THE EMPLOYMENT EFFECTS OF THE 'NEW ECONOMY'. A COMPARISON OF THE EUROPEAN UNION AND THE UNITED STATES

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This paper provides an analysis of the trends in labour productivity and employment growth at industry level in the European Union and the United States during the 1990s. We analyse relationships for groups of industries, i.e. industries that produce ICT products and services, those that invest strongly in ICT, and those that make less intensive use of ICT. The main findings are that the inverse relationship between employment and productivity growth has been much more prominent in manufacturing industries than in services industries. Secondly, during the 1990s, this relationship has turned positive in many industries, in particular in ICT-producing industries and in ICT-using industries in the service sector. Finally, the employment-reducing effects of productivity growth have remained considerably stronger in Europe than in the US.

1. Introduction

The explosive growth of investment in information and communication technology (ICT) has been at the centre of the 'new economy' hyperbole. While the slowdown in GDP growth since 2000 has tempered enthusiasm for investment in ICT in Europe and the United States alike, the contribution of ICT investment to economic performance should not be assessed solely on the basis of a cyclical slowdown in investment. In fact, recent analysis suggests that the structural forces of the late 1990s are still in place, despite the slowdown in growth on both sides of the Atlantic.[1]

Despite faster GDP growth, productivity growth in most European countries has slowed down during the second half of the 1990s. For the Union as a whole, the average annual growth rate of labour productivity, measured as gross domestic product per hour worked, fell from an average growth of 2.3 per cent in 1980–95 to 1.4 per cent in 1995–2000. In contrast, productivity growth in the United States accelerated from 1.3 per cent during the 1980s and first half of the 1990s to 1.9 per cent during the second half of the decade.

The acceleration of productivity growth in the United States has been widely attributed to the rapid increase in investment in information and communication technology (ICT) (OECD 2001). Some have stressed that this growth acceleration is to a large extent due to improved productivity growth in the ICT-producing sector (Jorgenson, 2001). Others have demonstrated an increasingly productive use of ICT goods and services elsewhere in the economy (Baily, 2002; Oliner and Sichel, 2002).

While there has been much discussion of the link between productivity growth and the 'new economy' there has been much less focus on the behaviour of employment.[2] Both the United States and the European Union experienced an improvement in the employment situation during the late 1990s. During the period 1995–2000, US employment, in terms of number of workers, increased at about 2.0 per cent annually with Europe registering 1.2 per cent growth per year. For the US this represented continuation of a long-standing trend of rapid employment growth for most of the 1980s and 1990s. In contrast, in the EU it constituted a sharp increase following a decade and a half of relatively slow employment growth. During the period 1980–95, employment growth in the European Union was meagre at 0.3 per cent.

Despite the acceleration, employment growth in Europe remained lower than in the US during the second half of the 1990s. In terms of total hours worked, the gap between US and EU labour input growth was even higher than for growth in employed persons. Average

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hours per employee in Europe declined while those in the US even increased somewhat (McGuckin and van Ark, 2003).

Thus, compared to the previous two decades, Europe has seen an improvement in the employment situation but with a strong slowdown in productivity growth. This suggests that the growth path of the EU in the 'new economy' era has become more labour intensive than it used to be, which suggests a negative relationship between employment and productivity growth, at least at the aggregate level. Europe shifted towards a more labour-intensive economic structure and away from its capital-intensive growth path of the 1980s and early 1990s.[3] In contrast the US has seen improvement in both productivity and employment growth. In fact, the US followed a balanced growth with both labour productivity and total working hours growing at about the same rate.

The inverse relationship between productivity and employment growth has been a concern in the literature and in political debate for a long time, starting as early as the 19th century with the Luddites movement arguing that industrialisation would destroy the jobs of skilled craftsmen. Naturally, in a stagnant economy labour productivity and employment growth will always move in different directions, as the sum of the two growth rates determines GDP growth. However, in a dynamic economy, the interaction between productivity and employment can take different directions. On the one hand, productivity and employment growth may be negatively related when labour-saving technological change is dominating the picture. On the other hand, and in particular in the longer run, productivity growth can enhance employment growth, especially when technological change is not only to process innovation but also to product innovation. New products or services are likely to generate additional demand, leading to new or expanded markets and causing a growth in output and employment.

Recent literature, in particular the OECD *Jobs Study* during the early 1990s and related follow-up studies, concluded that traditional distinctions between manufacturing and service industries, between demand and supply factors, and between process and product innovations all explain part of the mixed pattern of productivity–employment relationships.[4] The rise of Information and Communication Technology (ICT) has recently intensified the debate. Whereas previous major technologies of the 19th and 20th centuries have been clearly of a labour-saving nature, the impact of ICT is unclear. It has been argued that the use of ICT is skill-biased, but it might also complement low-skilled labour.[5] It is also clear that demand and supply effects on the labour market interact in a complex way, leading to very different patterns of output growth, productivity increases and employment performance, as is illustrated by the contrast between the US and Europe.

Our aim in this paper is to provide an analysis of productivity and employment trends at the industry level. By using a detailed dataset on labour productivity and employment in EU countries and the US, we analyse these relationships for three groups of industries: industries that produce ICT products and services, those that invest strongly in ICT, and those that make less intensive use of ICT.

In Section 2 we briefly describe the database and we introduce an industry taxonomy that distinguishes between ICT-producing, intensive ICT-using and 'non-ICT' industries. In Section 3 we report the trends in productivity and employment growth by major industry group, and in particular the change between 1990–5 and 1995–2000. In Section 4 we analyse the dynamics of productivity and employment growth at industry level in more detail. In Section 5 we consider this evidence in the light of various hypotheses and propose future approaches to understanding the dichotomy in the productivity–employment relationship between the EU and the US.

Our main findings are as follows. Firstly, the inverse relationship between employment and productivity growth is much more prominent in manufacturing industries than in service industries. Secondly, during the 1990s, this relationship has turned positive in many industries, in particular in ICT-producing industries and in ICT-using industries in the service sector. Finally, we conclude that the employment-reducing effects of productivity growth have remained considerably stronger in Europe than in the US.

Below we focus exclusively on the relation between labour productivity, expressed as value added per person employed, and 'raw' labour unadjusted for skills. At this moment we still lack reliable evidence on working hours at industry level in many countries. There is also insufficient information on skill distributions at the industry level across European countries to incorporate the change in skills induced by technological change.

As a final introductory note we acknowledge that, while our discussion focuses on comparisons between the United States and the European Union as a whole, there is a large diversity between countries concerning the relation between productivity and employment. Although a discussion of individual countries is beyond the scope of this paper, we provide two appendix tables (tables A2 and A3) which allow the reader to assess the evidence for individual countries. Here we only stress that while diversity is large, the main message from this paper, namely that the trade-off between productivity and employment has remained more predominant in Europe than in the US, also holds for most of the individual member countries.

2. Data and sources

For the analysis of productivity and employment growth in Europe and the US we developed a database, which contains information on value added and employment in sixteen OECD countries for 51 industries between 1990 and 2000.[6] The point of departure in this database is the new OECD STAN Database on national accounts. The STAN Database contains information on the most important national accounts variables from 1970 onwards on a common industrial classification.[7] The level of detail has to be very substantial to distinguish adequately between various ICT-producing and ICT-using industries. Hence for the level of detail used in this paper, only data for the period from 1990 onwards are available so far. In addition, STAN was supplemented with industry detail from national production surveys and services statistics covering production industries, distribution and services. In general the method employed was to use STAN aggregates as control totals and the additional data to divide these totals into sub-industries.

