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Labour productivity growth and industry structure. The impact of industry structure on productivity growth, export prices and labour compensation

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Abstract

In this paper labour productivity growth and its impacts are studied at the industry level. The development of productivity is analysed in 54 industries in 14 EU countries and in the US between 1979 and 2001. The conclusion of the study is that the industry structure that leads to fast productivity growth is connected to falling export prices. The relationship between labour productivity growth and labour compensation growth is relative weak and therefore the majority of the utility resulting from the productivity growth does not benefit the labour force.

Key words: industry structure, labour productivity, export prices, labour compensation

JEL classification numbers: F41, J30, O47

Työn tuottavuuden kasvu ja toimialarakenne
Toimialarakenteen vaikutus tuottavuuden kasvuun, vientihintoihin ja ansiotasoon

Suomen Pankin tutkimus
Keskustelualoitteita 4/2005

Johanna Sinkkonen
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Selvityksessä tarkastellaan työn tuottavuuden kasvua ja sen vaikutuksia toimiala-aineistoa käyttäen. Tarkastelun kohteena on 54 toimialaa 14 EU-maassa ja USA:ssa ajanjaksolla 1979–2001. Tarkastelun johtopäätös on, että nopeaan tuottavuuden kasvuun johtavaan tuotantorakenteeseen näyttää liittyvän vientihintojen lasku. Tuottavuuden kasvun yhteys ansiotason nousuun on melko vähäinen, jolloin valtaosa työn tuottavuuden kasvun hyödystä kohdistuu muille kuin työntekijöille.

Avainsanat: toimialarakenne, tuottavuus, vientihinnat, reaaliansiot

JEL-luokittelu: F41, J30, O47

Contents

1 Introduction

Labour productivity has grown at quite a different pace in different countries and economic areas. The development of productivity diverges also remarkably across industries. To what extent are the differences between countries explainable by examining different industry structures? How should the different industry structures be taken into consideration when interpreting the productivity growth differences between countries and how does the industry structure affect the GDP growth and the functional income distribution in a particular country?

In this study labour productivity growth is analysed at the industry level by studying 55 industries in 14 EU countries and in the USA. The purpose is to find out how the industry structure affects the aggregate productivity growth rates, what the relationship is between industry structure and export prices and how labour compensation growth is related to labour productivity growth.

This report is structured in the following way. After presenting the data sources used and discussing some methodological points in section 2, we proceed to examine productivity growth at the aggregate level and investigate the relative importance of industry, country and time factors for productivity development. After that we move on to industry-level analysis. In section 4 we first present our findings on productivity growth and relative productivity levels at the industry level. Secondly in section 5 we study the industry structure and differences in it across the countries examined to understand the relative importance of industries for aggregate productivity development. We get answers to such questions as: which industries have contributed most and least to the aggregate productivity growth and which industries have contributed most to the productivity growth acceleration in the US and to the deceleration in the EU-15 and Finland? To be able to study the impact of industry structure on productivity growth and other economic aggregates, we then decompose the productivity development into year, industry and country components in section 6. The results of this decomposition are utilised later in the report.

In section 7 we study how some important economic variables are affected by the industry structure and productivity growth. As the proportion of labour income of the total GDP has decreased in Finland and also the export prices have fallen, it seems that there could be a clear relationship between an industry structure with a high ICT share and these changes. In section 7 we examine if changes like these can be seen also in other countries.

2 Data and methodological problems

This section describes the data used in this report. Also the methodological problems related to the questions studied and the data adjustments needed are described.

2.1 Industry Labour Productivity Database

The primary data source in this study is the Industry Labour Productivity Database (hereafter ILPD) developed by O'Mahony and van Ark at the Groningen Growth and Development Centre. The Database consists of industry-level data for 15 EU countries and the USA. The data covers the years 1979–2001 and 56 industries.[1] Both goods and public and private service sectors are included. The primary variables in the database are nominal value added, industry deflators, employment and working hours per employee.

The data has been compiled from the OECD Structural Analysis (STAN) database. The STAN database is in turn based on the national accounts of the individual states. The STAN database has been complemented and disaggregated with industry-level statistics and national accounts data. To achieve international consistency in information and communications technology, US deflators are employed to obtain real output series.

2.2 Other data sources

For relative labour compensation and productivity levels, the data source used is the ICOP Database of the Groningen Growth and Development Centre (hereafter ICOP). The database consists of relative levels of productivity and unit labour costs for 26 manufacturing industries in 14 countries in the European Union and the United States. The series are based on 1997 benchmark comparisons. The database uses industry-specific unit value ratios to convert output in national currencies to a common currency and it thus takes into consideration the differences in relative price levels between industries.

For real GDP and total hours worked, the data source used is the Total Economy Database of the Groningen Growth and Development Centre (hereafter Total Economy). For export values, export prices, consumer price indexes and labour compensation at the national level, we have used data provided by Eurostat.

[1] See the list of industries (Appendix 1).

2.3 Methodological problems

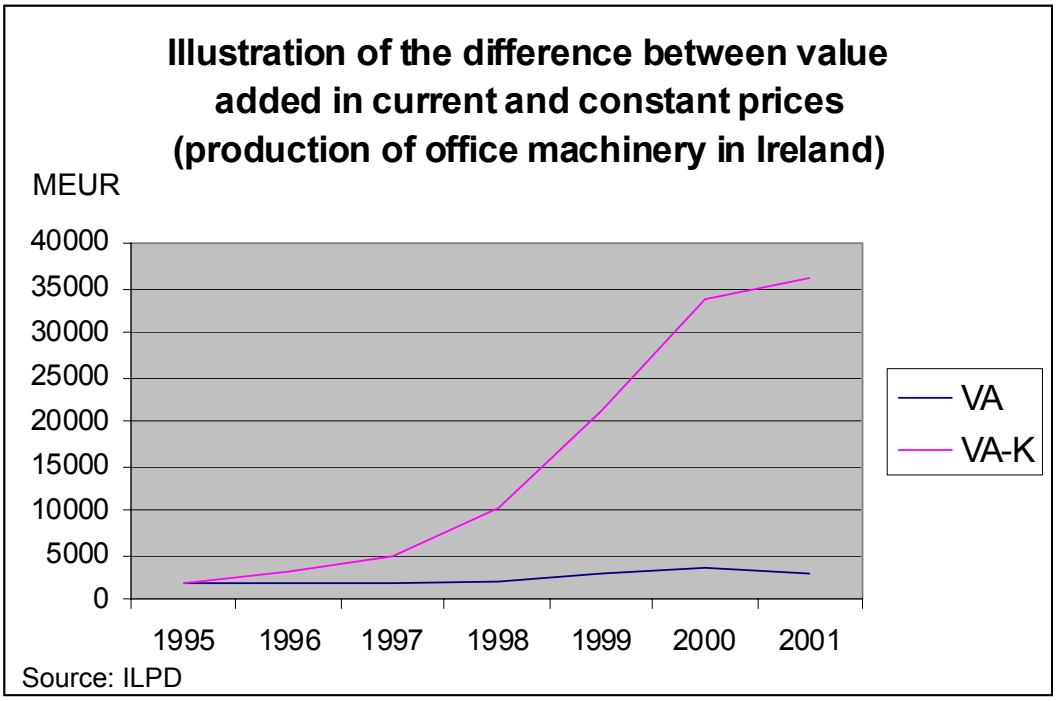
There are well-known problems in measuring ICT output in constant prices. The capabilities of computers have improved remarkably and the price of computing power has thus declined. Traditional methods of measuring price indexes for these products do not take into account this development. There are only a few countries that have an adequate method for calculating prices for ICT products. This means that productivity growth comparisons between different countries are not reliable. The Industry Labour Productivity Database of the Groningen Growth and Development Centre takes into consideration this problem by applying the US deflators for the computer and electronic industries to all other countries. (See O'Mahony and van Ark 2003)

The US uses so-called hedonic price indexes for quality adjustment. The method redefines goods in terms of their characteristics so that modified and new models represent a new combination of those characteristics. The hedonic method helps to separate the price and quality changes, for example, by helping to estimate how much a product would have cost in a previous period if it had been available. (OECD 2001)

This approach of applying US deflators to all countries examined is, however, slightly problematic. There are considerable differences between countries in industrial specialisation. The US, for example, produces computers, the prices of which have fallen very quickly. Most of the EU countries, however, do not produce computers but only peripheral equipment, the capabilities of which have not increased as fast. Accordingly there is a possibility that this approach exaggerates the productivity growth values in some countries. (See Pilat et al 2002)

When the US deflators are applied to the European countries where hedonic deflators are not being used normally, the productivity growth rates grow considerably in some industries. The following figure concerning Ireland illustrates this fact. Both the current price value added in the manufacturing of office machinery and the deflated constant price value added in Ireland can be seen in Figure 2.1. The hedonic deflation increases the value of production in this particular industry to over 12-fold for 2001.

Figure 2.1 **The significance of hedonic deflation is huge in some industries**



When similar deflators are applied to different countries, the comparability of the values certainly rises. Because the hedonic deflators are used to recalculate the value of ICT production, the significance of ICT industries naturally rises compared to the studies where national deflators are utilised. Colecchia and Schreyer (2001) compare the contribution of ICT to output growth when these different methods are used. One of their conclusions is that in Finland the contribution is more than threefold when the harmonised deflators are used instead of the national ones.

The difficulties in separating the price and quality changes affect strongly the comparability of price development in different countries. There are remarkable methodological problems in assessing the relationship between productivity growth and export prices or even in comparing export price development across the countries. The differences in statistical methodology lead to large differences in ICT price indexes that do not reflect the real differences in the price development of these products.

In calculating the productivity growth rates behind this study, the US price deflators are applied to all countries. This method harmonises the price indexes and makes the comparisons more justifiable. The export price indexes analysed in section 7 are, however, not based on these harmonized methods. They are based on various deflation methods and are thus not necessarily comparable. Countries

that employ hedonic deflators for ICT products normally register larger drops in ICT prices. In most countries the ICT products constitute only a small part of the total export value and thus the differences in their price indexes don't have a large effect on the total export price index. For some smaller countries like Ireland this effect can, however, be remarkable.

Besides the measurement problems related to ICT output, there are large measurement problems in the measurement of output in the service sector. Problems are especially severe in the public sector, where there is no common way to measure output. Service sector growth is often estimated by measuring inputs. This approach does not take into consideration changes in the quality of services. Therefore quality improvements in the service sector do not necessarily appear in the real output numbers and thus the growth in the service sector industries can be underestimated. The growing use of ICT technology, for example, has an impact on the quality of services. The increasing utilisation of new technologies affects the quality of the public health care as well as the quality of financial services. Therefore there is even more uncertainty in the productivity growth values of the service sector.

For the purposes of this study, no large data adjustments were needed. When conducting the regression analysis some data points were, however, censored. In very small industries particularly in small countries, the production can be very volatile. In some years, the value added can be negative because there can be only one or two companies operating in that particular industry and they can be unprofitable. When the following year is again clearly positive, the productivity seems to grow by hundreds or even thousands of per cents in a year. These outlier data points were removed by excluding those industries that employ less than a thousand persons from the regression analysis.

From the 15 EU countries covered in the Groningen Industry Labour Productivity Database, only 14 were included in this study. Luxembourg was excluded, because most of the industries there are very small.[2] Also one industry (private households with employed persons) was excluded because data on it was available only for a few countries.

[2] Note that Luxembourg was not removed from the aggregated EU-level data and therefore EU-15 refers to EU aggregate that includes Luxembourg.

3 Labour productivity at the aggregate level

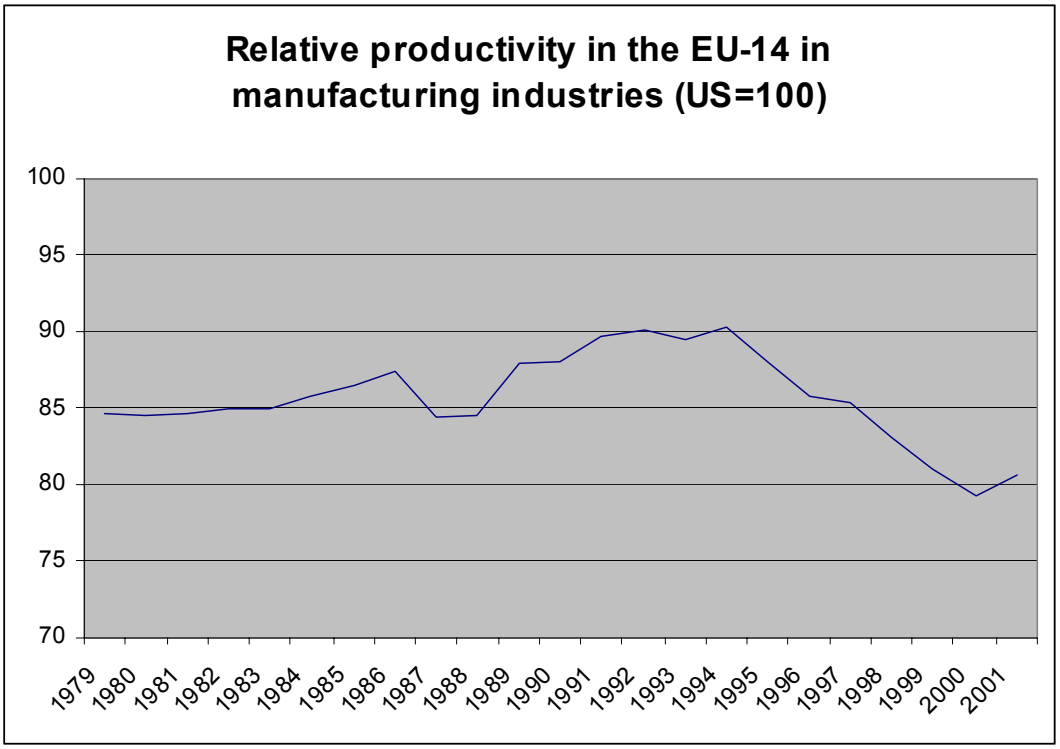
Labour productivity is defined as output per hour worked measured as the growth in value added at constant prices minus the growth in hours worked. In this section we discuss productivity growth at the aggregate level. How do productivity growth rates and levels differ between the EU countries and the United States and what lies behind these differences?

