Productivity Growth in the OECD Area: Some Recent Findings

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Productivity is, once more, on the agenda in many OECD countries. It has long been regarded as the long-run driver of economic growth, but attention for productivity-related issues has waxed and waned over the past decades. In recent years, productivity growth has received a great deal of attention in several OECD countries, notably Australia, Canada, the Netherlands, the United Kingdom and the United States. Recently, the growing focus on productivity has also affected work at the OECD. The organization was asked in 1999 by its member countries to examine the variation in growth (and productivity) performance in the OECD area, analyse its causes and provide guidance for policy making. The strong performance of the United States at the time and related claims about a "new economy" were among the reasons for this demand, as was the poor performance of several other OECD countries. A final report was presented to the OECD Ministerial meeting in May 2001 and was released in August 2001 (OECD, 2001a).

This article briefly summarizes some of the findings of OECD work on productivity; it also points to some work that is ongoing. The article first discusses recent trends in economic and productivity growth in the OECD area, and examines some of the main driving factors of differences in economic growth. Next, it focuses in more detail on the pick-up in multi-factor productivity growth in some OECD countries and explores why this may have increased in some countries over the recent period. A final section briefly examines the role of structural change in productivity growth. The article also touches briefly on some of the methodological work on productivity measurement that is underway at the OECD (Schreyer, 2001*a*).

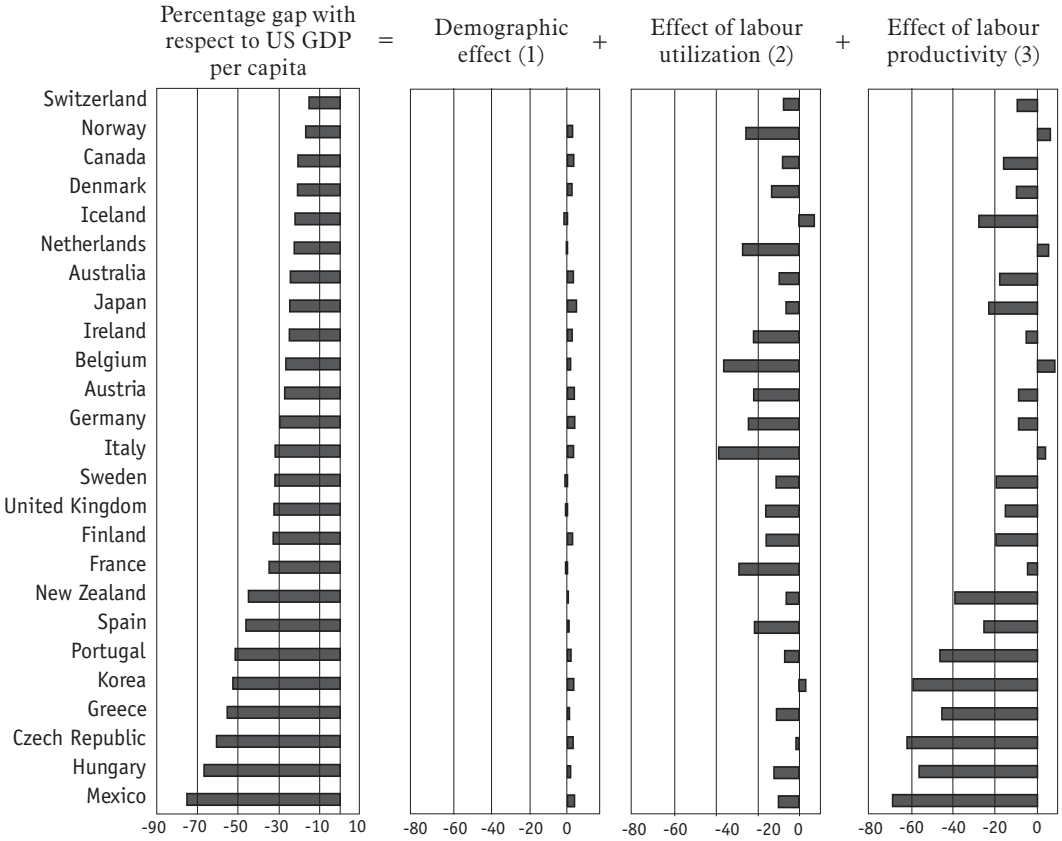
Recent growth patterns

In examining growth patterns today, it is important to remember that economic growth in the OECD area has varied considerably over the post-war period. In the 1950s and 1960s, most OECD countries grew rapidly as they recovered from the war and applied U.S. technology and knowledge to upgrade their economies. Growth of GDP per capita in Western Europe reached almost 4 per cent annually over the 1950-1973 period, and OECD countries in Southern Europe, as well as Japan and Korea grew even more rapidly (Maddison, 2001). This catch-up

Figure 1

Differentials in GDP per Capita and Determinants, 1999

Percentage point differences in PPP-based GDP per capita with respect to the United States



1. This measures the part of the gap in GDP per capita that is due to demographic factors. It is based on the ratio of the working-age population to the total population.
2. This measures the part of the gap in GDP per capita that is due to differences in labour utilization. It is based on employment rates and average hours worked.
3. This measures the part of the gap in GDP per capita that is due to differences in GDP per hour worked.