Three major groups of industries are being distinguished: ICT-producing industries, ICT-using industries and non-ICT industries. The first group includes producers of IT hardware, communication equipment, telecommunications and computer services (including software), and was distinguished based on an OECD classification (see for example OECD, 2002). The second and third groups are distinguished in terms of their intensity of use of ICT. This is a less straightforward undertaking since nearly every part of the economy uses some ICT. As a measure of ICT intensity, we rely on the share of ICT capital in total capital services in the United States from Stiroh (2001). Using these data, the top half of industries is classified as ICT-using and the bottom half as non-ICT.[8]

There are two reasons for applying the classification based on ICT investment intensity in the US to all countries. The first has to do with the very limited availability of data on ICT investment by industry outside the US, let alone capital stocks and capital services measures.[9] Secondly, given the leading role of the US, it is reasonable to assume that the distribution of ICT use in the US presents a set of technological opportunities, which may or may not have been taken up in other countries. Based on the available evidence for some European countries, van Ark *et al.* (2002a) show that the rankings of ICT intensity across industries is reasonably similar in the US and Europe. Table A1 shows all ICT-producing, ICT-using and non-ICT industries. We also make a distinction between manufacturing and services industries within each industry.

Before moving on, two important measurement problems need to be addressed, which are the method of aggregation and the deflation of ICT goods output. At present, many countries still use fixed-weight (Laspeyres) indices to calculate aggregate value added at constant prices. This can lead to serious substitution bias if the structure of the economy is changing over time. To correct for this problem, we calculate chain-weighted indices for all aggregated real output series to ensure consistency across countries. This means that our estimates for GDP will generally not conform to those from national statistical offices.

Another problem is the deflation of ICT goods. It is well known that the capabilities of semiconductors and computers have improved tremendously over the past few decades. Since consumers can buy computers with vastly more computing power at comparable prices, the price of computing power has declined continuously. However, traditional methods of sampling and quality adjustment in calculating price indices for these goods will almost certainly lead to an underestimation in the rate of the output price decline. At present there are only a few countries, like the US, Canada and France, that have an adequate system in place for measuring prices of computers and semiconductors. This means that measured productivity growth in ICT-producing industries in all other countries is likely to be much slower. We avoid this downward bias by applying a harmonisation procedure, which consists of applying the US deflators for each of the ICT-producing manufacturing industries to all other countries after making a correction for the general inflation level.[10] Although this of course influences the productivity

growth rates in the ICT-producing industries, we show that it does not have a large effect on the aggregate growth figures due to the relatively small weight of this sector in the total economy.

3. Major productivity and employment trends in ICT production and use

In this section we describe some of the major trends in productivity and employment growth at the industry level, focusing in particular on the changes which occurred during the 1990s.

Productivity trends by major industry

Table 1 shows the growth rates of labour productivity (measured as GDP per person employed) between the European Union and the United States. The table also shows the contributions of each industry group to aggregate productivity growth.[11] With a few exceptions the general picture is one of higher (and accelerated) US productivity growth rates compared to Europe during the second half of the 1990s.

Turning first to the ICT-producing industries, our attention is drawn to the rapid acceleration of productivity growth in this industry group. Table A1 shows a breakdown to individual industries, showing that most of the productivity acceleration took place in the production of computers and semiconductors.[12] This productivity advantage is strongly technology-driven as appears from a wide range of studies. Most ICT-producing industries exhibit faster productivity growth rates in the US than in the EU. Only in communication equipment and telecommunication services was productivity growth higher in Europe during the second half of the 1990s. Indeed the EU had a clear advantage over the United States in particular because of the rapid take-off of the wireless market.[13] It should be stressed, however, that on average the ICT-producing sector is considerably smaller in Europe than in the US, which is also reflected in its smaller contribution to aggregate GDP growth.

The second observation concerns the big improvement in productivity in the ICT-using sector (which excludes the ICT-producing industries) in the US. Most US industries in this group showed a fast acceleration in productivity growth after 1995. However, the US productivity advantage over Europe was limited to ICT-services. The EU experienced a negligible improvement in productivity growth of 0.3 percentage point compared to an increase of 3.5 percentage points in the

Table 1. Labour productivity growth, contributions by major industry, and GDP shares of ICT-producing, ICT-using and non-ICT industries in the EU and the US

	GDP per person employed				Contributions to aggregate productivity growth				GDP share	
	1990–1995		1995–2000		1990–1995		1995–2000		2000	
	EU[b]	US	EU[b]	US	EU[b]	US	EU[b]	US	EU[b]	US
Total economy	1.9	1.1	1.4	2.5	1.88	1.08	1.41	2.52	100.0	100.0
ICT-producing industries	6.7	8.1	8.7	10.1	0.33	0.51	0.47	0.75	5.9	7.3
ICT-producing manufacturing	11.1	15.1	13.8	23.7	0.17	0.40	0.22	0.68	1.6	2.6
ICT-producing services	4.4	3.1	6.5	1.8	0.16	0.11	0.25	0.07	4.3	4.7
ICT-using industries[a]	1.7	1.5	1.6	4.7	0.42	0.43	0.42	1.42	27.0	30.6
ICT-using manufacturing	3.1	–0.3	2.1	1.2	0.20	–0.01	0.13	0.05	5.9	4.3
ICT-using services	1.1	1.9	1.4	5.4	0.23	0.45	0.29	1.37	21.1	26.3
Non-ICT industries	1.6	0.2	0.7	0.5	1.10	0.23	0.48	0.36	67.1	62.1
Non-ICT manufacturing	3.8	3.0	1.5	1.4	0.51	0.31	0.18	0.13	11.9	9.3
Non-ICT services	0.6	–0.4	0.2	0.4	0.25	–0.15	0.08	0.18	44.7	43.0
Non-ICT other	2.7	0.7	1.9	0.6	0.34	0.07	0.21	0.05	10.5	9.8
Shift effect[c]					0.03	–0.10	0.05	–0.01		
Pro memoria: using national ICT deflators[d]										
Total economy	1.9	1.1	1.4	2.5						
ICT-producing manufacturing	7.8	15.1	10.1	23.7						

Source: Based on van Ark *et al.* (2002a). For country detail see table A1.

Notes: (a) Excluding ICT-producing. (b) EU includes Austria, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden and the United Kingdom, which represents over 90 per cent of EU GDP. (c) Contributions of industry groups refer to the 'intra-effect' only, that is the weighted average productivity growth of the group. The 'shift-effect' refers to the effect of reallocations between groups on aggregate productivity growth. (d) Based on actual national accounts deflators instead of US hedonic price deflators for ICT.

US (from 1.9 per cent between 1990 and 1995 to 5.4 per cent between 1995 and 2000). The US experienced the strongest productivity growth in securities trade, and wholesale and retail trade (see table A1). Together ICT-using service industries in the US have contributed 1.4 percentage points to aggregate productivity growth since 1995, compared to less than 0.3 percentage point in Europe. In ICT-using manu-facturing, despite a slowdown, productivity growth in Europe stayed higher than in the US after 1995.