3.1 Productivity development

Since the Second World War the productivity levels in Europe and in the US have been converging: the growth in Europe has been stronger. This catching-up process can still be seen in the average growth rates between 1990 and 1995: while the average labour productivity growth rate in the US was 1.1% between 1990 and 1995, in the EU-15 area it was 2.3%.

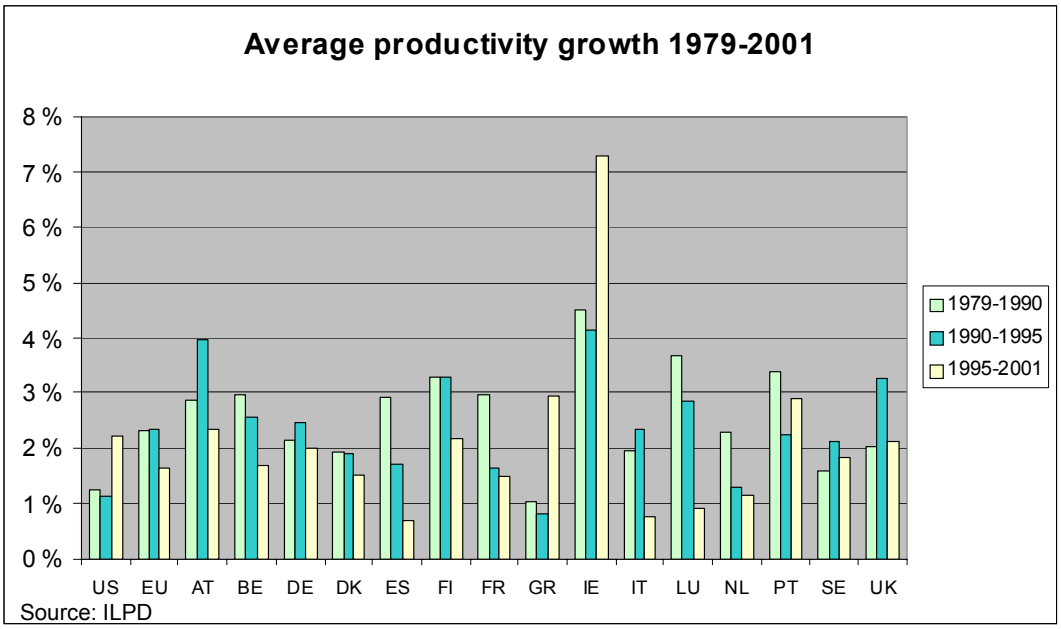
Since the mid-1990s the development has, however, changed. For the first time, the real GDP and labour productivity growth rates have been lower in the EU than in the US for several years in a row. Consequently the productivity gap between the EU countries and the US has widened. In manufacturing industries the EU-14 level has fallen from 90% of the US level to 81% between 1994 and 2001, as can be seen in the following figure (3.1). (O'Mahony et al 2003)

Figure 3.1 **The relative productivity level in the EU-14 has declined since 1994**



The variations between individual EU countries are, however, large both in the growth rates and productivity levels. As Figure 3.2 shows, there is considerable diversity between the EU-15 countries in growth rates. In the period 1995–2001 the average annual growth rate varies from Spain's 0.7% to Ireland's 7.3%.

Figure 3.2 **The productivity growth levels vary strongly between European countries**



As Figure 3.3 shows, the productivity growth levels also differ remarkably across countries. The downward trend after the mid-1990s was proportionally strongest in Italy and Sweden but also the relative levels of Spain, Germany, the Netherlands and the UK decreased. There are also some countries that have higher productivity levels in manufacturing than the US, most notably Ireland and Belgium.

If there is some kind of catching-up process still going on, the productivity growth value should be the bigger the lower the productivity level is. Figure 3.4 should show if there was a negative relationship between the productivity level and the productivity growth in a particular country. On the x axis are the labour productivity growth rates for manufacturing industries. It seems that Portugal could have been benefiting from its very low productivity level: the productivity growth rate in manufacturing there has been higher than in most of the EU countries. On the other hand, another country with a low productivity level, Greece, did not grow faster in the period examined than the other EU-15 countries. Based on this figure, it seems to be evident that the western European countries have not been benefiting from the catching-up process lately.

Figure 3.3 **The relative labour productivity levels in manufacturing are highest in Ireland and Belgium**

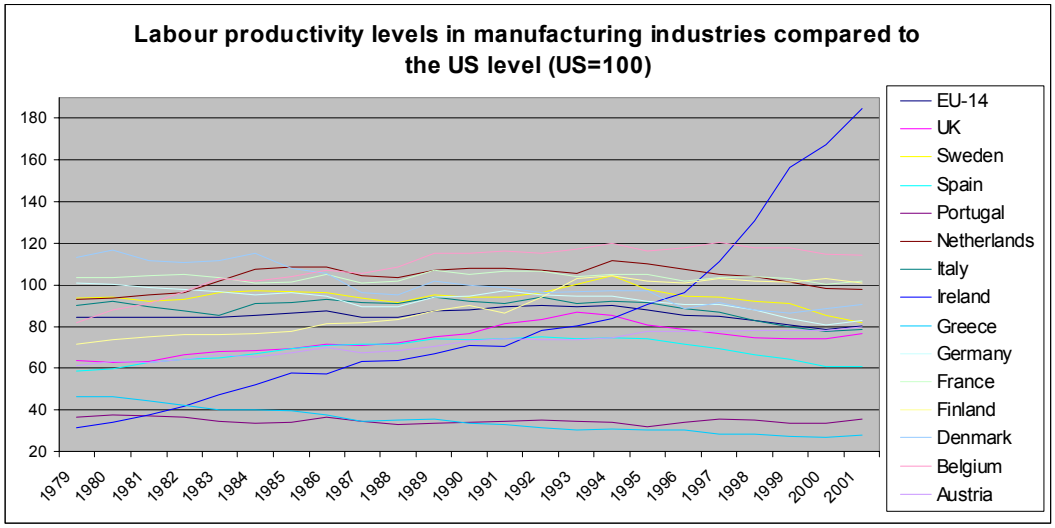
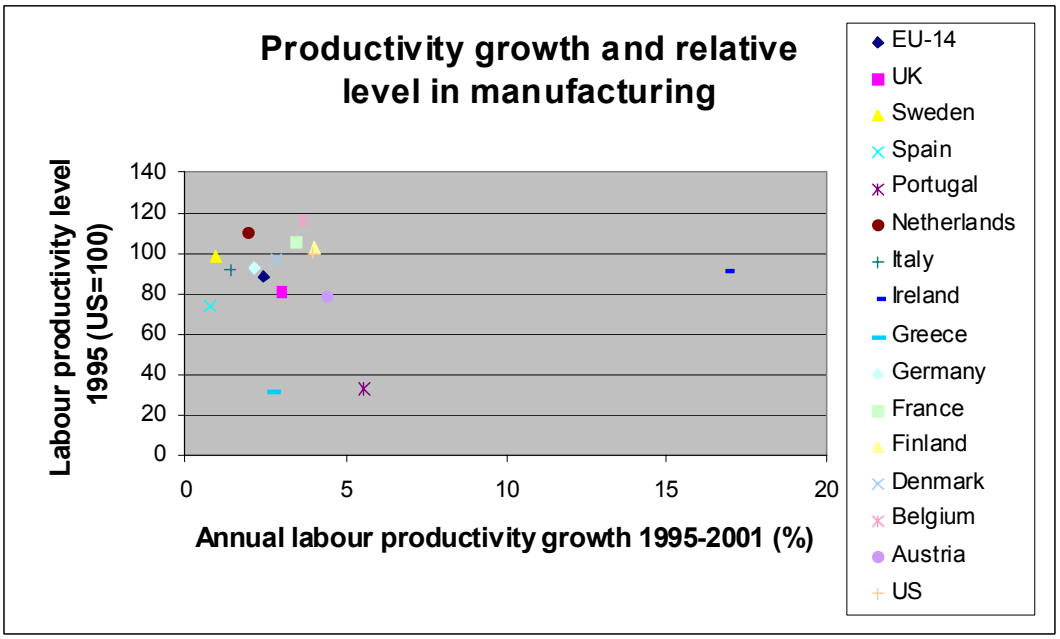


Figure 3.4 **Productivity growth and level do not correlate negatively at the country level**



3.2 The sources of productivity variance

There are remarkable differences between the countries when it comes to productivity growth rates. Productivity growth varies across countries, time and industries. How important are these different sources of variation? The sources of variation are examined with variance analysis (see, for example, Kinnunen 1998). In addition to the industry, country and the year-specific effect, also the combined effects of these factors are studied. The combined effect of the country and the year factors represents the country-specific cyclical fluctuations whereas the country and the industry factors together measure how the average growth of the industries varies between different countries. The combined industry and year factors represent the differences in the industry growth rates between years.

The following equation (3.1) includes all the different sources of variation.

$$y_{cit} = a_i + b_c + c_t + d_{ct} + e_{it} + f_{ic} + u_{ict} \qquad (3.1)$$

where a_i is the industry-specific factor
b_c is the country-specific factor
c_t is the year-specific factor
d_{ct} is the country-year factor
e_{it} is the industry-year factor
f_{ic} is the industry-country factor; and
u_{ict} is the residual that includes the combined effect of all three factors.

The following table summarizes the results of the variance analysis.

Table 3.1 **The industry is the largest source of variation of labour productivity development**

Source of variation	Symbol	SSD	%	Degrees of freedom	Variance estimate	Variance ratio	F 0.005	Significance
Industry	a	82.5629	21.32	54	1.5289	116.3510	1.5663	*
Country	b	1.2639	0.33	15	0.0843	6.4119	2.1880	*
Year	c	2.3597	0.61	21	0.1124	8.5510	1.9728	*
Country-year	d	8.7300	2.25	315	0.0277	2.1090	1.2197	*
Industry-year	e	57.4128	14.82	1134	0.0506	3.8528	1.1156	*
Industry-country	f	11.4745	2.96	810	0.0142	1.0780	1.1362	
Residual	u	223.5246	57.71	17010	0.0131			
Total		387.3285		19359				

The significance of the different factors is tested with the variance ratio, which is the ratio between the variance estimate and the variance of the residual. The

examined factors explain together about 42% of the total variation. All factors, except the industry-country factor, deviate statistically significantly from the variance of the residual.

The industry is clearly the most important source of variation. It explains about 21% of the total variation. Also the industry-year factor is an important one. Almost 15% of the variation can be explained by the year-specific differences in industry development. As the results show, there are no statistically significant country-specific differences in the industry growth rates.

The industry is the most important source of variation and therefore we move on next to examine more closely the productivity growth rates and relative productivity levels at the industry level.

4 Labour productivity at the industry level

According to the variance analysis conducted (see section 3.2), the largest source of variation in productivity development is the industry. The differences between the productivity growth rates of different countries cannot therefore be understood without studying the productivity development at the industry level. In this section we first analyse productivity growth rates of different industries. Secondly we move on to study the differences in productivity levels at the industry level.

4.1 Productivity growth rates at the industry level

Table 4.1 shows the labour productivity growth rates for the EU-15, the US and Finland. Remarkable diversity exists between the values of different industries: the values range from -12.1 per cent (railroad equipment in Finland 1995–2001) to 82.5 per cent (electronic valves and tubes in Finland 1995–2001). The largest and the smallest numbers occur usually in small industries. It is worth noting that the very large growth rates of office machinery and electronic valves and tubes occur in industries in which, according to the US deflators, prices are falling and quality is increasing very quickly. Thus the largest part of the growth in those industries is not resulting from the change in the current value added but from the reduction of the deflator.

