also affected overall efficiency, at least in a few OECD countries. Innovation and technology diffusion are also important, as a possible way to higher MFP and to future technological breakthroughs. Education and skills have also gained new significance, partly due to the diffusion of new technologies. In addition, MFP growth in new industries has been accompanied by the creation of start-up firms. While these factors play an important role, they also rely on sound fundamentals – macroeconomic stability, openness and competition, as well as economic and social institutions – if they are to work properly. Many of the countries that improved growth performance in the 1990s did so because they had been able to create an environment that could take advantage of the new technologies and business opportunities when they emerged. Moreover, strong fundamentals allowed these countries to improve productivity while simultaneously drawing more people into productive employment.

At the macroeconomic level, countries that enjoyed faster growth also had policies aimed at keeping inflation low and reducing the burden of public debt. Stable macroeconomic conditions make it easier for established businesses to plan ahead and for new businesses to survive their early years. Public spending geared to improving infrastructure and human capital also helps entrepreneurship flourish. But the successful countries also had other policies in place -- or policy reforms -- that reinforced the impact of prudent demand-management policies. Competition and openness to trade, investment and ideas encourages firms to search for new and better ways of satisfying consumer demands, while a liquid and competitive financial sector helps ensure that scarce financial resources are channelled to their most productive uses. Moreover, a combination of social and labour market policies and institutions that enables and encourages people of all ages and skill levels to find jobs easily and quickly is an all-important element in making it easier for societies to embrace change. Giving the right incentives to people to remain employable through life ensures that they can share the fruits of growth. Further policy actions to improve these fundamentals will still be needed in many OECD countries, in particular to further increase labour participation, as well as to reduce regulatory burdens and further strengthen competition in the economy. More can be done also to strengthen innovation, investment in human capital and firm creation. These areas still offer a potential to move closer to best policy practices and could help improve growth performance.

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