Thirdly, in the non-ICT sector (representing the less intensive users of ICT) labour productivity growth was slowest of the three major industry groups on both sides of the Atlantic. While growth slightly accelerated in the US (from 0.2 to 0.5 per cent), it decelerated substantially in the European Union. Still Appendix Table 1 shows that in many individual non-ICT services, particularly in health, repairs, education, and personal and social services, productivity growth in the EU was much lower in the US While measurement errors cloud the interpretation of the differences in this latter group, it does suggest that most of the US productivity growth advantage can be traced to industries that either produce or use ICT intensively.

Employment trends by major industry

Table 2 shows trends in employment growth by industry. In contrast to labour productivity growth, employment growth rates improved during the 1990s in all industry groups and for the EU and US alike (except for non-ICT manufacturing in the US). This clearly indicates that the second half of the 1990s has led to an improvement in employment growth rates which is not restricted to ICT-producing or ICT-using industries. Table 2 also shows that EU employment growth remained below US employment growth across all industry groups except for ICT-using and non-ICT manufacturing.

When focusing on the latest period 1995–2000, three observations stand out. Firstly, in terms of growth rates, the ICT-producing industries exhibited the largest differential in employment growth between the US and the EU. However, because of the small size of the sector (3.9 per cent of total employment in EU and 4.9 per cent in US) the contribution of ICT production to aggregate employment growth is relatively limited.

Secondly, despite a large improvement in employment growth in the EU, employment growth rates in intensive ICT-using industries remained slightly below those in the US during the period 1995–2000. In ICT-using manufacturing, employment continued to decline although much less so than during the first half of the 1990s. In ICT-using services employment growth in Europe and the US was similar (1.9 per cent in EU and 2.0 per cent in US) between 1995 and 2000. For the US this implies that faster productivity growth (an acceleration of four percentage points) need not come at the expense of employment growth. This picture even

Table 2. Employment growth, contributions by major industry, and employment shares of ICT-producing, ICT-using and non-ICT industries in the EU and the US

	Persons employed				Contributions to aggregate employment growth				Employment share	
	1990–1995		1995–2000		1990–1995		1995–2000		2000	
	EU[b]	US	EU[b]	US	EU[b]	US	EU[b]	US	EU[b]	US
Total economy	–0.6	1.1	0.6	2.0	–0.60	1.11	1.22	1.98	100.0	100.0
ICT-producing industries	–1.7	0.6	2.8	4.9	–0.06	0.02	0.11	0.23	3.9	4.9
ICT-producing manufacturing	–4.5	–1.6	0.4	1.5	–0.06	–0.03	0.01	0.03	1.2	1.6
ICT-producing services	0.0	2.2	3.9	6.9	0.00	0.05	0.10	0.20	2.7	3.3
ICT-using industries[a]	–0.7	0.3	1.3	1.6	–0.20	0.09	0.35	0.46	27.3	28.7
ICT-using manufacturing	–3.8	–1.6	–0.6	–0.8	–0.27	–0.09	–0.04	–0.04	6.1	4.2
ICT-using services	0.3	0.7	1.9	2.0	0.07	0.18	0.39	0.49	21.2	24.5
Non-ICT industries	–0.5	1.5	1.1	2.0	–0.33	1.00	0.76	1.30	68.8	66.4
Non-ICT manufacturing	–2.8	0.3	0.1	0.0	–0.34	0.02	0.01	0.00	11.1	6.8
Non-ICT services	1.0	1.9	1.9	2.1	0.41	0.96	0.87	1.08	45.8	50.5
Non-ICT other	–2.9	0.3	–0.9	2.5	–0.40	0.02	–0.12	0.22	11.9	9.1

Source: based on van Ark *et al.* (2002a). For country detail see Appendix table 1.

Notes: Employment is defined as number of persons employed. (a) Excluding ICT-producing. (b) EU includes Austria, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden and the United Kingdom, which represents over 85 per cent of EU employment.

holds for the industries that showed the largest productivity growth acceleration. In financial securities, retail trade and wholesale trade, employment growth accelerated by 1.8, 1.0 and 0.7 percentage points respectively.

Thirdly, and in contrast to the ICT-using sector, the difference in employment growth in the 'non-ICT' sector has remained strongly in favour of the United States. The largest contribution to this difference is made by the 'other non-ICT sector', which (when looking at table A1) can be further traced to much faster employment growth in the construction sector in the US. Although the differences in employment growth are less in non-ICT manufacturing and non-ICT services, there is much diversity between industries underlying these aggregate industry groups (see table A1). For example, and in contrast to common perceptions, EU employment growth in hotels and restaurants improved strongly and was substantially faster than in the US between 1995 and 2000. American employment growth in government, health and education was higher than in the EU, and in government the gap even widened substantially during the second half of the 1990s.

In summary, the evidence from this section shows that the deceleration in productivity performance and moderate employment growth in Europe at the aggregate level, vis-à-vis productivity acceleration and high employment growth in the US economy, hides very different trends at the level of industry groups and individual industries. In particular in ICT-using services, US productivity growth surged ahead of the EU without any sacrifice in terms of slower employment growth. In contrast the improvement in European employment growth has not been combined with a significant improvement in productivity growth in most industry groups. The question we discuss in the next section is whether less ICT production and less intensive use of ICT in Europe has changed the relation between productivity and employment growth in the EU vis-à-vis the US.

4. Has the 'new economy' reduced the employment losses from productivity growth?

In this section we focus on the extent to which the offsetting effects between growth (or decline) in labour productivity versus rise (or fall) in employment have changed between the first and the second halves of the 1990s. Charts 1 and 2 summarise the evidence concerning the existence of a trade-off between labour productivity and employment growth by major industry group in Europe and the US for the period from 1990–5

Chart 1. Productivity (GDP per person employed) and employment (persons employed) growth in ICT-using and non-ICT manufacturing and other non-ICT industries, EU and the US, 1990–1995 and 1995–2000