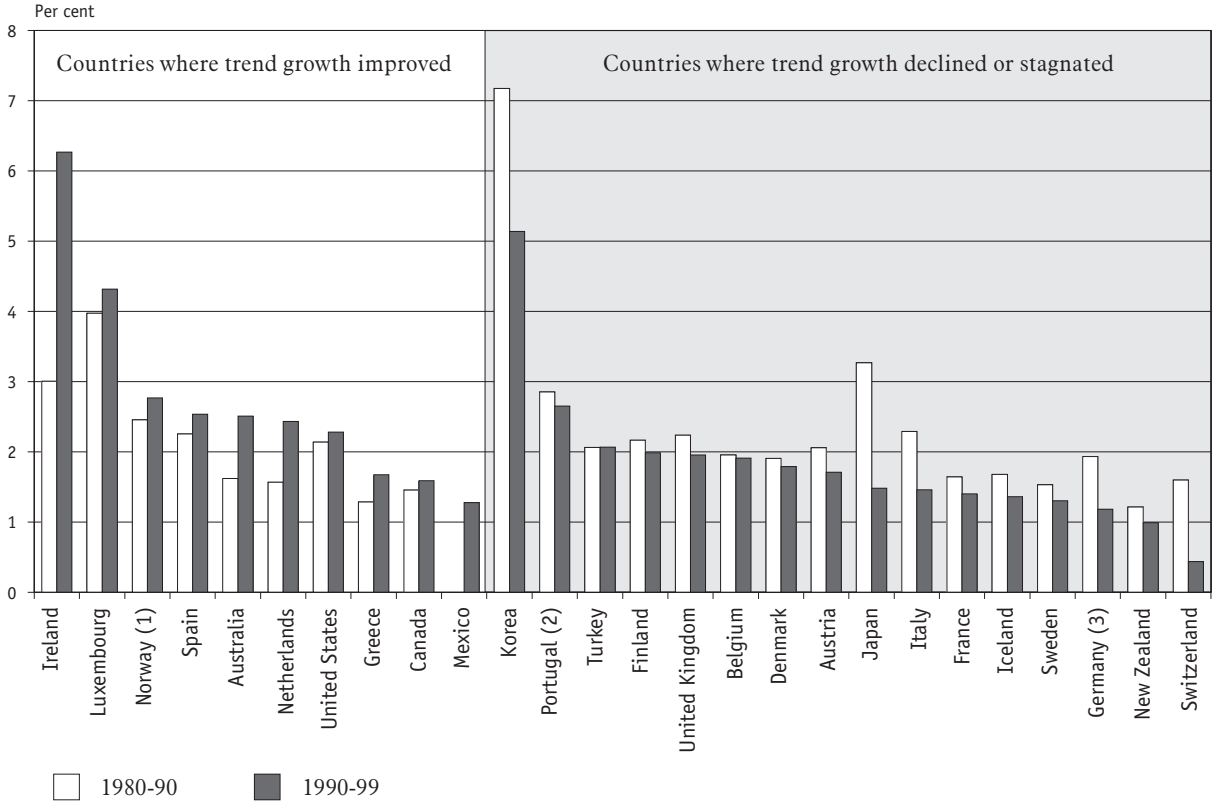
Source: Schreyer and Pilat (2001); GDP and population from OECD National Accounts; working-age population, labour force and employment from OECD Labour Force Statistics; hour worked from OECD calculations, see Scarpetta, *et al.* (2000). GDP converted to common currency by 1999 OECD PPP for GDP.

period came to a halt in the 1970s; average growth rates of GDP per capita over the 1973-98 period for much of the OECD area were only half that of the preceding period. Strong growth in some countries in recent years should be seen in the light of this overall slowdown.

Looking at recent growth patterns also benefits from an examination of current levels of income and productivity. In 1999, the United States had the highest level of GDP per capita in the OECD area (Figure 1). This is no different than it was over the past five decades. However, the gap between the U.S. level and that of other major OECD countries has widened markedly since the early 1990s, as underlying growth in some economies, particularly Japan and Germany, slowed in the 1990s when compared with the 1980s. The wide differences in income levels in 1999 therefore partly reflect discrepancies in growth patterns in the OECD area over the past decade.

This becomes clearer when comparing *trend* growth, *i.e.* growth rates adjusted for the business cycle.[1] Three OECD countries — Australia, Ireland and the Netherlands — registered

Figure 2
Trend Growth of GDP per Capita
Total economy, percentage change at annual rate



1. Total Norway. 2. 1990-98. 3. West Germany for 1980-90; Germany for 1991-99.

Source: OECD (2001*a*), based on data for the OECD *Economic Outlook*, No 68. See Scarpetta *et al*. (2000) for details.