Table 4.1 **Productivity growth rates of industries in the US, in the EU-15 and in Finland**

	US			EU-15			Finland		
	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001
Total	1.27	1.12	2.19	2.32	2.34	1.62	3.30	3.29	2.17
Agriculture	6.89	2.20	9.38	5.47	5.28	3.60	5.39	-0.23	6.19
Forestry	11.53	-9.24	3.74	4.67	3.34	2.45	2.88	9.96	2.55
Fishing	0.76	-10.67	14.43	3.11	1.40	0.29	5.17	7.80	-0.28
Mining and quarrying	4.46	5.22	-0.18	2.95	13.96	3.55	10.80	5.12	-0.39
Food, drink & tobacco	1.20	3.69	-5.84	2.59	2.73	0.83	3.77	6.57	3.28
Textiles	3.45	2.96	2.17	2.75	3.01	2.16	4.12	8.68	0.66
Clothing	3.10	2.70	5.52	2.60	5.24	3.40	3.47	2.11	0.20
Leather and footwear	4.28	4.57	0.09	2.67	3.58	1.18	3.90	4.03	1.65
Wood & products of wood and cork	2.62	-2.96	-0.85	2.28	2.99	2.22	5.02	5.84	4.43
Pulp, paper & paper products	1.36	-0.14	1.21	3.62	3.22	2.91	5.76	7.72	2.80
Printing & publishing	-1.40	-2.82	-0.51	2.35	1.97	1.89	3.87	3.97	2.49
Mineral oil refining, coke & nuclear fuel	7.20	5.68	0.57	-5.18	6.19	-1.00	2.39	5.82	-1.39
Chemicals	3.42	3.01	1.89	4.80	6.73	3.92	4.35	4.42	4.01
Rubber & plastics	4.29	4.40	4.14	2.29	2.71	1.27	5.59	3.93	0.11
Non-metallic mineral products	1.89	2.35	-0.52	3.23	3.17	1.50	3.90	4.39	1.40
Basic metals	0.81	3.62	2.73	4.81	6.42	1.31	5.94	8.01	4.11
Fabricated metal products	2.09	2.98	0.20	2.21	2.50	1.10	6.16	5.35	-0.29
Mechanical engineering	-0.65	0.32	-2.00	2.06	2.81	1.18	4.75	4.48	0.93
Office machinery	31.07	33.03	61.70	27.63	30.54	56.40	41.69	13.81	54.85
Insulated wire	5.33	2.43	3.89	5.07	6.76	0.38	4.17	10.34	4.94
Other electrical machinery and apparatus	0.72	1.08	-3.14	1.60	0.76	2.05	5.80	4.92	1.68
Electronic valves and tubes	25.76	46.52	67.82	22.87	41.61	76.71	21.96	39.36	82.50
Telecommunication equipment	23.85	4.95	-1.15	21.89	4.31	0.42	25.06	8.14	7.36
Radio and television receivers	10.93	-5.16	-7.68	11.17	-2.39	-6.62	13.85	-7.00	-2.54
Scientific instruments	3.06	-4.58	-6.03	1.49	-3.49	-7.33	6.00	-0.72	-7.43
Other instruments	2.83	2.34	4.55	2.66	6.54	3.75	4.14	9.43	1.73
Motor vehicles	-0.74	3.89	1.36	4.07	3.29	0.48	2.85	1.47	3.91
Building and repairing of ships and boats	3.42	-4.30	3.38	6.18	0.58	1.80	1.61	10.30	-1.25
Aircraft and spacecraft	1.27	-1.09	2.30	4.82	2.52	-0.43	8.28	12.31	-0.21
Railroad and transport equipment	3.03	-2.40	4.41	3.90	3.77	2.49	8.12	-9.25	-12.09
Furniture, misc. manufacturing; recycling	2.93	1.10	2.66	1.63	1.44	1.61	4.08	3.64	1.51
Electricity, gas and water supply	1.12	1.82	0.12	2.76	3.66	5.84	4.05	8.25	5.50
Construction	-0.78	0.41	-0.28	1.65	0.85	0.67	1.56	0.22	-0.80
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0.58	-2.38	-6.63	1.41	2.35	0.81	0.85	3.76	1.51
Wholesale trade and commission trade	2.62	2.91	7.83	1.87	3.43	1.70	3.56	-2.21	2.72
Retail trade	2.80	1.98	6.86	1.77	1.78	1.23	3.79	4.09	1.33
Hotels & catering	-1.08	-1.02	-0.23	-0.95	-0.78	-0.85	1.63	3.93	-1.50
Inland transport	1.74	1.04	0.60	2.61	3.06	2.44	2.01	2.65	1.42
Water transport	0.54	0.75	2.18	3.20	5.82	2.60	1.08	4.21	3.80

	US			EU-15			Finland		
	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001
Air transport	0.96	2.01	3.61	3.51	9.98	3.64	4.39	5.93	0.96
Supporting and auxiliary transport activities; activities of travel agencies	-0.94	-0.81	3.71	3.24	3.78	1.53	2.89	3.60	3.00
Communications	1.39	2.44	7.12	5.38	6.42	9.29	5.75	6.09	13.11
Financial intermediation	0.13	0.97	4.51	2.38	1.23	4.27	4.80	-0.52	9.10
Insurance and pension funding	-4.98	2.51	0.55	2.75	1.23	0.14	5.07	-1.51	-1.79
Activities auxiliary to financial intermediation	1.29	3.13	10.47	1.13	0.38	0.42			
Real estate activities	0.35	1.65	0.93	-0.66	-0.04	-0.57	1.73	6.70	1.01
Renting of machinery and equipment	-1.52	8.56	5.94	2.14	3.26	1.65	-2.49	3.05	2.08
Computer and related activities	6.53	2.42	-4.33	1.48	1.38	1.62	-0.70	-1.46	-1.10
Research and development	3.69	0.03	1.91	3.34	-0.49	-1.08	1.05	-0.49	-0.71
Legal, technical and advertising	-1.43	-0.90	-0.14	0.58	0.50	0.71	-0.38	3.06	1.16
Other business activities, nec	0.34	-0.67	0.77	-0.20	0.82	-1.11	0.51	-0.75	-1.89
Public administration and defence; compulsory social security	0.76	0.23	0.77	1.11	1.27	1.03	0.88	-0.91	1.53
Education	-0.32	0.27	-2.05	0.16	1.04	0.26	0.22	-0.16	-0.39
Health and social work	-1.51	-1.81	-0.27	0.41	1.25	1.04	0.78	-0.64	-0.35
Other community, social and personal services	0.69	0.65	-0.69	0.26	0.75	0.36	1.22	-0.15	0.54

Source: ILPD

The industries with the fastest labour productivity growth in the US can be seen in the following table (4.2a), which compares their productivity growth values in the EU-15, Finland and the US. Tables 4.2b and c show the fastest-growing industries in the EU-15 and Finland.

Table 4.2a **Industries with the highest growth rates in the US 1995–2001**

Industry	US	EU-15	Finland
Electronic valves and tubes	67.82	76.71	82.50
Office machinery	61.70	56.40	54.85
Fishing	14.43	0.29	-0.28
Activities auxiliary to financial intermediation	10.47	0.42	
Agriculture	9.38	3.60	6.19
Wholesale trade and commission trade	7.83	1.70	2.72
Communications	7.12	9.29	13.11
Retail trade	6.86	1.23	1.33
Renting of machinery and equipment	5.94	1.65	2.08
Clothing	5.52	3.40	0.20

Table 4.2b **Industries with the highest growth in the EU-15 1995–2001**

Industry	EU-15	US	Finland
Electronic valves and tubes	76.71	67.82	82.50
Office machinery	56.40	61.70	54.85
Communications	9.29	7.12	13.11
Electricity, gas and water supply	5.84	0.12	5.50
Financial intermediation	4.27	4.51	9.10
Chemicals	3.92	1.89	4.01
Other instruments	3.75	4.55	1.73
Air transport	3.64	3.61	0.96
Agriculture	3.60	9.38	6.19
Mining and quarrying	3.55	-0.18	-0.39

Table 4.2c **Industries with the highest growth in Finland 1995–2001**

Industry	Finland	US	EU-15
Electronic valves and tubes	82.50	67.82	76.71
Office machinery	54.85	61.70	56.40
Communications	13.11	7.12	9.29
Financial intermediation	9.10	4.51	4.27
Telecommunication equipment	7.36	-1.15	0.42
Agriculture	6.19	9.38	3.60
Electricity, gas and water supply	5.50	0.12	5.84
Insulated wire	4.94	3.89	0.38
Wood & products of wood and cork	4.43	-0.85	2.22
Basic metals	4.11	2.73	1.31

It should be noted that ICT industries ie electronic valves and tubes and office machinery are on top of the list in all of the three areas but after them the lists vary somewhat. The US list includes service sector industries such as wholesale and retail trade that are not included in the European lists. Service sector industry communications is included in all of the lists. The lists for Finland and the EU-15 include basic manufacturing industries that are almost totally absent from the US list.

In addition to the industries with the highest growth rates, it is also interesting to see what industries have been developing the worst during recent years (see Tables 4.3a-c). Among the slowest-growing industries in all three areas are some manufacturing industries, such as the manufacturing of radio and television receivers and scientific instruments. It is also worth noticing that the larger part of badly developing industries consists of service industries in the EU-15 (6 of 10)

and in Finland (5 of 10), compared to the US (3 of 10), where some of the basic manufacturing industries are developing relatively poorly.

Table 4.3a **Industries with the lowest growth rates in the US 1995–2001**

Industry	US	EU-15	Finland
Radio and television receivers	-7.68	-6.62	-2.54
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	-6.63	0.81	1.51
Scientific instruments	-6.03	-7.33	-7.43
Food, drink & tobacco	-5.84	0.83	3.28
Computer and related activities	-4.33	1.62	-1.10
Other electrical machinery and apparatus nec	-3.14	2.05	1.68
Education	-2.05	0.26	-0.39
Mechanical engineering	-2.00	1.18	0.93
Telecommunication equipment	-1.15	0.42	7.36
Wood & products of wood and cork	-0.85	2.22	4.43

Table 4.3b **Industries with the lowest growth rates in the EU-15 during 1995–2001**

Industry	EU-15	US	Finland
Scientific instruments	-7.33	-6.03	-7.43
Radio and television receivers	-6.62	-7.68	-2.54
Other business activities	-1.11	0.77	-1.89
Research and development	-1.08	1.91	-0.71
Mineral oil refining, coke & nuclear fuel	-1.00	0.57	-1.39
Hotels & catering	-0.85	-0.23	-1.50
Real estate activities	-0.57	0.93	1.01
Aircraft and spacecraft	-0.43	2.30	-0.21
Insurance and pension funding	0.14	0.55	-1.79
Education	0.26	-2.05	-0.39

Table 4.3c **Industries with the lowest growth rates in Finland 1995–2001**

Industry	Finland	US	EU-15
Railroad equipment and transport equipment	-12.09	4.41	2.49
Scientific instruments	-7.43	-6.03	-7.33
Radio and television receivers	-2.54	-7.68	-6.62
Other business activities, nec	-1.89	0.77	-1.11
Insurance and pension funding	-1.79	0.55	0.14
Hotels & catering	-1.50	-0.23	-0.85
Mineral oil refining, coke & nuclear fuel	-1.39	0.57	-1.00
Building and repairing of ships and boats	-1.25	3.38	1.80
Computer and related activities	-1.10	-4.33	1.62
Construction	-0.80	-0.28	0.67

4.2 Productivity levels at the industry level

In section 3.1 we took note that the relative productivity levels are on average below the US level in EU countries but the levels vary a lot also among the EU countries. In addition, diversity exists across industries behind these levels, as can be seen in Table 4.4 below. It includes only manufacturing industries due to the lack of data available.

Table 4.4 **The relative productivity levels vary strongly between industries (productivity level as % of the US level)**

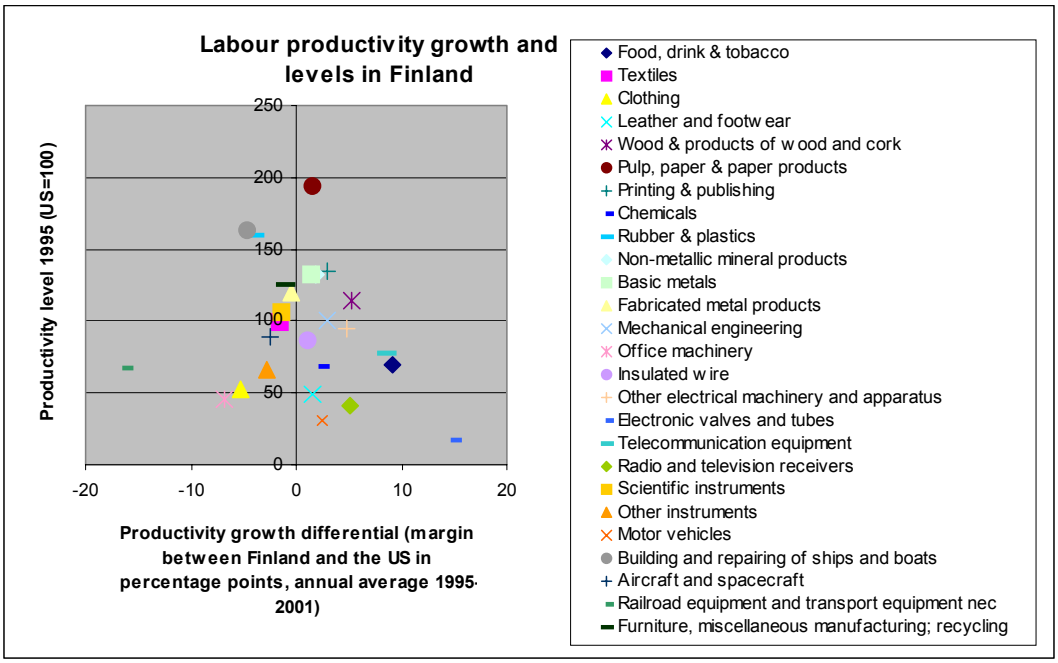
	1979-1981		1994-1996		1999-2001	
Industry	EU-14	Finland	EU-14	Finland	EU-14	Finland
Food, drink & tobacco	64.5	45.6	79.7	76.3	100.6	110.3
Textiles	103.4	72.2	99.1	103.0	100.8	99.6
Clothing	66.1	54.1	67.7	57.7	61.0	42.3
Leather and footwear	95.2	52.7	88.0	57.6	89.9	56.0
Wood & products of wood and cork	63.0	57.6	86.8	122.3	101.3	158.0
Pulp, paper & paper products	76.8	90.0	104.9	176.6	120.0	214.5
Printing & publishing	67.0	58.8	120.3	131.4	134.5	153.8
Chemicals	54.7	63.0	70.5	69.0	78.4	76.2
Rubber & plastics	180.2	137.5	145.8	158.3	127.0	125.6
Non-metallic mineral products	121.2	102.9	142.6	137.5	148.8	138.9
Basic metals	65.1	60.7	109.1	129.4	107.8	143.8
Fabricated metal products	108.9	73.3	108.5	119.7	111.4	116.6
Mechanical engineering	66.5	49.8	97.4	97.9	110.8	112.3
Office machinery	133.3	43.1	89.8	42.9	71.9	17.7
Insulated wire	87.3	76.2	93.7	88.3	77.6	96.7
Other electrical machinery and apparatus nec	79.7	56.2	91.3	98.1	112.1	118.3
Electronic valves and tubes	47.8	28.2	31.8	20.7	41.6	26.3
Telecommunication equipment	71.9	57.2	63.9	77.6	65.7	119.6
Radio and television receivers	44.0	23.9	62.8	39.5	63.1	47.9
Scientific instruments	114.4	72.7	106.9	113.7	103.2	106.2
Other instruments	42.8	46.2	49.2	62.3	47.3	54.7
Motor vehicles	30.0	24.6	44.9	30.9	43.7	35.7
Building and repairing of ships and boats	59.2	93.0	95.8	163.3	88.7	134.2
Aircraft and spacecraft	46.7	28.0	69.9	73.7	71.8	95.8
Railroad equipment and transport equipment nec	68.8	66.9	76.4	73.5	80.4	40.9
Furniture, miscellaneous manufacturing; recycling	110.5	97.0	100.8	128.7	94.4	116.1
Total manufacturing	**84.6**	**73.7**	**88.0**	**102.6**	**80.3**	**101.8**