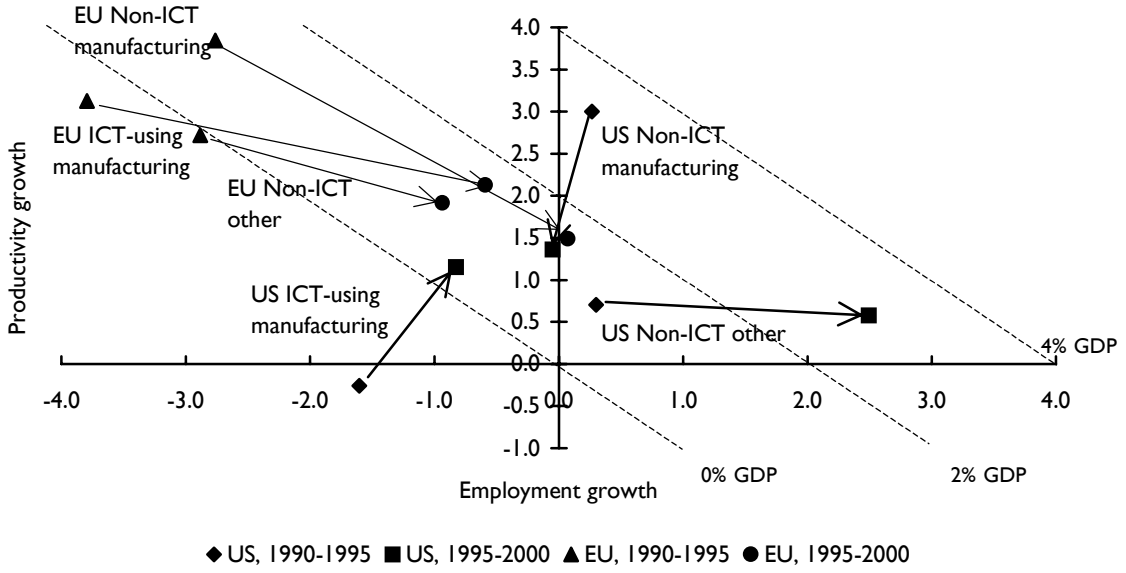
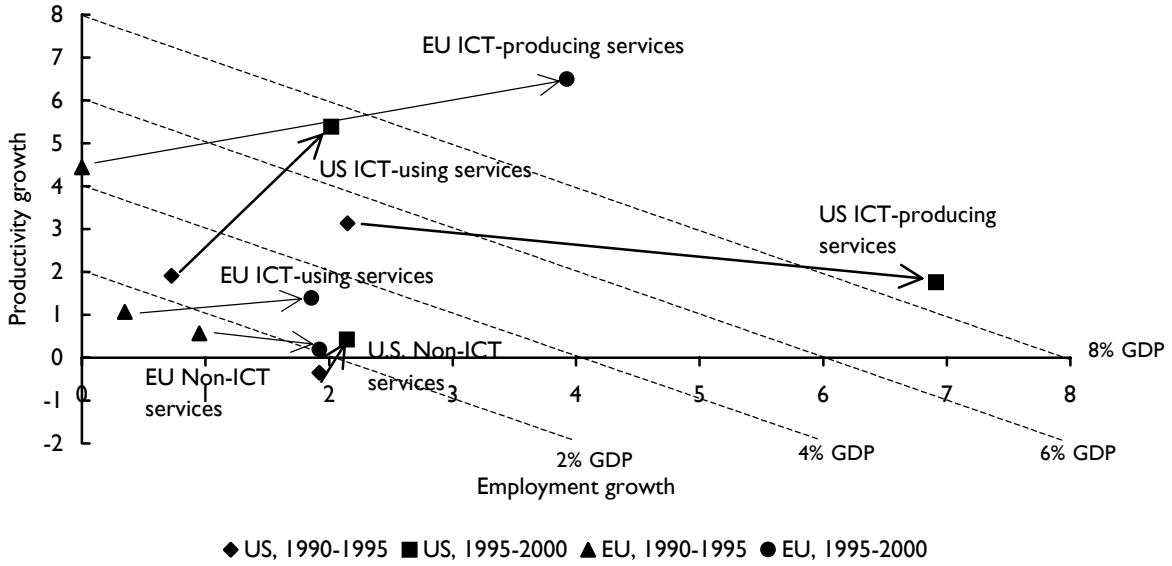


Chart 2. Productivity (GDP per person employed) and employment (persons employed) growth in the ICT-producing, ICT-using and non-ICT services EU and the US, 1990–1995 and 1995–2000



and from 1995–2000. The diagonals through the figures represent the growth of GDP attributable to each of the industry groups, which is the result of summing the growth rate in output per person employed and that of employment.

Chart 1 shows that ICT-using manufacturing, non-ICT manufacturing and the "other" industry group are mostly characterised by positive productivity growth, but declining or stagnant employment. In Europe especially, the inverse relationship between productivity and employment growth appears strong. During the second half of the 1990s productivity growth slowed down in each of the three industry groups, while the employment performance improved but remained negative or close to zero. The picture for the manufacturing and 'other' industry groups in the US is somewhat more diverse. In ICT-using manufacturing, productivity in the US improved from negative to positive growth during the late 1990s, but employment growth remained negative. Indeed output growth in ICT-using manufacturing remained lower in the US than in the EU. In non-ICT manufacturing, US productivity growth remained positive but employment growth fell to zero. In contrast to the manufacturing industries, US employment growth in the 'other' industry group was positive and accelerated in combination with positive (although low) productivity growth. Indeed output growth in the 'other' industry group was much larger than in Europe, which is largely driven by the rapid employment growth in US construction (with only limited productivity growth) during the second half of the 1990s.

The contrast between charts 1 and 2 stands out clearly, as none of the industry groups in chart 2 exhibit the negative relationship between productivity and employment growth seen in chart 1, either for the EU or the US. Chart 2 shows positive productivity and employment growth for all three service industries (ICT-producing services, ICT-using service and non-ICT services).[14] While the employment growth rate in ICT-producing services in the US was much higher than in Europe during the second half of the 1990s, Europe combined slower employment growth with higher productivity growth, leading to fairly similar output growth rates. In contrast, the clear US productivity advantage in ICT-using services was not compensated for by faster employment growth in Europe. Hence the GDP growth rate of ICT-using services in the EU has remained several percentage points below the US during the second half of the 1990s.

Table 3 adds further detail to the observations above by using data for the full set of 51 industries in the database. It shows the percentage of value added by major industry group that is characterised by a positive relationship between productivity and employment growth. Three observations stand out from this table. Firstly, at the aggregate level the share of output of industries with a

Table 3. Percentage of output by industry group with a positive relation between labour productivity and employment growth, EU and US, 1990–1995 and 1995–2000

	1990–1995		1995–2000	
	EU	US	EU	US
Total	17.8	47.6	42.4	72.8
ICT-producing industries	34.1	78.9	39.6	47.5
ICT-producing manufacturing	43.5	49.5	45.7	30.5
ICT-producing services	29.9	100.0	37.2	58.0
ICT-using industries	20.0	58.9	66.5	91.3
ICT-using manufacturing	0.0	51.6	37.9	78.6
ICT-using services	26.2	60.6	74.7	93.6
Non-ICT industries	15.8	39.7	33.1	66.6
Non-ICT manufacturing	0.0	53.5	32.4	42.1
Non-ICT services	25.3	36.2	29.5	73.8
Non-ICT other	0.0	41.0	48.4	59.6

Source: based on van Ark *et al.* (2002a).
Notes: Industries are weighted by the average share in value added over the period. Productivity is defined as value added per person employed, and employment as number of persons employed.

positive productivity–employment relationship has gone up in both the EU and the US by about 25 percentage points between 1990–5 and 1995–2000. Secondly, the latter share remains about 30 percentage points lower in Europe compared to the US, namely at 42.4 per cent and 72.8 per cent respectively between 1995 and 2000. Thirdly, there are substantial differences across industry groups. Clearly the ICT-using industry group has the largest output share with a positive relationship between productivity and employment growth, in particular in ICT-using services. In the US as much as 94 per cent of output in ICT-using services is characterised by such a positive relationship. In the ICT-producing industries, the technology is clearly of a more labour saving nature, and in the case of the US tradeoffs have even increased in importance. In non-ICT the picture is mixed, but on the whole the US has a higher industry output share with positive relationships, in particular in non-ICT services. On the whole, services industries are more often characterised by a positive relationship than manufacturing industries.