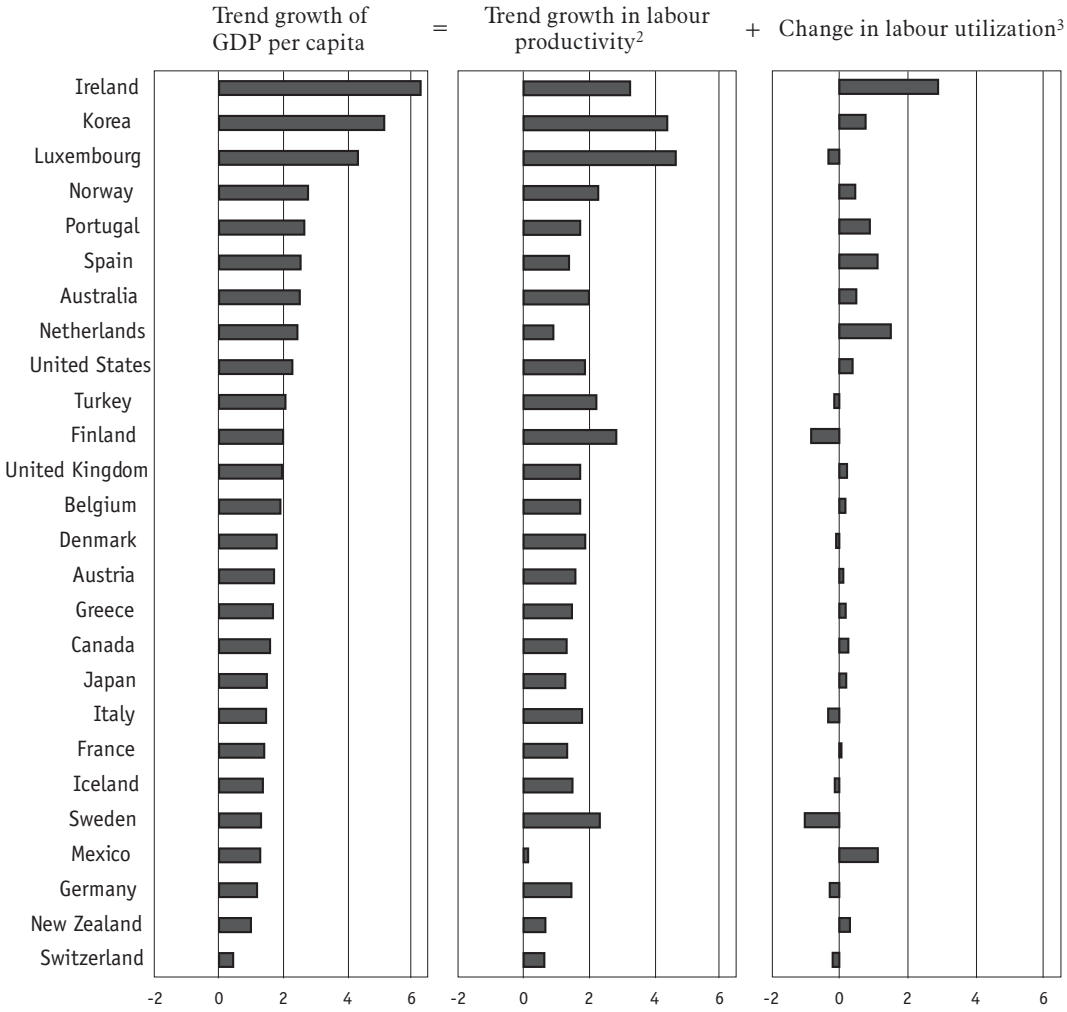
markedly stronger growth of GDP per capita over the past decade compared with the 1980s (Figure 2). Several other countries also experienced some improvement. This includes the United States, where trend growth accelerated strongly in the second half of the decade. In contrast, the increase in GDP per capita in many other OECD countries, including Japan and much of Europe, slowed, in some cases quite markedly so. In several countries, such as Finland, Canada, Greece, Iceland and Sweden, a pick-up in trend growth of GDP per capita became apparent only in the second half of the 1990s.

OECD research suggests that the divergence in growth performance in the OECD area is not a reflection of different measurement techniques used in OECD countries (Schreyer, 2001a). Some studies have claimed that strong growth in the United States is partly due to the way its GDP is being measured. This is unlikely. First, almost all OECD countries have now adopted the 1993 System of National Accounts, which implies that the framework for the measurement of GDP levels is broadly the same across countries. Second, while the measurement of prices does differ across countries, and only some countries currently use hedonic deflators, this has only a small impact on estimates of total GDP, usually of the order of 0.1 to 0.2 percentage points. Overall cross-country comparisons of GDP should still be valid as a result. Third, the United States uses chain-weighted indexes in combination with its hedonic price index for computers. The combined effect of these two methods on GDP growth should be minor as they broadly balance each other out.

Figure 3

Changes in Labour Utilization Contribute to Trend Growth in GDP per Capita

Total economy, percentage change at annual rates, 1990-99[1]



1. 1991-99 for Germany; 1990-98 for Korea and Portugal.

2. Trend growth in GDP per person employed.

3. Trend growth in labour utilization, measured as persons employed to the total population, and including the demographic effect.

Source: OECD (2001*a*), based on data for the OECD *Economic Outlook*, No 68.