(Source: ICOP)

It is evident that the productivity levels differ widely across the industries and countries studied. For example, in motor vehicles, radio and television receivers, electronic valves and tubes, and office machinery both the EU-14 and Finland have very low productivity levels relative to the US level. On the other hand, in pulp and paper and in metal products, the EU is ahead of the US. Europe thus manages well in traditional manufacturing industries while the US is ahead in sectors that have the highest value added per person. The EU's deteriorating position in office machinery, insulated wire and in telecommunications equipment since the 1980s is one of the reasons behind the US' better productivity performance.

The relative levels and growth rates of industries in Finland and in the US are contrasted in Figure 4.1. On the x axis of Figure 4.1 are the productivity growth differentials between the rates in the USA and Finland: when the x values are positive, the growth is faster in Finland, and when they are negative, the growth is faster in the US. The y axis represents the productivity levels for the manufacturing industries compared to the US levels, which are 100 for each industry. It seems that some industries could be benefiting from the catching-up process but there are also those that are growing slowly although their relative productivity level is very low. The high growth rate of some of the industries changed their relative position between 1995 and 2001, as we can see in Table 4.4. For example, food & drink and telecommunication equipment industries had a higher productivity level in 2001 in Finland than in the US, although their productivity was clearly below the US level in 1995.

Figure 4.1 **Only some productivity growth values seem to benefit from the catching-up process in manufacturing industries in Finland**



In this section we have examined the productivity growth and relative productivity levels at the industry level. Because the fastest-growing industries are usually small ones, their contribution to the aggregate growth rate is limited. In addition to the growth rates, we thus have to understand how the industry structures vary between countries. In the next section we examine industry structures in different countries and the dissimilarities between them.

5 Industry structure and contributors to productivity development

In this section we examine the industry structures in the countries studied to be able to see how the individual industries contribute to the aggregate growth rate. Section 5.1 analyses differences in industry structure. Section 5.2 discusses the contributions of individual industries.

5.1 Industry structure

This section focuses on the industry structure in the EU-15 and in the US. The following table shows how the industry structures correlate between the EU-15 countries and the US. The table shows that the value-added shares of industries correlate quite highly. However, some smaller member countries, especially Ireland, specialize more heavily in some industries and the correlation is much lower than for the whole EU-15. The table also shows that the correlations increased between the years 1979 and 2001 in every country examined.

Table 5.1 **Correlations between value-added shares of industries in the EU-15 and the US**

	1979	2001
EU-15	0.94	0.96
Austria	0.85	0.90
Belgium	0.76	0.77
Denmark	0.89	0.92
Finland	0.80	0.82
France	0.91	0.95
Germany	0.91	0.92
Greece	0.76	0.84
Ireland	0.50	0.51
Italy	0.81	0.93
Netherlands	0.89	0.93
Portugal	0.68	0.78
Spain	0.79	0.83
Sweden	0.86	0.86
UK	0.89	0.92

Source: ILPD

The following table (5.2) shows the industry shares in value added for the EU-15 area, the US and Finland for the periods 1979–1981, 1989–1991 and 1999–2001. As can be seen, there are remarkable differences in the industry structures. While the share of manufacturing decreased constantly in the US and the EU-15, it increased in Finland from the period 1989–1991 to the period 1999–2001. Correspondingly the share of services is lower in Finland. The main differences regarding the manufacturing sector are the shares of basic manufacturing and, on the other hand, the high-tech sectors: whereas in the EU-15 the share of basic manufacturing industries is clearly bigger than in the US, the share of high-tech industries such as office machinery and electronic valves is two times larger in the US than in the EU-15. This difference in new technology intensity is illustrated in Table 5.3, where the industries are grouped according to their ICT intensities. The grouping follows the one used by O'Mahony and van Ark (2003) and it groups industries based on whether they produce ICT goods or services, use ICT intensively or do not use ICT intensively. (For the ICT taxonomy, see Appendix 2.)

Table 5.2 **Output shares of industries (% of total value added)**

	1979-1981			1989-1991			1999-2001		
Industry	US	EU	FI	US	EU	FI	US	EU	FI
Agriculture	2.6	2.7	4.4	1.9	2.1	3.3	1.5	1.5	1.4
Forestry	0.1	0.3	4.3	0.1	0.3	2.7	0.1	0.2	2.1
Fishing	0.1	0.1	0.2	0.0	0.1	0.1	0.0	0.1	0.1
Mining and quarrying	3.5	2.1	0.5	1.7	1.0	0.4	1.2	0.8	0.2
Food, drink & tobacco	2.0	2.8	2.9	1.8	2.4	2.5	1.4	2.0	1.6
Textiles	0.7	1.1	0.9	0.5	1.0	0.3	0.3	0.7	0.2
Clothing	0.6	0.8	1.1	0.4	0.7	0.5	0.2	0.5	0.2
Leather and footwear	0.2	0.5	0.3	0.1	0.4	0.1	0.0	0.3	0.1
Wood & products of wood and cork	0.7	0.6	2.1	0.6	0.5	1.3	0.4	0.5	1.1
Pulp, paper & paper products	0.9	0.7	4.1	0.8	0.6	3.0	0.6	0.6	4.2
Printing & publishing	1.3	1.3	1.8	1.3	1.3	1.8	1.1	1.2	1.4
Mineral oil refining, coke & nuclear fuel	0.8	0.9	1.1	0.5	0.4	0.5	0.4	0.3	0.3
Chemicals	1.9	2.4	1.4	2.0	2.2	1.4	1.8	1.9	1.4
Rubber & plastics	0.7	1.1	0.8	0.6	1.1	0.7	0.6	1.0	0.8
Non-metallic mineral products	0.7	1.3	1.1	0.5	1.1	1.0	0.4	1.0	0.8
Basic metals	1.8	1.3	1.2	0.8	1.0	1.0	0.5	0.6	1.0
Fabricated metal products	1.8	2.4	1.2	1.3	2.1	1.4	1.1	1.8	1.5
Mechanical engineering	2.5	3.0	3.0	1.7	2.4	2.7	1.2	2.0	2.7
Office machinery	0.6	0.3	0.1	0.6	0.3	0.2	0.4	0.2	0.0
Insulated wire	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1
Other electrical machinery and apparatus	0.8	1.3	0.6	0.6	1.1	0.6	0.3	0.9	0.7
Electronic valves and tubes	0.4	0.1	0.0	0.6	0.1	0.1	0.8	0.2	0.2
Telecommunication equipment	0.4	0.3	0.3	0.5	0.2	0.4	0.6	0.3	4.7

	1979-1981			1989-1991			1999-2001		
Industry	US	EU	FI	US	EU	FI	US	EU	FI
Radio and television receivers	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.0
Scientific instruments	0.7	0.5	0.1	0.7	0.5	0.1	0.5	0.4	0.3
Other instruments	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.3
Motor vehicles	1.3	1.7	0.4	0.9	1.6	0.4	1.3	1.4	0.3
Building and repairing of ships and boats	0.1	0.3	0.8	0.1	0.2	0.4	0.1	0.2	0.3
Aircraft and spacecraft	0.7	0.4	0.0	0.9	0.4	0.1	0.6	0.4	0.2
Railroad equipment and transport equipment nec	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Furniture, miscellaneous manufacturing; recycling	0.7	1.1	1.0	0.6	0.9	0.8	0.6	0.8	0.6
Total manufacturing	22.6	26.7	27.1	18.8	23.1	21.9	15.6	19.4	25.1
Electricity, gas and water supply	2.3	2.7	3.2	2.7	2.7	2.2	2.0	2.2	1.9
Construction	4.9	7.2	6.7	4.5	6.7	7.5	4.9	5.8	5.6
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0.6	1.7	1.7	0.7	1.8	1.7	0.6	1.9	1.6
Wholesale trade and commission trade, except of motor vehicles and motorcycles	6.3	4.6	5.6	5.6	4.8	5.5	5.9	4.9	5.1
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	6.9	4.5	4.1	6.6	4.7	3.9	6.6	4.6	3.2
Hotels & catering	2.3	1.9	1.6	2.4	2.3	1.8	2.5	2.7	1.4
Inland transport	2.8	2.6	3.8	1.9	2.6	3.8	1.8	2.3	3.6
Water transport	0.3	0.4	1.0	0.2	0.3	0.5	0.1	0.2	0.7
Air transport	0.6	0.3	0.4	0.8	0.3	0.5	0.9	0.5	0.6
Supporting and auxiliary transport activities; activities of travel agencies	0.3	1.1	1.7	0.3	1.1	1.9	0.3	1.4	2.3
Communications	2.8	2.3	2.0	2.3	2.5	2.2	2.4	2.7	3.2
Financial intermediation, except insurance and pension funding	2.6	3.7	2.7	3.5	4.3	3.8	4.7	3.9	2.8
Insurance and pension funding, except compulsory social security	1.2	0.8	0.5	1.1	0.8	0.4	1.7	0.9	0.4
Activities auxiliary to financial intermediation	1.0	0.4	0.0	1.5	0.5	0.1	2.3	0.7	0.4
Real estate activities	9.1	6.9	7.8	10.5	8.5	8.7	10.4	10.0	11.4
Renting of machinery and equipment	0.3	0.6	0.3	0.5	0.9	0.3	0.7	1.2	0.3
Computer and related activities	0.4	0.5	0.4	1.0	0.9	0.9	2.1	1.8	1.6
Research and development	0.3	0.4	0.3	0.4	0.5	0.4	0.5	0.4	0.5
Legal, technical and advertising	2.9	2.6	1.2	4.4	3.6	1.9	4.6	4.7	2.5
Other business activities, nec	1.6	2.0	0.6	2.5	2.5	1.1	3.5	3.3	1.4
Total business sector services	42.1	37.3	35.8	46.2	42.8	39.2	51.8	48.0	42.4
Public administration and defence; compulsory social security	9.7	7.5	4.6	9.8	7.1	5.4	8.3	6.5	4.8
Education	4.6	4.9	4.4	4.9	4.8	5.1	4.7	5.1	4.8
Health and social work	5.3	5.3	6.0	7.0	5.8	8.3	7.3	6.4	7.7
Other community, social and personal services	2.1	3.1	2.8	2.5	3.6	3.7	2.6	4.1	3.6
Total community, social and personal services	21.7	20.8	17.9	24.2	21.3	22.5	23.0	22.0	20.9