In summary, we find that most of the progress in breaking up the negative relationship between productivity and employment growth has been made in ICT-using services, and – in particular in Europe – much more so than in non-ICT services. As a result one may conclude that the 'new economy' has contributed to improved employment growth in Europe. However, despite this improvement, the trade-off has continued to dominate the overall picture in Europe. This suggest that other factors than access to ICT technology have prevented Europe seizing the benefits in terms of faster productivity and output growth to the same degree as the United States.

5. Concluding remarks

Our preliminary analysis on the employment effects of the 'new economy' points to three main findings. First, we find that the inverse relationship between productivity and employment growth is mostly stronger in manufacturing than in services. Second, as a result of increased use of ICT, this relationship has turned positive during the second half of the 1990s, in particular in ICT-using services. Finally, Europe fell behind the US in most industry groups because of slow productivity growth and/or limited employment expansion. Indeed the employment-reducing effects of productivity growth have remained much more persistent in Europe than in the US.

The reasons for the difference in the relation between employment and productivity growth between the two regions may be multifold, but broadly speaking they fall into three categories. Firstly, the development of the wage–rental ratio is one of the standard macroeconomic explanations for changes in labour and capital intensity affecting productivity and employment growth. During the 1990s wage moderation and active labour market policies raised labour force participation rates in Europe but, at the same time, reduced the growth of labour cost relative to capital cost. Faster employment growth but slower labour productivity growth (due to less capital deepening) are a likely result of these policies.[15]

Secondly, the functioning of product, labour and capital markets determines the allocation of resources to their most productive uses. Concerning labour markets, there is strong evidence of continued high employment protection in Europe which reduces job mobility across old and new firms and industries. European product markets are often burdened with regulations that slow down new entries. There is also evidence of strong links between employment and product market regulations.[16] An important characteristic concerning the effect of reforms on productivity is that it can often take considerable time and effort before the supply and demand forces have come back into line to generate simultaneous employment and productivity increases. For example,

retail trade reforms may quickly raise employment, but the effect on productivity growth depends on whether the retail market can generate the economies of scale due to those reforms.[17] Although reforms in Europe are under way, they have mostly come later than in the US, they are applied in a fragmented way across the Union, and they are often not rigorously pursued.

Finally, the importance of the characteristics of the innovation process should not be overlooked. This, for example, may explain the different employment–productivity relationship between manufacturing and services. As argued by Edquist *et al.* (2001), technological change in manufacturing industries, including those that produce or intensively use ICT, often represents process innovation of a labour-saving nature. Indeed our results indicate that a positive relation between productivity and employment growth is much rarer in manufacturing than in services. In the services sector, the innovation process is more strongly dominated by product innovation (often in combination with ICT investment) with a strong impact on output and employment growth but with a mixed result for productivity growth. Part of the new services, in particular knowledge intensive business services, are used as an input in other industries, strengthened by the continuous process of outsourcing of services by manufacturing industries. Another part of the newly produced services is used as a final output by consumers. Both types of services have become increasingly important in the US economy, as reflected by rapid growth of output and employment in wholesale trade and financial securities (which are mainly intermediate input industries) as well as retail trade (which is a final product industry). In Europe, output growth in the area of business services is large, but with only limited productivity growth.

Slow productivity growth has long been seen as the Achilles' heel of a services-dominated economy, going back to the formulation of the cost-disease hypothesis by Baumol (1967). The US experience, however, suggests that ICT can be an important source in stimulating innovations in ICT-using services industries. Stronger productivity growth may partly reflect increased investment in ICT capital, but mounting evidence suggests that innovation of an organisational and managerial nature needs to accompany ICT investment to generate greater efficiency.[18] The exact impact of such innovations on employment growth is not unambiguous (Edquist *et al.*, 2001), but during the 1990s increased demand in ICT-using services has offset any employment-reducing effects in the US. Lagging productivity and moderate employment growth in Europe may mean that the national systems of technology and innovation in European countries have so far failed to generate the type of innovation that is strengthening both employment and productivity growth in particular in the areas of product and organisational innovations.

A more detailed analysis of these and other explanatory factors and their interdependencies is one area for further research. In addition, the full story on the relation between productivity and employment requires the integration of labour skills in the analysis. Except for the lack of comparable data, skill comparisons also require a clear view on the precise competencies needed to produce and use ICT. For example, recent literature has suggested that the well-known skill biased nature of ICT may partly be offset by facilitated use of ICT to complement unskilled labour (Acemoglu, 2002).

NOTES

1 See McGuckin and van Ark (2003). In 2001 productivity growth in the United States fell to 0.4 per cent followed by a strong recovery in 2002 at 2.8 per cent. In the EU, productivity growth remained relatively high at 1.3 per cent in 2001, but it slowed by 0.5 per cent in 2002. These differences are largely related to a different timing in the economic downturn since 2000.

2 See Petit and Soete (2001) for a recent collection of contributions on related topics.

3 There is a large literature on these various explanations for slow employment growth in Europe during the late 1970s, 1980s and early 1990s but a full review goes beyond the scope of this paper. See OECD (1994a, b and c, 1995, 1996a and b, 2001 and 2003) for good summaries of the various debates.

4 See also Edquist *et al.* (2001).

5 See for example, Acemoglu (2002).

6 The underlying data material and further analysis are described in more detail in van Ark, Inklaar and McGuckin (2002a).

7 The STAN Database uses the international classification ISIC revision 3. This classification is very similar to the one European countries are using, but especially for the US, much effort has to be put into reconciling differences in industrial classification, see Appendix B of van Ark *et al.* (2002a).

8 The exceptions are the education and health sectors which rank fairly high in terms of their ICT capital share, but near the bottom on alternative measures such as ICT capital per worker or per unit of output. Results are qualitatively similar if these industries were included as ICT-using, however.

9 See van Ark *et al.* (2002b) for some of the difficulties in acquiring ICT investment even for the aggregate European economies.

10 See van Ark *et al.* (2002a) for details on this method and Triplett (1996) for the importance of double deflation in the computer and semiconductor industries.

11 For the latter purpose we have employed a shift-share analysis which decomposes aggregate productivity growth into the contributions of industries by weighing an industry's produc-

tivity growth by its employment share. The effect on aggregate productivity growth of reallocations of employment between industries is reported separately in table 1 as the 'shift-effect'. See van Ark *et al.* (2002a) for more details.

12 At the same time some other ICT-producing manufacturing industries, like radio and TV equipment, showed negative productivity growth. The reason for the decline in productivity is that these industries make intensive use of semiconductors and other electronic components. While the prices of these inputs have spectacularly decreased, the output of these industries is valued at roughly unchanged prices. As a result, the (implicit) price of value added is rising rapidly and productivity is declining.

13 Recently concerns have surfaced concerning the still too fragmented market structure of the European telecoms market. See, for example, Isern and Rios (2002).

14 ICT-producing manufacturing industry groups are omitted from these figures because of the exceptionally high productivity growth rates. As tables 1 and 2 show, productivity growth rates are strongly positive, but it was not until after 1995 that the trade-off was broken, and both the EU and the US showed positive employment growth in this sector. The positive employment growth, however, did not expand to the computer industry itself or to the fiber optics industry.