While measurement does not seem to be part of the explanation, the OECD work does point to an important role for differences in labour utilization (Figure 3). The United States, together with a few other countries, improved its labour productivity and labour utilization at the same time — *i.e.* more people worked more productively. In contrast, some European countries had strong productivity growth, but low employment growth, particularly in the first half of the 1990s. Their higher productivity growth may have been achieved by a greater use of capital or by dismissing (or not employing) low-productivity workers.

Differences in labour utilization and labour productivity also help to explain the large gap in income levels in 1999 (Figure 1). France, Italy, Belgium and the Netherlands, for instance, have high productivity levels, and their lower employment rates and shorter working hours help explain the bulk of the income gap with the United States, whose labour utilization rate was higher (Scarpetta *et al.*, 2000). For countries in

the OECD area with lower income levels, low levels of labour productivity are the main reason for the large gap in income levels.

Labour utilization is thus one factor explaining the variation in growth performance; it also points to the importance of labour market performance in explaining growth differentials. Labour productivity, meanwhile, 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 greater overall efficiency in how these factors of production are used together, or multi-factor productivity (MFP). MFP reflects many types of efficiency improvements, such as improved managerial practices, organizational changes and innovative ways of producing goods and services.

The quality of labour is the first factor that plays a fundamental role in labour productivity growth. The rise in the educational attainment among workers over the 1990s is only one sign of this role; increases in the level of post-educational skills may be even more important, although few hard measures are available. Another reason is technology: the demand for more and better skills has risen in response to more and better technology. Improvements in the quality of labour have directly contributed to labour productivity growth in virtually all OECD countries (Scarpetta *et al.*, 2000; OECD, 2000*b*).[2]

Investment in physical capital is the second factor that plays an important role. It 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, information and communication technologies (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, has encouraged investment in ICT, at times shifting investment away from other assets. The available data for OECD countries 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 35 per cent in 1999 (Colecchia and Schreyer, 2001).

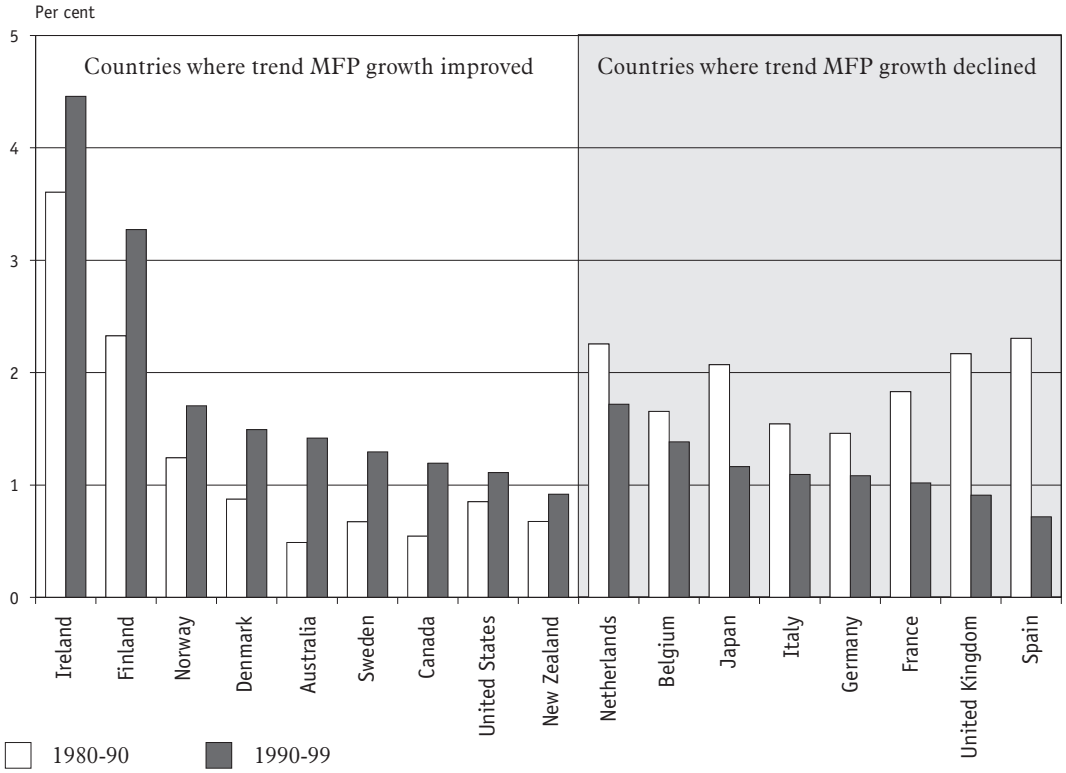
While ICT investment accelerated in most OECD countries, the pace of that investment and its impact on growth differed widely. For the countries for which data are available, ICT investment accounted for between 0.3 and 0.9 percentage points of growth in GDP per capita over the 1995-99 period.[3] The United States, Australia and Finland received the largest boost; Japan, Germany, France and Italy the smallest. Software accounted for up to a third of the overall contribution of ICT investment to GDP growth in OECD countries. Estimates for the United Kingdom (Oulton, 2001) suggest that the role of ICT investment was larger in that country over 1994-98 than in other major EU countries. A study for the Netherlands suggests, however, only a small role for ICT investment over 1996-99 (Van der Wiel, 2000).