Source: ILPD

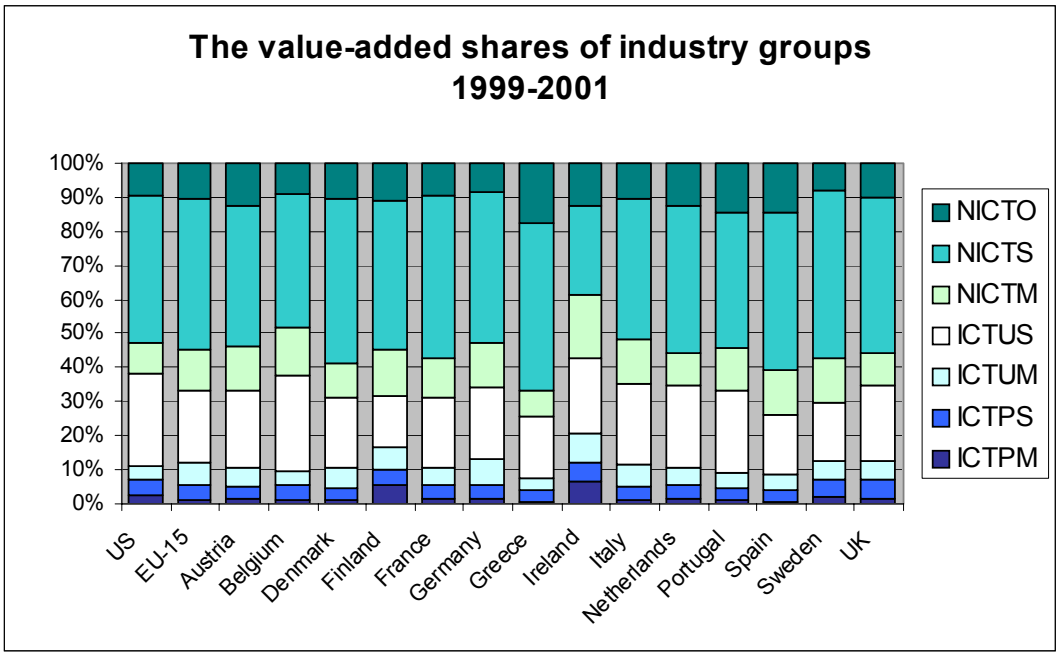
Table 5.3 **Output shares of industry groups (ICT taxonomy) (% of total value added)**

	1979–1981			1989–1991			1999–2001		
Industry group	US	EU	FI	US	EU	FI	US	EU	FI
ICT-producing manufacturing	2.3	1.6	0.8	2.5	1.5	1.1	2.3	1.2	5.3
ICT-producing services	3.2	2.9	2.4	3.3	3.4	3.0	4.5	4.5	4.8
ICT-using manufacturing	7.0	8.4	8.6	5.9	7.3	7.3	4.3	6.2	6.4
ICT-using services	21.4	17.6	14.8	23.5	20.0	16.2	27.0	21.3	14.8
Non-ICT using manufacturing	13.2	16.6	17.6	10.3	14.3	13.6	8.9	12.0	13.4
Non-ICT using services	39.2	37.7	36.5	43.5	40.6	42.5	43.1	44.3	43.8
Non-ICT using industries (other)	13.6	15.2	19.3	10.9	12.9	16.2	9.7	10.5	11.2

Source: ILPD

As can be seen, the ICT-using services and ICT-producing manufacturing are remarkably bigger in the US than in the EU-15. While the latter was in 1999–2001 very large in Finland thanks to the strong telecommunications sector, the ICT-using services sector in this period was weak. In fact, its share is in Finland smaller than in any other country examined in this study (see Figure 5.1). The share of ICT-producing manufacturing was highest in Ireland, on average 6.5% between 1999 and 2001, and lowest in Greece, about 0.3% of the total value added.

Figure 5.1 **The value-added shares of industry groups vary between countries**



While the ICT-producing manufacturing industries have enjoyed high productivity growth rates, it's reasonable to assume that their higher share in the US compared to the EU-15 has contributed to the higher average growth rates since the mid-1990s. Industry's contribution to the aggregate productivity growth does not depend only on its growth rate but also on its value-added share of the economy. As we have seen, the industries growing the fastest and slowest are usually the small ones. Consequently they do not contribute to the aggregate productivity development as much as could be thought at first glance. Next we examine more closely the contributions of different industries to the aggregate rates.

5.2 Contributors to productivity growth and productivity growth changes

In this section we discuss the factors contributing to productivity growth. First we compare the growth contributors in the EU-15, the US and in Finland. Then we move on to examine which industries have contributed most to the changes in the aggregate rates in recent years: what are the industries that should be thanked for the productivity growth acceleration in the US and blamed for the deceleration in Europe.

5.2.1 Contributors to productivity growth

To get an understanding of an industry's contribution to aggregate labour productivity growth, the growth values should be weighted with their shares: the contribution is the difference between the industry's contribution to the total value added and to the total labour input. To be specific, the industry-specific rates of change of constant value added are weighted with the current price shares of the industries and the growth rates of the hours worked are weighted with each industry's share of the total labour compensation

$$s^i_{VA}\Delta VA^i - s^i_L \Delta L^i \qquad (5.1)$$

where s^i_{VA} is the share of the industry i of the current value added
ΔVA^i is the change of the real value added in the industry i
s^i_L is the share of the industry i of total labour compensation; and
ΔL^i is the change of the total hours worked in the industry i.

The following tables (5.4a–c) sum up the results. The first column of each country shows the industry's percentage point contribution to the aggregate growth rate. The second column shows how large the contribution is in percentages.

Table 5.4a **The top positive contributors to the labour productivity growth in the US 1995–2001**

	US		EU-15		Finland	
Industry	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.
Electronic valves and tubes	0.56	22.3	0.13	7.5	0.14	6.0
Wholesale trade	0.46	18.5	0.09	5.2	0.16	6.9
Retail trade	0.45	18.1	0.05	2.9	0.02	0.9
Real estate activities	0.29	11.7	0.15	8.9	0.35	15.1
Office machinery	0.27	11.0	0.12	7.0	0.08	3.5
Activities auxiliary to financial intermediation	0.23	9.3	0.00	0.1	-	-
Financial intermediation	0.23	9.3	0.17	10.0	0.21	9.1
Communications	0.18	7.1	0.25	15.1	0.38	16.5
Agriculture	0.15	5.9	0.06	3.4	0.18	8.0
Public administration and defence	0.07	2.7	0.08	4.5	0.08	3.6

Table 5.4b **The top positive contributions to the labour productivity growth in the EU-15 1995–2001**

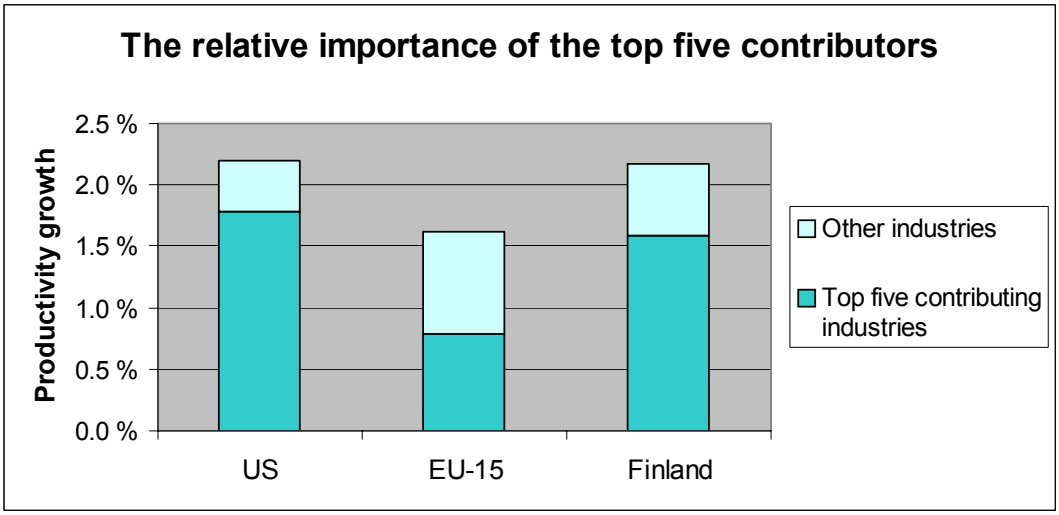
	EU-15		US		Finland	
Industry	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.
Communications	0.25	15.1	0.18	7.1	0.38	16.5
Financial intermediation	0.17	10.0	0.23	9.2	0.21	9.1
Real estate activities	0.15	8.9	0.29	11.7	0.35	15.1
Electronic valves and tubes	0.13	7.5	0.56	22.3	0.14	6.0
Office machinery	0.12	7.0	0.27	11.0	0.08	3.5
Electricity, gas and water supply	0.10	5.8	-0.01	-0.3	0.09	3.8
Wholesale trade	0.09	5.2	0.46	18.5	0.16	6.9
Public administration and defence	0.08	4.5	0.07	2.7	0.08	3.6
Chemicals	0.08	4.5	0.04	1.5	0.06	2.6
Renting of machinery and equipment	0.06	3.5	0.04	1.5	0.01	0.6

Table 5.4c **The top positive contributions to the labour productivity growth in Finland 1995–2001**

	Finland		EU-15		US	
Industry	%-point contrib.	%-contrib.	%-point contrib.	%- contrib.	%-point contrib.	%-contrib.
Telecommunication equipment	0.57	24.6	0.00	0.1	0.00	0.0
Communications	0.38	16.5	0.25	15.1	0.18	7.1
Real estate activities	0.35	15.1	0.15	8.9	0.29	11.7
Financial intermediation	0.21	9.1	0.17	10.0	0.23	9.3
Agriculture	0.18	8.0	0.06	3.4	0.15	5.9
Wholesale trade	0.16	6.9	0.09	5.2	0.46	18.5
Electronic valves and tubes	0.14	6.1	0.13	7.5	0.56	22.3
Pulp, paper & paper products	0.11	4.7	0.02	1.0	0.01	0.4
Electricity, gas and water supply	0.09	3.8	0.10	5.8	-0.01	-0.3
Public administration and defence	0.08	3.6	0.08	4.5	0.07	2.7

An interesting point is the importance of the wholesale and retail trade sectors for the US labour productivity growth. While the wholesale trade contributes 0.09 percentage points to the aggregate labour productivity growth in the EU-15 and 0.16 percentage points in Finland, its contribution in the US is 0.46 percentage points. The retail trade is almost as important as the wholesale trade in the US, contributing 0.45 percentage points, whereas it does not appear at all on the top list either in Finland or in the EU-15. In fact, its contribution in Finland is 0.02 percentage points and 0.05 in the EU-15. Another interesting point is the fact that the combined contribution of the largest contributors is remarkably smaller in the EU than in the US and also somewhat smaller in Finland. The five largest contributors are responsible for over 80% of the productivity growth in the US, under 50% in the EU-15 and over 70% in Finland (see Figure 5.2).

Figure 5.2 **The relative importance of the five most important contributions to productivity growth 1995–2001**



It could also be interesting to see the most important industries that affect the aggregate productivity growth negatively (see Appendix 3). These negative contributors include public services like education and health and social work, but as noted in section 2, these figures are not reliable because there is no common method for quantifying the output of public services. However, some differences do exist between the US and the EU in this regard: while the top negative list of the US includes mainly manufacturing industries, the lists of the EU-15 and Finland also include some market services.

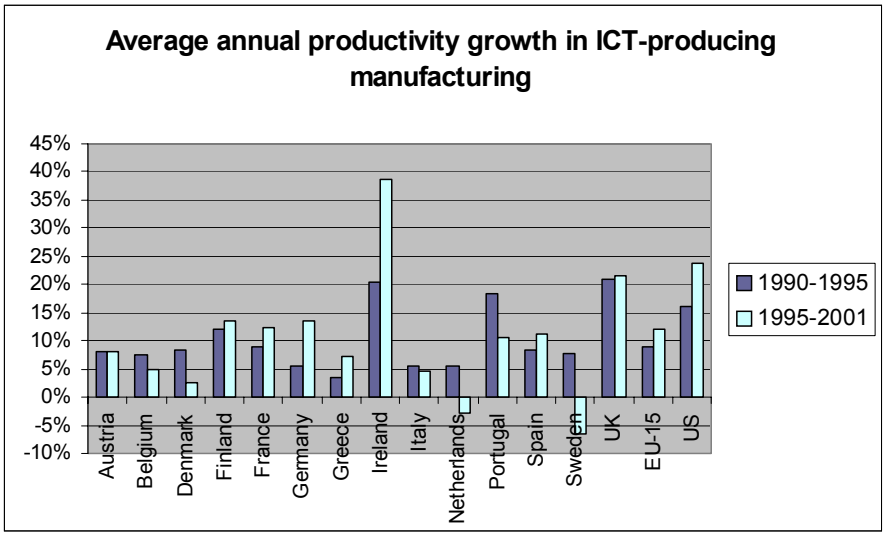
Despite the differences in the development of some market service industries, the labour productivity growth values seem to follow similar trends across industries. Table 5.5 shows the correlations between EU-15 countries and US values. The correlations are quite high; they range from 0.72 between Portugal and the US to 0.93 between the EU-15 and the US. However, as O'Mahony et al (2003) show, these correlations are strongly affected by high growth rates in ICT manufacturing. When the ICT manufacturing industries are excluded, the correlations drop and are even negative in some cases. These correlation values can be seen in the second column of Table 5.5. The industry factor's share as a source of correlation would thus drop also in the variance analysis (see section 3.2) if the ICT manufacturing industries were excluded.