15 See Naastepad and Kleinknecht (2002) for a review of the Dutch experience in relation to other European countries and the United States.

16 For a review, see Nicoletti *et al.* (2001).

17 See McKinsey Global Institute (2002).

18 For a detailed account of the US productivity experience in service industries see for example Triplett and Bosworth (2002). See Brynjolfson and Hitt (2000) and McKinsey Global Institute (2001, 2002) for more on ICT and complementary innovations in organizational change.

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APPENDIX

Table A1. Labour productivity and employment growth and differential for EU and US industries, 1990–1995 and 1995–2000

ISIC		GDP per person employed						Persons employed					
		1990–1995			1995–2000			1990–1995			1995–2000		
Rev 3		EU	US	US–EU	EU	US	US–EU	EU	US	US–EU	EU	US	US–EU
	Total economy	*1.9*	*1.1*	*0.8*	*1.4*	*2.5*	*1.1*	*–0.6*	*1.1*	*1.7*	*1.2*	*2.0*	*0.8*
	ICT-producing industries	*6.7*	*8.1*	*1.4*	*8.7*	*10.1*	*1.4*	*–1.7*	*0.6*	*2.2*	*2.8*	*4.9*	*2.1*
	Manufacturing	11.1	15.1	4.0	13.8	23.7	10.0	–4.5	–1.6	2.9	0.4	1.5	1.1
30	Computers	33.2	28.6	–4.6	49.3	52.3	3.0	–8.6	–3.8	4.8	–2.2	–2.9	–0.7
313	Fiber optics	6.9	5.6	–1.3	2.9	5.7	2.8	–4.6	–1.2	3.4	–2.3	–1.6	0.7
321	Semiconductors	37.7	36.8	–1.0	56.4	52.1	–4.3	–6.3	1.6	8.0	0.1	3.0	2.9
322	Communication eq.	5.0	6.6	1.7	3.5	–0.4	–3.9	–2.2	–1.9	0.2	2.2	5.0	2.8
323	Radio and TV eq.	–2.6	–4.6	–2.1	–13.9	–12.5	1.4	–6.2	0.5	6.8	–0.5	3.9	4.5
331	Instruments	–2.6	–4.5	–1.9	–7.2	–5.9	1.3	–2.9	–3.0	0.0	1.1	0.9	–0.2
	Services	*4.4*	*3.1*	*–1.3*	*6.5*	*1.8*	*–4.7*	*0.0*	*2.2*	*2.2*	*3.9*	*6.9*	*3.0*
64	Telecommunications	5.7	3.3	–2.5	9.9	6.5	–3.4	–1.7	0.0	1.8	–0.1	2.7	2.8
72	Computer services	1.5	2.7	1.2	1.5	–4.5	–6.0	3.9	6.5	2.6	10.0	12.6	2.6
	ICT-using industries[a]	*1.7*	*1.5*	*–0.2*	*1.6*	*4.7*	*3.2*	*–0.7*	*0.3*	*1.1*	*1.3*	*1.6*	*0.3*
	Manufacturing	3.1	–0.3	–3.4	2.1	1.2	–1.0	–3.8	–1.6	2.2	–0.6	–0.8	–0.2
18	Apparel	5.2	3.4	–1.8	2.9	3.8	0.9	–6.3	–2.9	3.4	–4.4	–8.3	–3.9
22	Printing & publishing	1.9	–2.6	–4.6	2.5	–0.2	–2.7	–1.7	–0.2	1.4	–0.8	–0.4	0.4
29	Machinery	4.2	0.9	–3.3	1.0	0.3	–0.7	–4.7	0.0	4.7	0.2	0.3	0.1
31–313	Electrical mach.	2.2	0.5	–1.6	2.3	–0.7	–3.0	–3.6	–1.4	2.2	–0.1	–2.6	–2.6
33–331	Watches & instruments	7.5	2.1	–5.3	5.1	14.2	9.1	–4.5	–5.0	–0.5	0.8	–9.5	–10.3
351	Ships	4.1	–3.8	–7.9	0.4	–0.2	–0.6	–5.1	–3.6	1.5	2.8	–0.5	–3.3
353	Aircraft	0.5	–1.0	–1.5	6.4	1.1	–5.3	–5.8	–10.0	–4.1	–2.7	–0.1	2.5
352+359	Railroad and other	5.9	–2.0	–7.9	3.1	–0.1	–3.1	–4.9	4.4	9.2	–1.0	4.4	5.3
36–37	Misc. manufacturing	1.1	1.3	0.3	1.5	2.4	0.9	–1.7	0.1	1.8	–0.1	1.0	1.1
	Services	*1.1*	*1.9*	*0.8*	*1.4*	*5.4*	*4.0*	*0.3*	*0.7*	*0.4*	*1.9*	*2.0*	*0.2*
51	Wholesale trade	2.9	3.4	0.5	1.2	6.1	13.4	–0.5	0.6	1.1	1.6	1.6	0.0
52	Retail trade	1.1	2.3	1.2	1.4	6.9	4.9	0.2	0.9	0.8	1.1	1.6	0.5
65	Banks	0.4	1.3	0.9	3.0	2.8	5.5	–0.3	–0.9	–0.6	0.0	1.8	1.8
66	Insurance	0.2	3.0	2.8	0.2	–1.0	–1.1	–0.6	–0.1	0.5	0.5	1.1	0.7
67	Securities trade	1.1	3.2	2.1	2.0	15.3	–0.2	0.5	2.2	1.7	2.6	4.0	1.5
71	Renting of machinery	2.4	6.7	4.2	0.5	5.7	5.2	–0.2	0.9	1.1	3.9	3.6	–0.3
73	R&D	–0.2	1.0	1.2	–0.5	3.1	3.6	1.2	0.2	–1.0	2.1	2.1	0.0
741–743	Prof.l services	–0.4	–0.7	–0.3	0.4	1.0	0.6	2.5	1.1	–1.3	4.7	3.7	–1.0
	Non-ICT industries	*1.6*	*0.2*	*–1.4*	*0.7*	*0.5*	*–0.2*	*–0.5*	*1.5*	*2.0*	*1.1*	*2.0*	*0.9*
	Manufacturing	*3.8*	*3.0*	*–0.8*	*1.5*	*1.4*	*–0.1*	*–2.8*	*0.3*	*3.0*	*0.1*	*0.0*	*–0.1*
15–16	Food & beverages	2.9	3.5	0.6	0.0	–4.5	–4.5	–1.5	0.1	1.6	0.3	0.0	–0.2
17	Textiles	3.5	3.0	–0.4	1.4	3.3	2.0	–4.7	–0.4	4.3	–1.8	–4.8	–3.0
19	Leather	3.3	4.9	1.6	0.7	1.3	0.5	–6.0	–4.6	1.4	–3.1	–7.5	–4.4
20	Wood	2.5	–2.8	–5.3	2.7	0.3	–2.4	–1.7	1.2	2.9	–0.5	0.9	1.4
21	Paper	3.5	0.0	–3.5	2.3	0.2	–2.1	–2.2	–0.1	2.1	–0.5	–1.1	–0.5
23	Petroleum & coal	9.6	5.0	–4.5	0.2	1.5	1.3	–5.5	–1.9	3.7	–2.1	–2.5	–0.4
24	Chemicals	6.8	3.4	–3.4	4.7	4.4	–0.4	–3.7	–0.9	2.8	–0.9	0.0	0.9
25	Rubber & plastics	3.2	4.6	1.4	1.6	4.1	2.5	–0.8	1.9	2.7	1.1	0.7	–0.3
26	Stone, clay & glass	2.5	2.8	0.3	1.4	2.6	1.3	–2.6	–0.6	2.0	–0.1	1.2	1.3
27	Basic metals	6.9	3.9	–3.0	0.9	3.1	2.2	–6.4	–1.4	5.0	–1.6	–0.2	1.4
28	Fabricated metals	2.2	3.2	1.0	0.9	0.6	–0.3	–2.0	0.3	2.3	0.7	1.2	0.6
34	Motor vehicles	3.2	4.9	1.7	0.9	1.4	0.5	–3.1	3.2	6.3	2.4	1.1	–1.3
	Services	*0.6*	*–0.4*	*–0.9*	*0.2*	*0.4*	*0.2*	*1.0*	*1.9*	*1.0*	*1.9*	*2.1*	*0.2*
50	Repairs	–0.1	–1.4	–1.2	1.0	–2.5	–3.4	–0.5	0.7	1.2	1.9	2.5	0.6
55	Hotels & restaurants	–1.8	–1.1	0.7	–1.2	0.4	1.6	1.4	1.9	0.4	3.0	1.9	–1.1
60–63	Transportation	3.2	2.1	–1.1	1.7	1.6	0.0	–1.1	2.3	3.5	1.6	2.8	1.2
70	Real estate	–0.7	1.6	2.3	–0.8	1.7	2.5	2.4	0.6	–1.8	2.6	1.9	–0.7
74.9	Other business serv.	–1.1	–1.0	0.1	–0.3	1.4	1.7	3.3	5.4	2.1	6.0	5.6	–0.4
75	Government	1.4	0.0	–1.4	1.1	0.2	–0.8	–0.4	0.2	0.6	–0.3	1.0	1.3
80	Education	0.9	–0.2	–1.1	–0.1	–1.2	–1.1	0.6	3.2	2.6	1.0	3.2	2.2
85	Health	0.8	–2.2	–2.9	0.4	–0.3	–0.7	1.9	3.5	1.7	1.7	2.1	0.4
90–93	Personal & social serv.	–0.2	0.3	0.5	–0.5	–0.9	–0.5	2.0	2.2	0.2	2.9	2.6	–0.4
95	Private households	–0.4	2.2	2.6	0.0	0.7	0.7	3.3	–0.8	–4.1	2.9	–1.2	–4.1
	Other non-ICT industries	*2.7*	*0.7*	*–2.0*	*1.9*	*0.6*	*–1.3*	*–2.9*	*0.3*	*3.2*	*–0.9*	*2.5*	*3.4*
01–05	Agriculture	5.2	–1.0	–6.3	4.0	6.3	2.3	–4.8	1.8	6.6	–2.2	–0.3	2.0
10–14	Mining	7.5	5.4	–2.1	3.5	–1.8	–5.4	–10.5	–4.1	6.5	–4.2	–1.6	2.6
40–41	Utilities	4.5	2.5	–2.0	4.9	2.3	–2.7	–2.8	–0.8	2.0	–2.7	–1.3	1.5
45	Construction	0.4	0.5	0.1	0.2	0.2	0.0	–1.1	0.1	1.3	0.1	4.5	4.4