The shift in investment towards ICT has also led to a change in the composition of the capital stock in OECD countries towards assets with higher "marginal" productivity, *i.e.* an improvement in the overall quality of the capital stock. The improvement in quality implies that investment in ICT has had larger effects on GDP growth than similar investment in other assets would have had. In the United States, over the 1995-99 period, increased quality is estimated to account for over 0.5 percentage points of the total contribution of capital to GDP growth, of 1.7 percentage points. In Australia, about one-quarter of the 1.6 percentage point contribution of capital to GDP growth over 1990-99 is estimated to be due to improved quality (Colecchia and Schreyer, 2001).

Figure 4

Trend Multi-factor Productivity Growth Increased in Many Countries

Business Sector, average annual percentage growth, 1980-90 and 1990-99[1]



1. Series start in 1983 for Belgium, Denmark, Ireland and 1987 for New Zealand; they end in 1997 for Austria, Belgium, Italy and New Zealand. 1998 for Australia, Denmark, France, Ireland, Japan, Netherlands and United Kingdom. Data for Germany for 1990-99 start in 1991. The estimates are adjusted for hours worked and are based on trend series. They are not adjusted for changes in the quality of human capital, or the composition of the capital stock, as such data are only available for a few OECD countries.

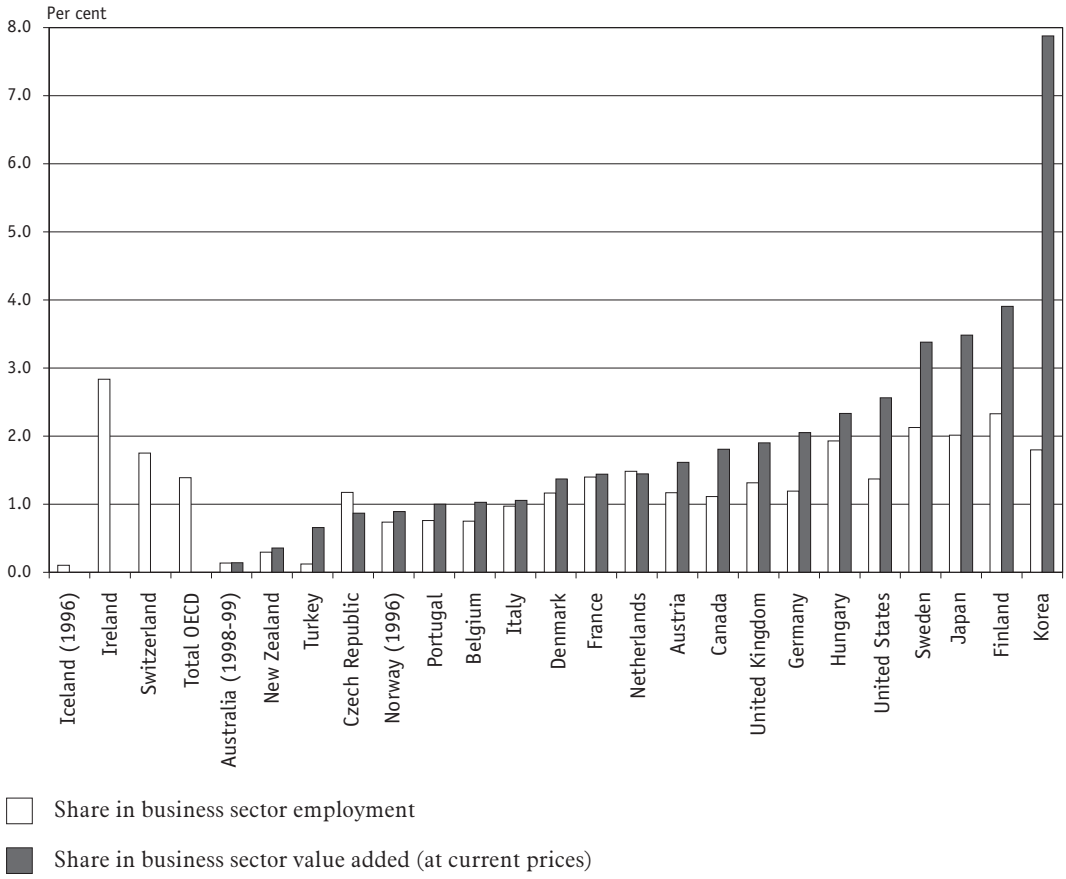
Source: OECD (2001*a*); see Scarpetta et al. (2000) for methodological details.

The pick-up in MFP growth

The final factor that accounts for some of the pick-up in labour productivity growth is a faster increase in trend multi-factor productivity growth in the 1990s. MFP growth rose particularly in Australia, Canada, Denmark, Finland, Ireland and Sweden (Figure 4). In the second half of the 1990s, the trend in MFP improved further in several countries, including the United States. This improvement 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, organizational 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 all of these factors. Some is available, though, and is discussed below.