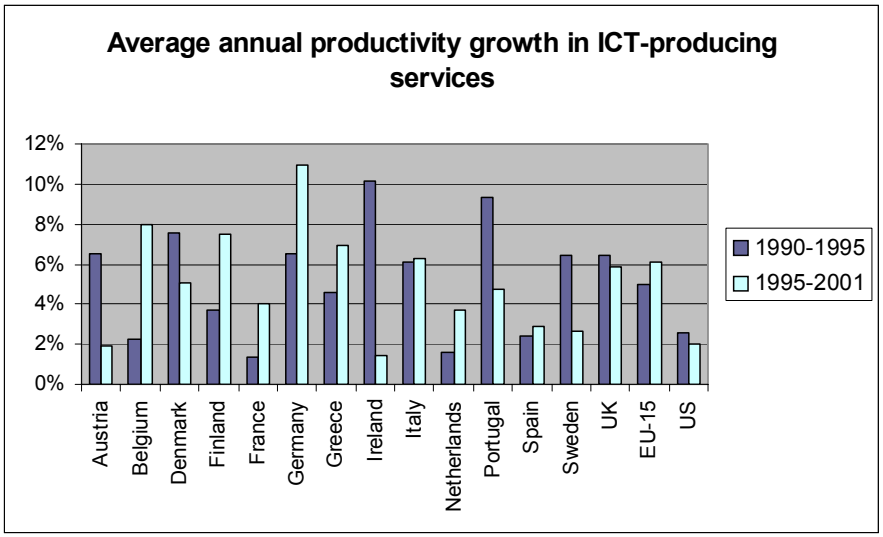
Table 5.5 **Correlations between EU-15 and US labour productivity growth values 1995–2001**

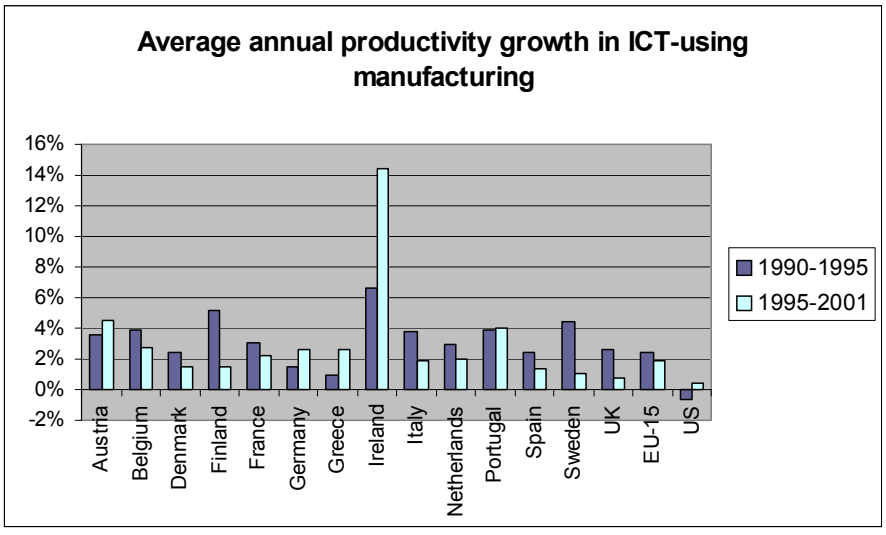
	All industries	Excluding ICT manufacturing
EU-15	0.93	0.24
Austria	0.86	0.05
Belgium	0.86	0.13
Denmark	0.83	0.05
Finland	0.89	0.14
France	0.85	0.00
Germany	0.92	0.36
Greece	0.86	0.01
Ireland	0.79	-0.12
Italy	0.87	0.04
Netherlands	0.90	0.18
Portugal	0.72	0.03
Spain	0.92	0.27
Sweden	0.85	0.06
UK	0.76	-0.10

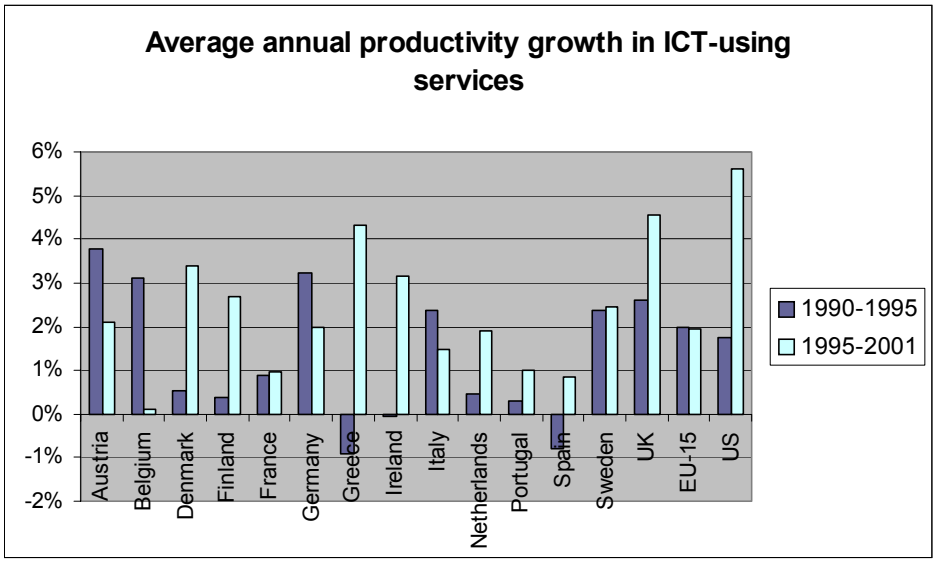
The correlations seem to be even surprisingly low when the ICT manufacturing is excluded. Let's move on to see what kinds of differences exist when we aggregate the labour productivity growth rates according to this ICT taxonomy (see Figures 5.3a–g). It is notable that Ireland is developing very strongly across all sectors but it is especially overwhelming in all manufacturing groups. The only groups where the US is growing faster than the EU-15 or Finland between 1995 and 2001 are ICT-producing manufacturing and ICT-using services. In the other groups the development in the US is even surprisingly weak. In ICT-producing manufacturing the growth in the period 1995–2001 was on average 23.7% in the US, 12.1% in the EU-15 and 13.6% in Finland. In ICT-using services the growth rate was 5.6% in the US, 2.0% in the EU-15 and 2.7% in Finland. From Table 5.3 we remember that the share of ICT-using services is remarkably larger in the USA (27%) than in the EU (21.3%) or particularly in Finland (14.8%) and thus these industries seem to contribute quite remarkably to the aggregate growth in the US. The EU and Finland are doing relatively well in both ICT-using and non-ICT-using manufacturing industries compared to the US. Surprisingly the growth rates in the EU-15 and Finland are higher also in ICT-producing services and in non-ICT-using services and in other sectors. Growth is, however, very slow in non-ICT-using services in all three areas.

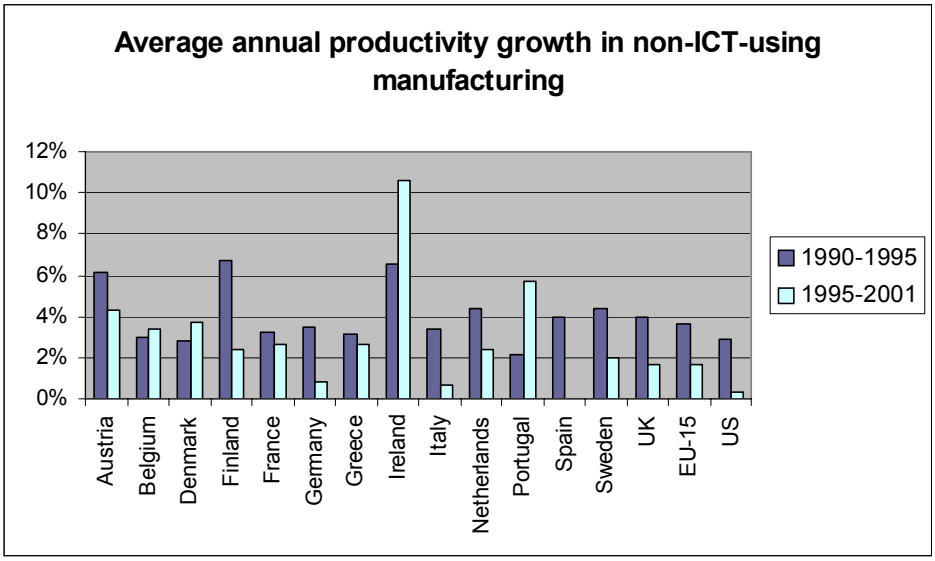
Figure 5.3a–g **Average productivity growth rates in industry groups categorised according to the industry taxonomies**

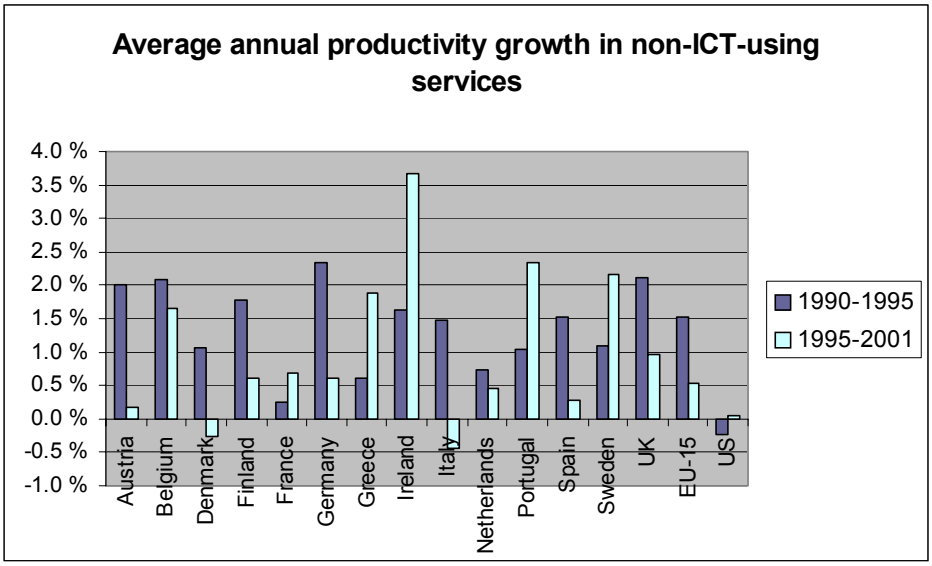


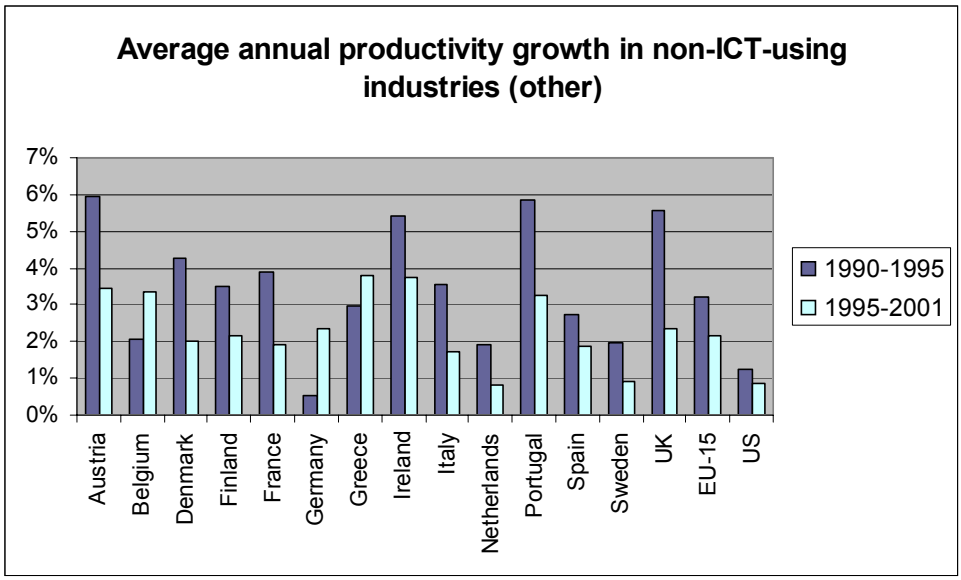





Average annual productivity growth in ICT-using services
6%
5%
4%
3%
2%
1%
0%
-1%
-2%
Austria
Belgium
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Netherlands
Portugal
Spain
Sweden
UK
EU-15
US
1990-1995
1995-2001


Average annual productivity growth in non-ICT-using manufacturing
12%
10%
8%
6%
4%
2%
0%
Austria
Belgium
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Netherlands
Portugal
Spain
Sweden
UK
EU-15
US
1990-1995
1995-2001

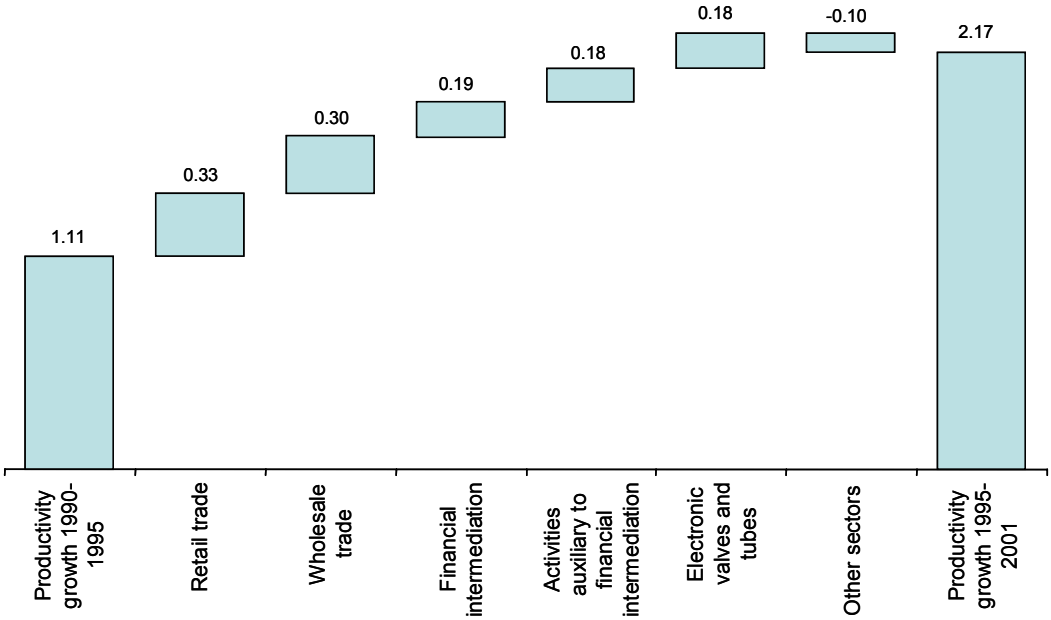

Average annual productivity growth in non-ICT-using services
4.0 %
3.5 %
3.0 %
2.5 %
2.0 %
1.5 %
1.0 %
0.5 %
0.0 %
-0.5 %
-1.0 %
Austria
Belgium
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Netherlands
Portugal
Spain
Sweden
UK
EU-15
US
1990-1995
1995-2001



5.2.2 Contributors to productivity growth acceleration and deceleration

The different productivity growth rates and the factors contributing to them are not the only thing that interests us when we compare the development in the USA and in the EU countries. As we saw in section 3.1, productivity growth accelerated in the US from the first half of the 1990s to the second half but decelerated in most of the western European countries (acceleration has taken place only in Ireland, Portugal and Greece). To be able to understand the factors that have been important in creating this difference, we have to examine the contributors to productivity growth acceleration. The largest contributors to productivity growth are not necessarily the largest contributors to acceleration. For example, in the US real estate activities were the fourth largest contributor to productivity growth in the period 1995–2001. However, the real estate sector did not contribute to the productivity growth acceleration because its average annual growth rate declined from 1.65% to 0.93% from the period 1990–1995 to the period 1995–2001. The largest contributors to the US growth acceleration can be seen in the following figure.