Note: EU includes Austria, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden and the United Kingdom.

Table A2. Average annual growth rate of labour productivity growth by industry group

	Austria	Den.	Finland	France	Germ.[a]	Ireland	Italy	Neths.	Spain	Sweden	UK	**EU**	Canada	Japan	Norway	Switz.	US
1990–1995																	
Total economy	2.3	1.6	3.3	1.0	2.1	3.0	1.8	0.7	1.6	2.8	2.8	**1.9**	1.1	0.8	3.3	–0.1	**1.1**
ICT-producing industries	5.8	7.6	6.9	4.7	7.1	11.2	2.5	3.8	4.3	4.8	8.8	**6.7**	2.6	8.8	3.2	1.5	**8.1**
ICT-producing manufacturing	7.6	6.5	8.9	10.0	6.8	17.1	4.6	5.7	8.3	–0.7	15.8	**11.1**	11.8	12.4	8.4	1.4	**15.1**
ICT-producing services	4.8	7.9	4.8	2.6	5.9	2.2	1.6	2.3	3.1	6.8	5.6	**4.4**	0.4	4.2	2.1	1.5	**3.1**
ICT-using industries[b]	2.2	1.1	1.9	1.1	1.6	1.4	2.2	0.6	–0.2	3.4	2.3	**1.7**	1.8	0.7	4.3	–1.5	**1.5**
ICT-using manufacturing	1.9	2.7	4.7	3.3	2.6	6.1	3.4	1.8	1.7	5.6	2.1	**3.1**	2.1	–1.1	1.3	0.0	**–0.3**
ICT-using services	2.1	0.6	0.7	0.5	1.1	0.2	1.6	0.4	–0.7	2.5	2.5	**1.1**	1.9	1.4	5.2	–2.0	**1.9**
Non-ICT industries	2.1	1.4	3.4	0.7	2.0	2.6	1.5	0.5	2.0	2.4	2.5	**1.6**	0.5	0.1	3.0	0.7	**0.2**
Non-ICT manufacturing	4.6	2.9	6.2	3.4	4.4	7.8	2.7	3.7	3.5	6.3	4.0	**3.8**	2.1	0.4	2.2	4.4	**3.0**
Non-ICT services	0.1	0.5	2.0	–0.3	0.9	–0.9	0.6	–0.2	0.9	1.5	1.5	**0.6**	–0.2	–0.2	0.7	–0.2	**–0.4**
Non-ICT other	4.5	4.1	4.2	1.6	2.7	2.9	3.0	0.9	2.9	2.8	6.1	**2.7**	1.4	0.2	9.3	–0.2	**0.7**
Pro memoria: with national deflators[c]																	
Total economy	2.2	1.6	3.3	1.1	2.1	2.4	1.8	0.6	1.5	2.8	2.7	**1.9**	1.0	0.7	3.2	0.0	**1.1**
ICT-producing manufacturing	3.8	6.7	12.4	9.5	4.3	4.0	3.5	4.3	0.5	–0.1	9.8	**7.8**	6.8	6.8	2.3	4.8	**15.1**
1995–2000																	
Total economy	2.3	1.9	2.5	1.2	1.3	5.3	0.8	0.9	0.4	2.1	1.8	**1.4**	1.4	0.9	1.7	1.1	**2.5**
ICT-producing industries	3.4	5.9	10.9	8.7	12.7	23.5	6.3	3.2	5.9	2.7	8.3	**8.7**	5.3	12.1	8.4	–1.9	**10.1**
ICT-producing manufacturing	9.6	5.7	13.2	15.0	13.7	42.3	6.0	–1.9	13.1	1.1	16.1	**13.8**	16.9	19.5	4.9	–4.3	**23.7**
ICT-producing services	–0.4	5.9	8.1	6.2	11.9	–0.2	6.2	4.5	4.1	3.3	5.2	**6.5**	2.8	4.0	9.2	–0.7	**1.8**
ICT-using industries[b]	3.0	2.0	2.5	1.0	1.3	2.9	1.0	2.0	0.1	2.9	2.3	**1.6**	2.5	0.1	3.7	1.3	**4.7**
ICT-using manufacturing	6.0	0.1	1.5	1.9	2.4	8.7	1.5	2.7	1.1	1.7	1.7	**2.1**	1.1	0.5	–1.3	3.3	**1.2**
ICT-using services	2.1	2.5	3.0	0.7	0.9	1.4	0.6	1.9	–0.1	3.3	2.6	**1.4**	2.8	0.0	4.8	0.8	**5.4**
Non-ICT industries	1.8	1.5	1.4	0.7	0.5	2.7	0.4	0.2	0.1	1.6	0.8	**0.7**	0.5	0.1	0.7	1.1	**0.5**
Non-ICT manufacturing	4.6	3.8	3.0	2.7	0.5	10.4	0.6	2.0	–0.3	3.3	0.5	**1.5**	1.3	–0.3	1.7	4.4	**1.4**
Non-ICT services	–0.4	1.2	0.6	0.1	–0.1	–1.2	–0.4	0.1	–0.1	1.4	0.9	**0.2**	–0.4	0.6	0.4	0.8	**0.4**
Non-ICT other	4.0	1.2	2.3	1.1	2.3	1.2	2.5	0.0	1.3	0.5	1.5	**1.9**	1.1	–1.5	1.4	–1.3	**0.6**
Pro memoria: with national deflators[c]																	
Total economy	2.2	1.8	2.9	1.2	1.3	3.3	0.8	1.0	0.3	2.5	1.6	**1.4**	1.3	0.7	1.7	1.2	**2.5**
ICT-producing manufacturing	4.6	3.9	19.9	13.9	6.8	8.6	1.4	3.3	1.6	21.1	5.5	**10.1**	6.6	9.3	3.2	0.7	**23.7**