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 so since 1995. While the ICT manufacturing sector is relatively small

Figure 5
The Share of ICT Manufacturing Sector in the Business Sector, 1998



Source: The OECD definition of ICT manufacturing covers the following industries according to the International Standard Industry Classification (ISIC) Revision 3:

3000 Manufacture of office, accounting and computing machinery;

3130 Manufacture of insulated wire and cable;

3210 Manufacture of electronic valves and tubes and other electronic components;

3220 Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy;

3230 Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods;

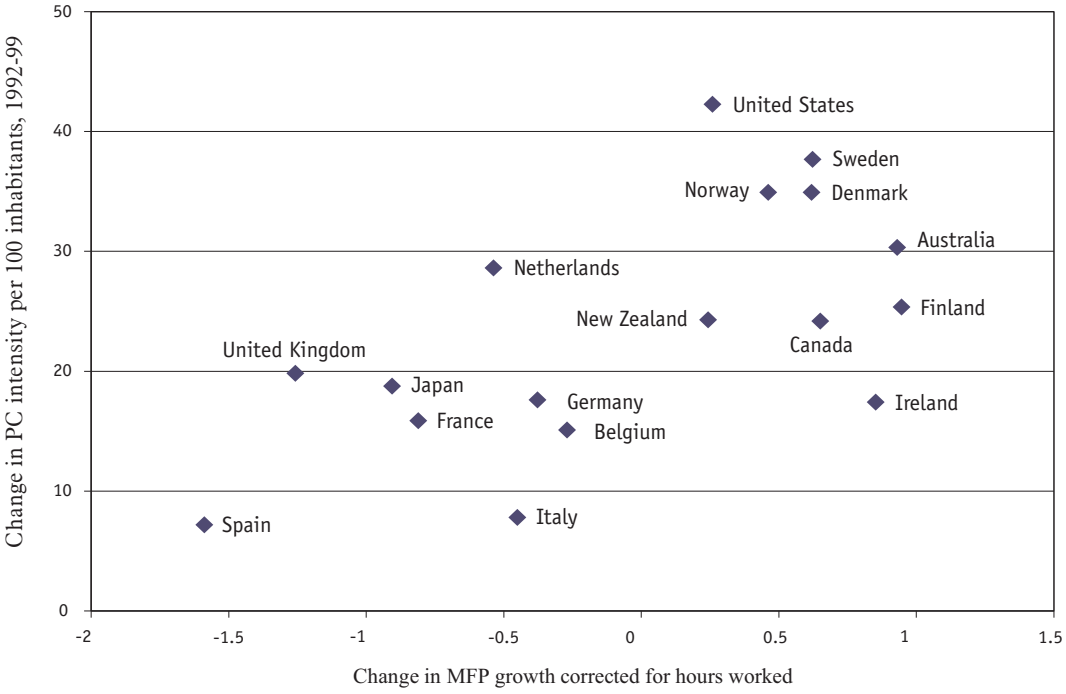
3312 Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment;

3313 Manufacture of industrial process control equipment. See OECD (2000*b*) for further detail and for complete coverage of the ICT sector, including ICT services.

in most OECD countries (Figure 5), it can make a large contribution to growth if it expands much more rapidly than other sectors. In the United States, for instance, MFP growth in the ICT-producing sector explains about 0.2-0.3 per cent of the overall pick-up in MFP growth since 1995 (U.S. Council of Economic Advisors, 2001). Some other OECD countries, such as Finland, have also benefited from rapid MFP growth in the ICT-producing sector (Pilat and Lee, 2001).

MFP also reflects the effects of competition. Analysis of productivity growth at the firm level shows that the effects of competition, such as the entry and exit of firms and changes in market shares are important drivers of productivity growth (Bartelsman and Doms, 2000; OECD, 2001*b*). New firms typically 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

Figure 6
Pick-up in MFP Growth and Increase in ICT Use



Note: *Correlation coefficient: 0.61; T statistic: 3.0.*

Source: Figure 4 and OECD *Information Technology Outlook* 2000.

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. In contrast, growth in mature industries is typically driven by productivity growth within existing firms or by the exit of obsolete firms.[4]

Third, R&D and technological change are important drivers of MFP growth (Guellec and Van Pottelsberghe, 2001). Foreign 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. But domestic R&D, *i.e.* business, government and university research, is also an important driver of MFP growth. It is also key in tapping into foreign knowledge; countries that invest in their own R&D appear to benefit most from foreign R&D.[5]

The fourth driver of MFP that can be identified is the use of ICT in the production process. For ICT to have benefits on MFP in countries that do not produce ICT goods, it needs to have spill-over effects linked to its use in the production process. These effects have proven difficult to identify over the past decade, even though ICT has diffused rapidly. Partly, this was due to three factors. First, some of the benefits of ICT may not be picked up in the productivity statistics (Triplett, 1999). For instance, the improved convenience of financial services due to automatic teller machines (ATMs) is only counted as an improvement in the quality of financial services in some OECD countries. Similar problems exist for insurance and business services. In fact, ICT may have aggravated the problems of measuring productivity, as it allows greater customisation and differentiation of services provided, which is difficult to capture in statistical surveys. A second reason is that the benefits of ICT use might take some time to emerge, as did the impacts of other key technologies, such as electricity. This is because the diffusion of new technologies is often

slow and firms can take a long time to adjust to them. For instance, ICT use may require organizational change and upskilling of workers, none of which can be done overnight. Third, assuming ICT can lift MFP in part via the networks it provides, it takes time to build networks that are sufficiently large to have an effect on the economy. As investment and diffusion of ICT was high in the 1990s, networks have probably broadened, suggesting that computers may now show up much more clearly in the productivity statistics.