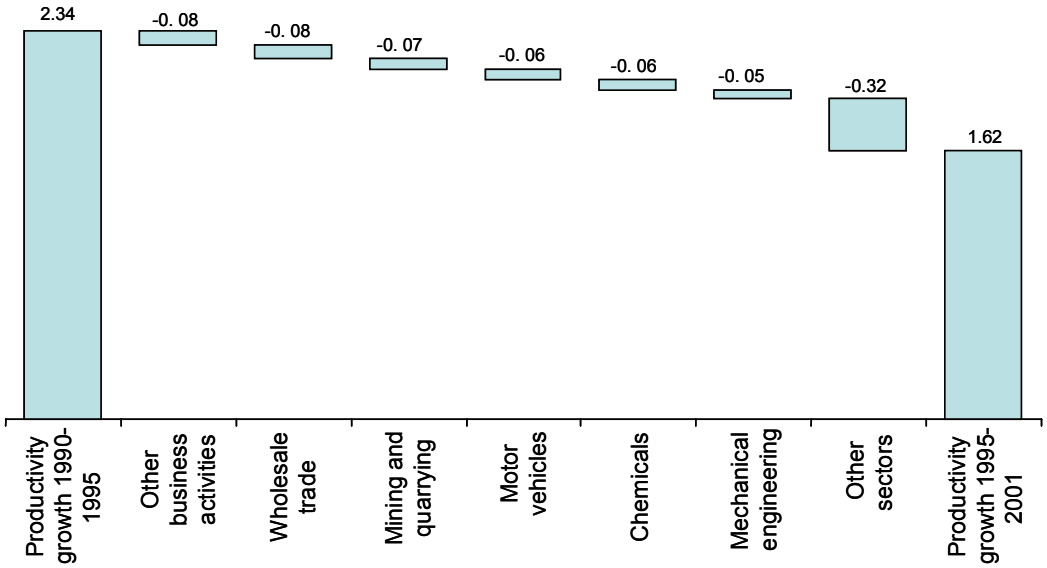
Figure 5.4 **Retail and wholesale trade contributed most to the productivity growth acceleration in the US**



This figure emphasizes the significance of market services. Especially the retail and wholesale trade industries are important. Their growth rates have risen from 1.98 to 6.86 per cent (retail trade) and from 2.91 to 7.83 per cent (wholesale trade). Because these sectors are very large in the US, they contribute to the acceleration significantly. It is interesting that the positive contribution of the top five industries is so high. The class 'other sectors' includes all other 49 industries, of which 26 contributed positively to the productivity growth acceleration and 23 contributed negatively.

While the average annual productivity growth accelerated in the US, the development was in the opposite direction in the EU-15 and Finland. The productivity growth rate declined from 2.34 to 1.62 per cent in the EU-15 and from 3.29 to 2.17 per cent in Finland. Therefore it is interesting to explore whether there are some large contributors to the deceleration like those contributing to the acceleration in the US. These contributors can be seen in Figures 5.5 and 5.6.

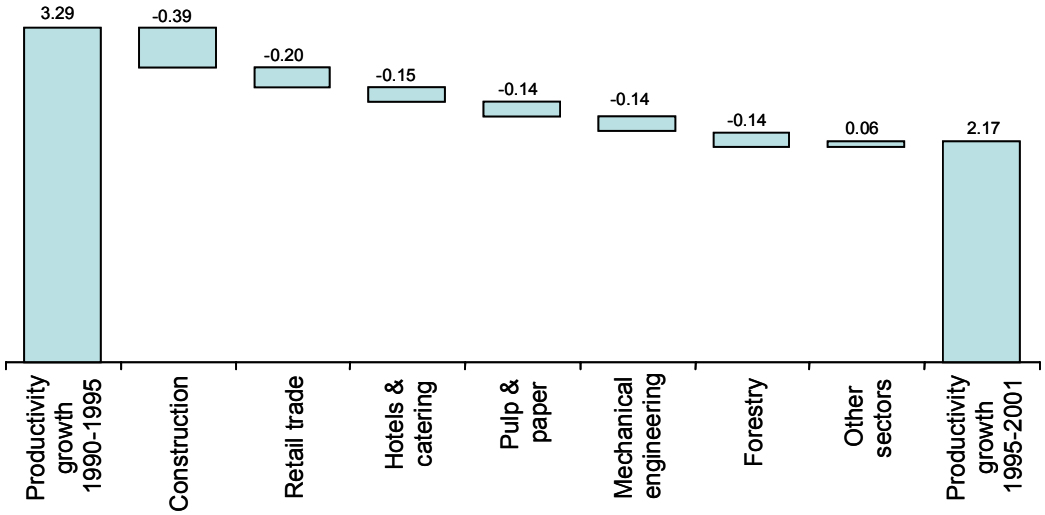
Figure 5.5 **The largest contributors to productivity growth deceleration in the EU-15 include both business services and manufacturing industries**



It is evident that the contributors to the deceleration in the EU have a smaller impact than the contributors to the acceleration in the US. The market services behave again differently in the EU-15 than in the US. While the wholesale trade was the second-largest source of acceleration in the US, it was the second-largest source of deceleration in the EU-15. The other sectors include 49 industries in which productivity growth decelerated in 39 industries and accelerated in 10 industries. The deceleration was thus a very widespread phenomenon and it occurred in most of the industries.

In Finland the contributions of individual industries to the aggregate deceleration are larger than in the EU-15. Especially deceleration in construction had a huge impact on aggregate negative development. Retail trade, which was the largest source of acceleration in the US, was the second-largest source of deceleration in Finland. The other sectors include 48 industries, of which 14 accelerated and 34 decelerated. Thus the deceleration was a quite widespread phenomenon also in Finland although some strongly accelerating industries caused the net effect of the other sectors to be positive.

Figure 5.6 **Construction was the most important contributor to productivity growth deceleration in Finland**



6 Decomposing productivity development

At least the fast-growing ICT-manufacturing industries follow similar growth trends across countries. Because they make a remarkable contribution to aggregate productivity in some of the countries examined, countries' average productivity growth rates are affected by their industry structure.

In order to get a rough idea of the extent to which the differences in industry structure affect the country comparison industry-level data was used to decompose productivity changes into three parts: industry-specific, country-specific and year-specific components.

Every productivity growth value consists of four parts: the country component, the industry component and the year component plus the error term

$$q_{cit} = q_c + q_i + q_t + \varepsilon \qquad (6.1)$$

As a result of the regression analysis, we got industry-specific coefficients q_i common to each country and year (for the results, see Appendix 4). The largest coefficients are naturally associated with strongly developing ICT industries like the manufacturing of office machinery and electronic valves and tubes. The lowest figures, on the other hand, belong to some service sectors, both public and market. By using these industry coefficients and industry weights (w_i) for every country, structural components for each country could then be calculated. The industry weights were calculated by dividing the current value added of each

industry by the total value added. The following formula represents a country's average productivity growth in a particular year

$$Q_{cit} = q_c + \sum w_i q_i + q_t \qquad (6.2)$$

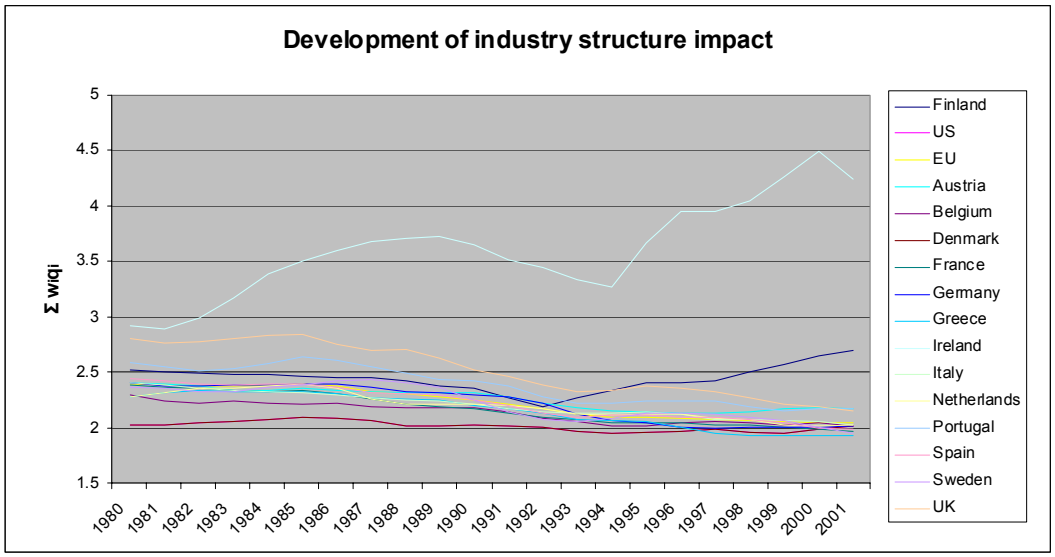
6.1 Industry components

The structural components for each country in each year were calculated from the formula

$$Q_i = \sum w_i q_i \qquad (6.3)$$

Before the calculation the coefficients were scaled: the average of the country components was scaled to zero and the same was done for the year components. After this the industry components were re-estimated. The following figure shows the development of the structural components.

Figure 6.1 **The industry structure impact on productivity in Ireland differs dramatically from the other countries**



Because the industry coefficients qi are the same for every country, Figure 6.1 illustrates how the structure of the economy in each country has developed when it comes to higher and lower productivity growth industries. Ireland is high above the other countries because the fast-growing ICT industries are very strong there.

Finland is in second place because of the strong telecommunications sector and the USA is number three because of the strong semiconductor (electronic valves and tubes) and computer (office machinery) manufacturing. The differences between the other EU countries can be seen more easily in figure 6.2, from which Ireland is excluded. As can be seen, the general trend here is decreasing. One of the reasons for that is the growing weight of service sectors in which productivity has on average grown slowly.

Because we have used data from the years 1979–2001 to estimate the industry components, the industry coefficients do not reflect the possible jumps in the industry productivity development. This is slightly problematic because we saw in section 3.2 that the industry-year factor was relatively important, which means that there are remarkable differences in industry development between years. It is, for example, possible that development in some sectors has accelerated permanently but if this has happened in very recent years, the large number of smaller earlier values hides this development.