Notes: (a) 1995–99. (b) Excluding ICT-producing industries. (c) Based on actual national accounts deflators instead of US hedonic price deflators for ICT.

Table A3. Average annual growth rate of total number of persons employed by industry group

	Austria	Den.	Finland	France	Germ.[a]	Ireland	Italy	Neths.	Spain	Sweden	UK	**EU**	Canada	Japan	Norway	Switz.	US
1990–1995																	
Total economy	0.2	–0.5	–3.9	–0.2	–0.4	2.0	–0.5	1.3	–0.5	–2.2	–1.1	**–0.6**	0.5	0.7	0.6	–0.1	**1.1**
ICT-producing industries	–0.1	–1.9	0.5	–0.6	–5.2	5.2	0.9	–0.8	1.1	1.1	–1.2	**–1.7**	3.3	0.1	2.5	–0.9	**0.6**
ICT-producing manufacturing	–0.6	–2.6	7.1	–2.6	–9.4	8.1	–1.3	–4.3	–2.1	10.4	–3.8	**–4.5**	–1.0	–0.7	0.3	–4.4	**–1.6**
ICT-producing services	0.4	–1.6	–2.5	0.3	–2.1	2.3	2.1	1.6	2.3	–2.7	0.2	**0.0**	4.3	1.4	3.0	1.3	**2.2**
ICT-using industries[b]	0.1	–1.2	–4.9	–0.8	–0.9	2.0	–0.5	1.9	–0.2	–2.2	–1.1	**–0.7**	0.1	–0.1	0.2	–0.8	**0.3**
ICT-using manufacturing	–2.6	–1.7	–4.9	–3.1	–6.0	1.3	–1.8	–0.5	–1.9	–5.0	–3.1	**–3.8**	–2.9	–1.0	1.4	–2.5	**–1.6**
ICT-using services	1.0	–1.1	–4.9	–0.1	1.3	2.2	0.1	2.4	0.3	–1.0	–0.6	**0.3**	0.5	0.3	–0.2	–0.3	**0.7**
Non-ICT industries	0.2	–0.2	–3.8	0.1	0.0	1.7	–0.6	1.2	–0.6	–2.4	–1.1	**–0.5**	0.6	1.2	0.6	0.4	**1.5**
Non-ICT manufacturing	–1.8	–0.8	–4.6	–2.5	–3.8	1.4	–1.5	–1.3	–1.5	–4.2	–3.3	**–2.8**	0.2	–0.1	–0.6	–1.6	**0.3**
Non-ICT services	1.7	0.4	–1.9	1.5	1.3	4.6	0.4	1.9	1.4	–1.5	0.4	**1.0**	1.3	2.3	1.6	1.6	**1.9**
Non-ICT other	–1.0	–2.1	–8.1	–2.8	0.0	–2.4	–2.7	0.1	–4.1	–4.8	–5.3	**–2.9**	–1.5	0.1	–2.7	–1.2	**0.3**
1995–2000																	
Total economy	0.5	1.1	2.3	1.0	0.7	5.6	1.0	2.6	2.9	0.8	1.2	**1.2**	2.2	–0.1	1.7	0.6	**2.0**
ICT-producing industries	2.8	2.3	6.9	2.0	0.4	14.4	1.7	7.0	3.6	3.7	4.6	**2.8**	5.4	–0.1	1.8	4.3	**4.9**
ICT-producing manufacturing	0.6	0.5	7.9	0.4	–1.2	10.8	0.5	0.9	1.2	1.9	0.5	**0.4**	1.9	–0.8	1.1	1.9	**1.5**
ICT-producing services	4.2	2.9	6.4	2.7	1.3	17.9	2.2	9.9	4.3	4.7	6.2	**3.9**	6.1	0.8	2.0	5.5	**6.9**
ICT-using industries[b]	0.9	1.2	2.0	0.5	1.0	6.2	1.4	2.9	3.3	1.2	0.9	**1.3**	2.8	–0.3	1.5	0.3	**1.6**
ICT-using manufacturing	–1.7	–0.6	1.1	–1.1	–1.8	1.2	–0.4	0.3	4.3	–0.9	–0.5	**–0.6**	2.5	–1.7	–0.3	–1.6	**–0.8**
ICT-using services	1.6	1.9	2.4	0.9	1.9	7.3	2.1	3.4	3.0	1.9	1.2	**1.9**	2.8	0.1	2.2	0.8	**2.0**
Non-ICT industries	0.2	1.0	2.0	1.1	0.6	4.6	0.8	2.2	2.7	0.4	1.1	**1.1**	1.6	0.0	1.8	0.4	**2.0**
Non-ICT manufacturing	–0.7	–0.7	1.6	–0.6	–0.2	3.4	0.3	0.2	3.3	0.4	–1.1	**0.1**	3.1	–1.6	0.3	–1.4	**0.0**
Non-ICT services	1.7	1.6	2.5	2.0	2.0	5.3	1.6	2.7	2.6	0.5	1.7	**1.9**	1.4	0.9	2.1	1.3	**2.1**
Non-ICT other	–1.9	–0.1	0.9	–1.3	–3.3	3.9	–1.3	1.3	2.5	–0.3	0.0	**–0.9**	1.1	–0.6	1.0	–0.8	**2.5**

Notes: (a) 1995–99. (b) Excluding ICT-producing industries.