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 MFP growth in recent years, *e.g.* in the United States, Australia and Finland (Stiroh, 2001; Productivity Commission, 1999; Pilat and Lee, 2001). Second, there is evidence at the firm level that ICT can help to improve the overall efficiency of capital and labour (Brynjolfsson and Hitt, 2000). Third, countries that experienced a more rapid diffusion of ICT in the 1990s typically experienced a more rapid pick-up in MFP growth in the 1990s than countries where the diffusion process was slower (Figure 6).

There are other factors that may have contributed to higher MFP 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 service sectors such as distribution, financial services, transport and telecommunications (Gönenc *et al.* 2001). This does not contradict the findings above; greater competition may have been among the ultimate drivers of greater use of ICT, more rapid innovation, the entry of new firms and the exit of unproductive firms.

The contribution of structural change to productivity growth

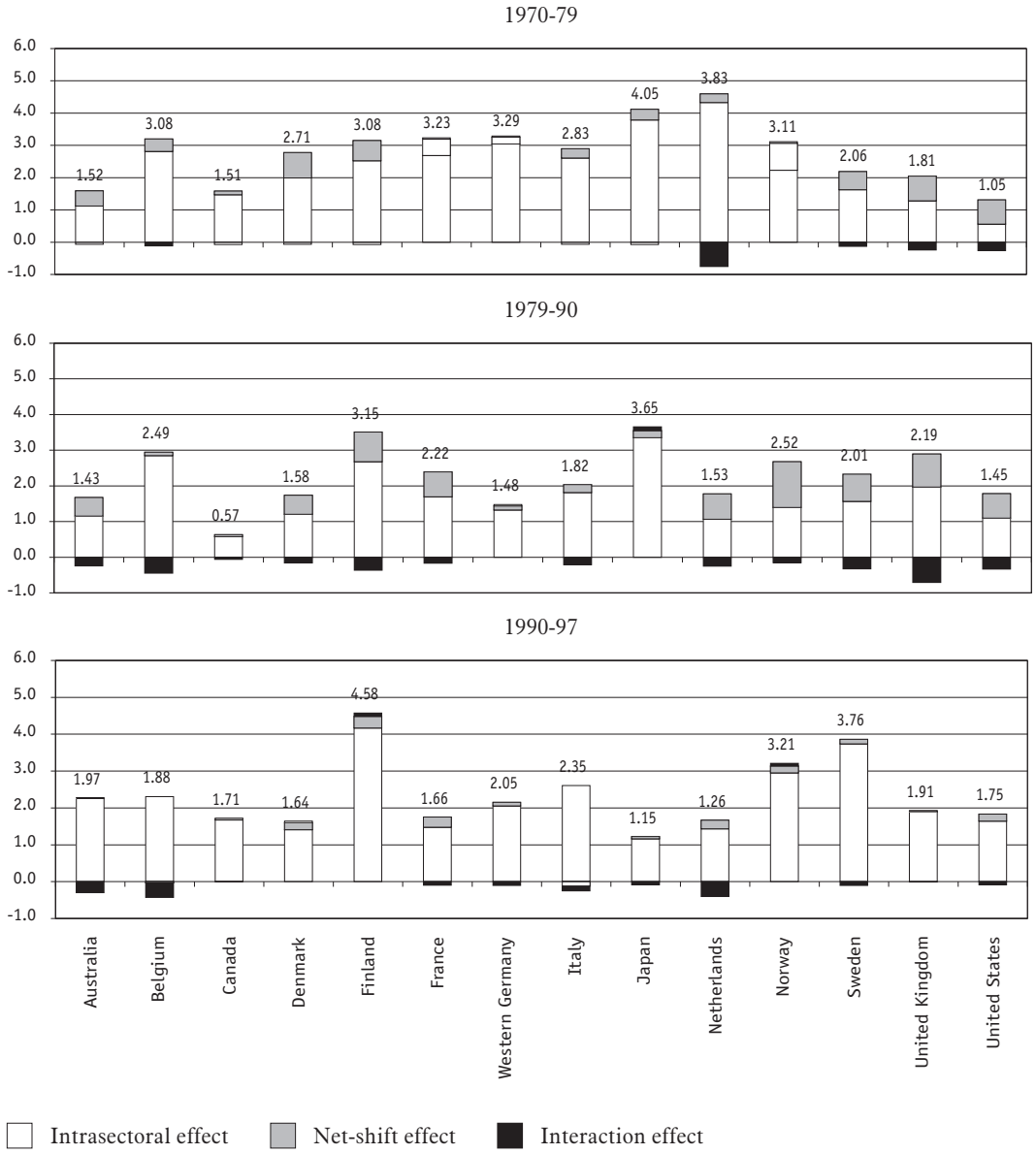
Aggregate analysis of productivity growth may hide significant differences in trends across economic activities. Recent OECD work has therefore also considered the sectoral and firm-level dimensions of productivity growth (Scarpetta *et al*., 2000; OECD, 2001*b*; Pilat and Lee, 2001). Only one aspect of this work is discussed here, namely the role of structural change. Aggregate productivity growth partly depends on shifts of resources across industries. Historically, these shifts were an important driver of productivity, as resources moved from the low-productive agricultural sector to a more productive manufacturing sector. More recently, the evidence from aggregate data seems to suggest that a large contribution to overall productivity growth patterns comes from productivity changes within industries rather than as a result of significant shifts of employment across industries (van Ark, 1996).

Figure 7 presents a decomposition of labour productivity growth in the business sector in three factors using the industry decomposition available in the former ISDB-STAN database (2-digit ISIC for services and a 3-4 digit ISIC for manufacturing):[6] an "intra-sectoral effect", that measures productivity growth within industries; a "net-shift effect", that measures the impact on productivity of the shift in employment between industries; and a residual third effect, the "interaction effect". This last effect is positive when sectors with growing productivity have a growing employment share or when industries with

Figure 7

Decomposition of Labour Productivity Growth, by Period

Average annual per cent rate of change



Source: Scarpetta, et al. (2000).

falling relative productivity decline in size. It is negative when industries with growing relative productivity decline in size or when industries with falling productivity grow in size.

The results of these calculations show that the intra-industry effect is the most important contributor to productivity growth in the non-farm business sector. The net-shift effect also makes an important contribution, but primarily during the 1970-79 and 1979-90 periods. Most of this impact can be allocated to the increased size of the business services sector. The interaction effect tends to be negative for most countries. It was particularly important in the United Kingdom in the 1980s, where it was linked to the decline of mining and manufacturing. These results are confirmed by looking at manufacturing only (Scarpetta, *et al.* 2000). Employment shifts across manufacturing industries played a very modest role in most countries.

The evidence that productivity growth is more than ever a matter of performance improvement within industries is perhaps not surprising for the countries examined above, as around 70 per cent of value added in these countries is already in the services sector. However, other OECD economies, including Ireland and Japan as well as some low-income countries have much smaller service sectors, suggesting that there may be further scope for structural change. In addition, there is likely to be scope for further structural change and improved resource allocation within the industries considered in Figure 7. This is confirmed by work with firm-level data (OECD, 2001*b*).

Summing up

The OECD work over the past years reflects the growing interest in productivity in many countries. Much work has been completed regarding the measurement of productivity and the comparability of productivity growth rates across OECD countries (Schreyer, 2001*a*; 2001*b*). A considerable amount of work has also been done to develop better data, *e.g.* on the role of ICT. Much attention has also focused on the analysis of growth patterns, at the aggregate, sectoral and firm level, and on the various factors that drive productivity growth. Ultimately, this work should improve the understanding of productivity growth, and help to give guidance to policies to improve productivity growth in OECD member countries. A comprehensive policy report on growth was presented to the OECD Ministerial Meeting in May (OECD, 2001*a*), and led to a request for further work. Much has been completed in recent years, but several areas still require further work.

Notes

* This paper does not necessarily represent the views of the OECD or its member countries. It draws on "The New Economy: Beyond the Hype" (OECD, 2001a), which was prepared for the 2001 OECD Ministerial Meeting. The full version of this report was released in August. This paper also benefits from the work of many colleagues at the OECD in the area of productivity and growth. More detail on this work and a range of studies are available on the OECD Internet site, at: http:\\www.oecd.org\subject\growth. Email: dirk.pilat@oecd.org.

1 The adjustment for the business cycle is discussed in greater detail in Scarpetta, et al. (2000).

2 The key role of human capital is confirmed by Bassanini and Scarpetta (2001). Based on a new database, they find that one additional year of schooling would, on average, lead to about 6 per cent higher GDP in the long run.

3 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). Methodological differences in the measurement of software investment may affect the results, however.

4 The analysis of productivity growth at the firm level continues at OECD, and is based on close co-operation with researchers and statistical offices in OECD Member countries. A progress report is published as OECD (2001b).

5 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 increases in government and university performed R&D increased MFP by 0.2 per cent. Embodied technology has only a small impact on MFP in these estimates: a 1 per cent increase leads to a 0.02 per cent increase in MFP. See Guellec and Van Pottelsberghe (2001) for more detail.

6 The shift-share analysis presented here has limitations other than the lack of detail for services (Timmer and Szirmai, 1999). First, it focuses on labour productivity, and not on multi-factor productivity. Second, it assumes that marginal productivity of factor inputs moving in or out an industry is the same as average productivity. Finally, if output growth is positively related to productivity growth (the Verdoorn effect), the impact of structural change may be underestimated, since part of the shift to rapid-growth sectors will be counted in the within-effect. The breakdown shown here will be extended in more detail with the new STAN database, which is based on ISIC Revision 3 and provides greater detail for the services sector. More detail on STAN is available on the OECD Internet site: http://www.oecd.org under the theme "Growth."

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