Figure 6.2 **The industry structure impact component is generally downward sloping**

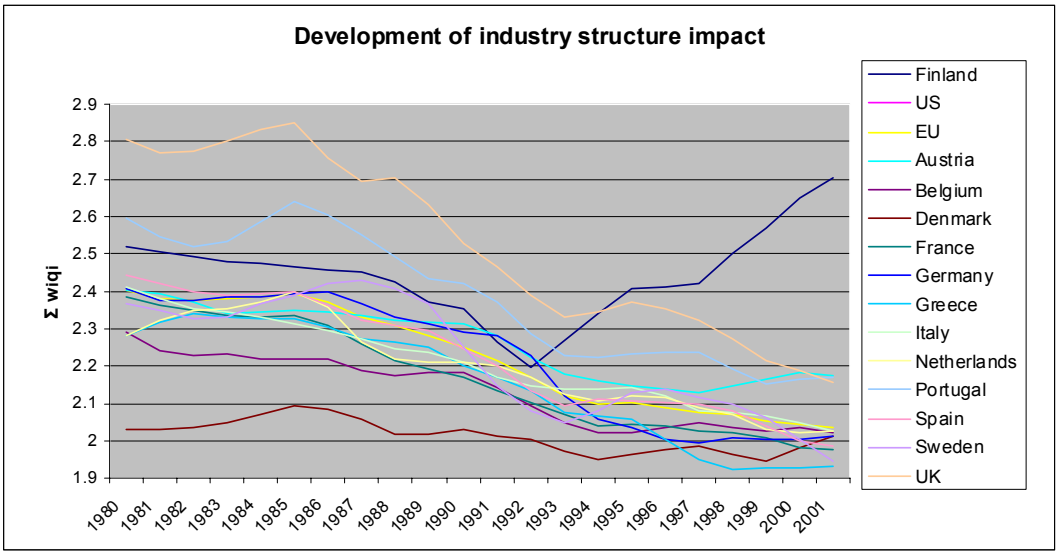


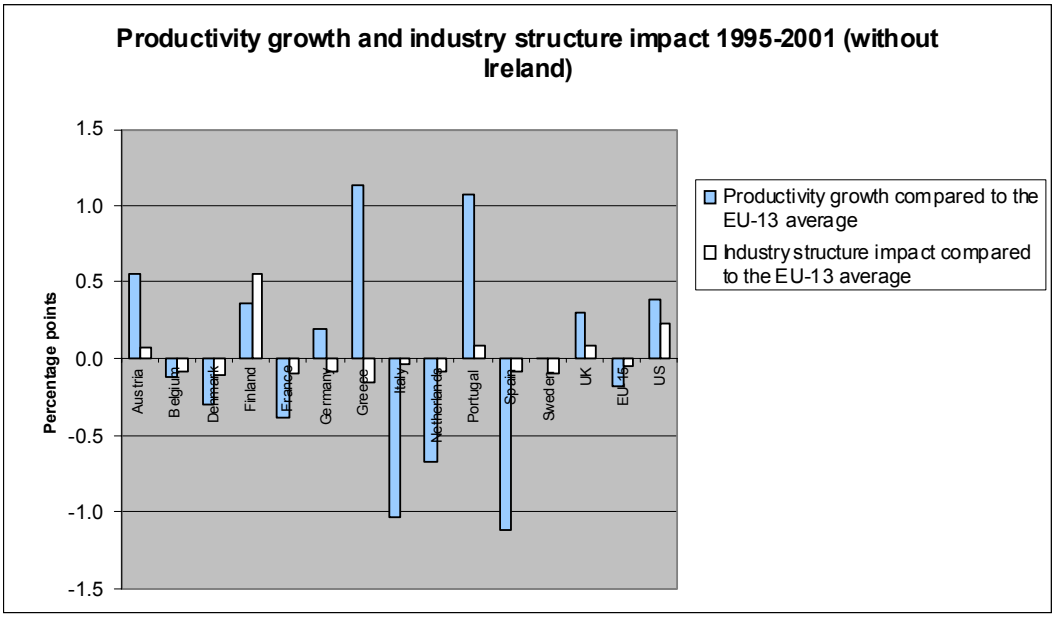
Figure 6.3 shows the relative importance of the industry-specific factors by country. Both productivity growth rates and industry structure impacts are compared in the figure to the EU-13[3] (unweighted) average. As the figure shows, compared to the average rates, the industry structure's effect on productivity growth is positive in Austria, Finland, Portugal, the UK and the US. If the

[3] EU-15 excluding Ireland and Luxembourg. In Ireland the exceptionally strong ICT sector has contributed remarkably to its productivity growth, which is incomparable to the other countries.

industry structure were in these countries like the average structure in the EU-13, the productivity growth rate would be lower. The industry structure impact is the largest in Finland, where the productivity growth rate would in fact be negative, if the industry structure impact were absent. As can be seen, cutting off the structural effect would reduce the difference in annual average productivity growth between the EU and the US from 0.57 to 0.27 percentage points for the period 1995–2001.

According to the 5th structural issues report of the ECB (Sectoral Specification in the EU: a Macro-Economic Perspective), changes in aggregate labour productivity are mostly explained by developments within sectors. Only a minor part of the aggregate productivity change is attributable to the reallocation of production. Even though the change in the industry structure explains only a minor part of the productivity change, the industrial structure itself affects the average growth in a country. To the extent that the aggregate productivity growth originates from industry-specific factors, there is clearly a danger of misinterpretation: the average productivity growth should not be taken to indicate the overall efficiency of production or the comparative advantage of a country.

Figure 6.3 **Productivity growth and industry structure impact**



6.2 Country components

The country coefficients presented in Appendix 4 are based on the years 1979–2001. As in the case of industry coefficients, these single coefficients do not show if the productivity has grown regularly or if there have been some jumps or falls

in the average development. To be better able to estimate this, the estimation was redone separately for three periods: 1979–1990, 1990–1995 and 1995–2001. The results can be seen in Table 6.1. The table presents the coefficients when their average is scaled to zero. (For all coefficients, see Appendix 5.)

As can be seen, the coefficient of Finland is clearly above the average for 1979–1990 and 1990–1995 but in the period 1995–2001 is below the average value. This corresponds to the findings of Figure 6.3: because Finland's industry structure would indicate higher productivity growth than the average level between 1995 and 2001, the country coefficient indeed has to be rather low. Austria, Belgium and Ireland have in all periods coefficients that are above the average, whereas the US, the EU-15, France and Sweden have in all periods rather low coefficients.

Table 6.1 **The country coefficients vary remarkably between periods**

	1979–1990	1990–1995	1995–2001
US	-0.59	-2.19	-0.35
EU-15	-0.60	-0.41	-0.80
AUSTRIA	0.10	2.63	0.27
BELGIUM	1.49	0.19	0.82
DENMARK	-0.74	-0.16	0.24
FINLAND	1.31	0.73	-1.05
FRANCE	-0.47	-0.93	-0.31
GERMANY	-0.75	-0.99	1.18
GREECE	-2.18	-1.57	1.94
IRELAND	1.79	1.67	2.31
ITALY	-0.90	0.37	-2.36
NETHERLANDS	0.24	-0.11	-0.66
PORTUGAL	0.52	-0.02	2.40
SPAIN	0.84	-0.78	-2.32
SWEDEN	-0.29	-0.24	-1.29
UK	0.23	1.81	-0.01

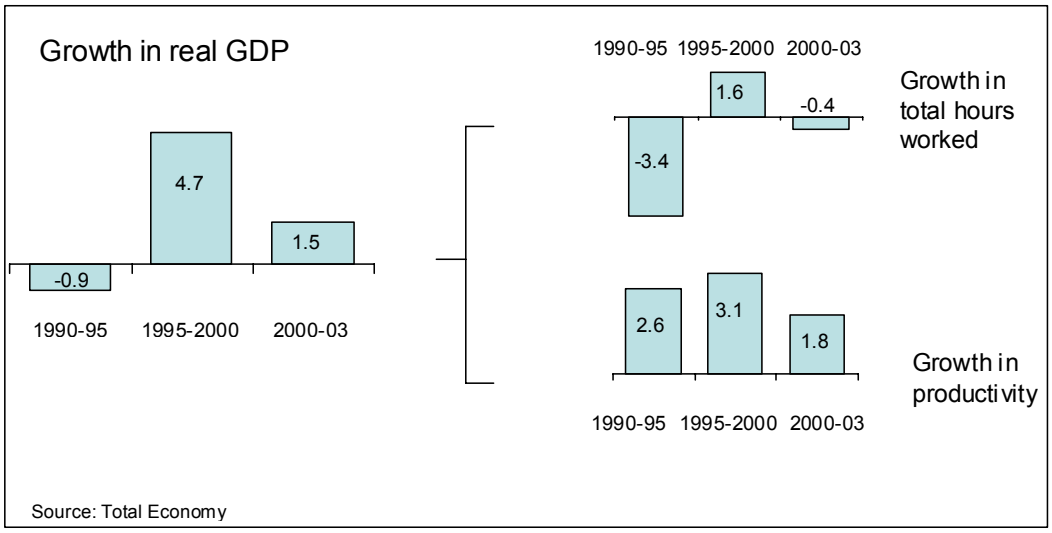
7 The impact of industry structure on economic growth and welfare

Productivity growth can profit the labour force because it enables wage increases. It can also benefit the owners of capital either domestically or overseas. When the productivity growth leads to lower export prices it profits consumers abroad. In this section we analyse the impact of industry structure and productivity growth on GDP growth and its real winners. First we study the GDP and changes in it. Secondly we move on to study the development of labour costs and export prices and thirdly we see how the industry structure affects the labour compensation.

7.1 GDP growth and level

GDP growth can be divided into two parts: into the growth of productivity and into the growth of hours worked. Figure 7.1 illustrates this decomposition for Finland.

Figure 7.1 **GDP growth in Finland decomposed into the productivity growth and into the growth of hours worked**



The GDP growth and the productivity growth are thus closely linked. However, the productivity can be increased in two ways and they affect the GDP in opposite ways. When the value added increases, GDP by definition grows. The productivity grows also when the employment per output produced decreases. If this leads to a higher unemployment level, the productivity growth can be

connected to the slower growth of per capita GDP. In Finland the period between the years 1990 and 1995 illustrates the difference: the GDP decreased on average 0.9% per year although the labour productivity grew at an annual rate of 2.6 %. The reason behind the favourable production growth rate was the very unfavourable development of employment: the total working hours went down 3.4 per cent annually, as can be seen in Figure 7.1. (See also Appendix 6 for a similar decomposition for other countries.)

The relative GDP levels (as % of the US level) can be seen in the table below. The per capita ratios are on the left side and the per hour ratios on the right side. The first ones are naturally much smaller due to the lower employment per population and hours worked per person ratios in Europe. The difference between the two values is largest in Belgium, France and Germany, where the GDP per hour levels for 2003 are clearly above the US level but the GDP per capita levels are not even ¾ of the US level.

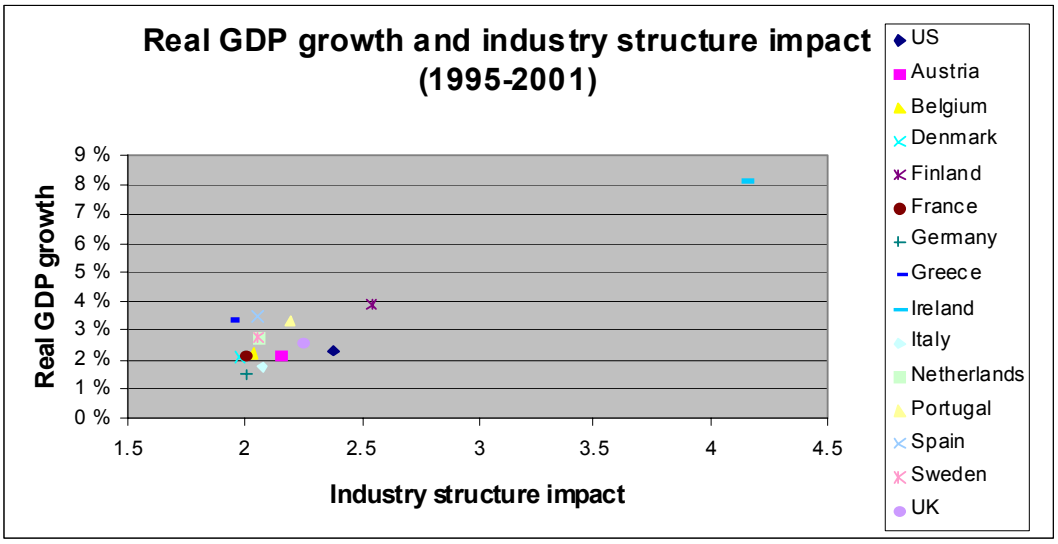
Table 7.1 **GDP per capita and hours worked as % of the US level**

	GDP per capita as % of US level					GDP per hour worked as % of US level				
	1980	1990	1995	2000	2003	1980	1990	1995	2000	2003
Austria	80.7	79.4	79.9	78.3	77.4	90.4	92.3	95.7	102.2	98.9
Belgium	80.3	76.4	77.0	75.7	74.7	95.7	104.0	111.0	115.9	109.0
Denmark	86.4	83.9	86.0	83.6	83.7	90.6	94.7	101.4	100.0	100.2
Finland	72.8	75.9	67.1	72.4	73.1	68.3	78.3	84.4	89.6	89.5
France	80.7	79.4	79.9	78.3	71.4	90.4	92.3	95.7	102.2	104.9
Germany	91.4	79.7	79.4	74.8	73.2	97.9	91.8	103.5	104.9	103.9
Greece	52.4	46.7	45.6	46.4	50.4	60.0	57.7	56.5	59.1	62.2
Ireland	49.5	54.8	63.4	83.6	90.7	58.2	75.2	85.1	102.6	107.6
Italy	77.5	77.0	76.9	72.9	72.4	94.9	99.8	106.3	101.8	95.5
Netherlands	83.4	78.4	79.6	80.7	77.9	108.9	114.3	116.3	109.3	105.2
Portugal	45.0	48.5	49.8	51.9	50.8	46.3	47.5	53.9	55.5	52.8
Spain	52.7	55.3	55.9	58.1	60.2	66.9	80.1	85.2	76.5	71.8
Sweden	81.9	77.7	74.0	74.9	76.0	85.6	82.3	86.6	88.2	88.0
UK	70.1	71.3	72.1	71.7	73.1	72.7	78.0	85.7	86.5	85.3

Source: Total Economy

The scatter diagram illustrating the values of individual countries' GDP growth can be seen below. The relationship between the industry structure impact (see section 6.1) and the real GDP growth is positive but not statistically significant.

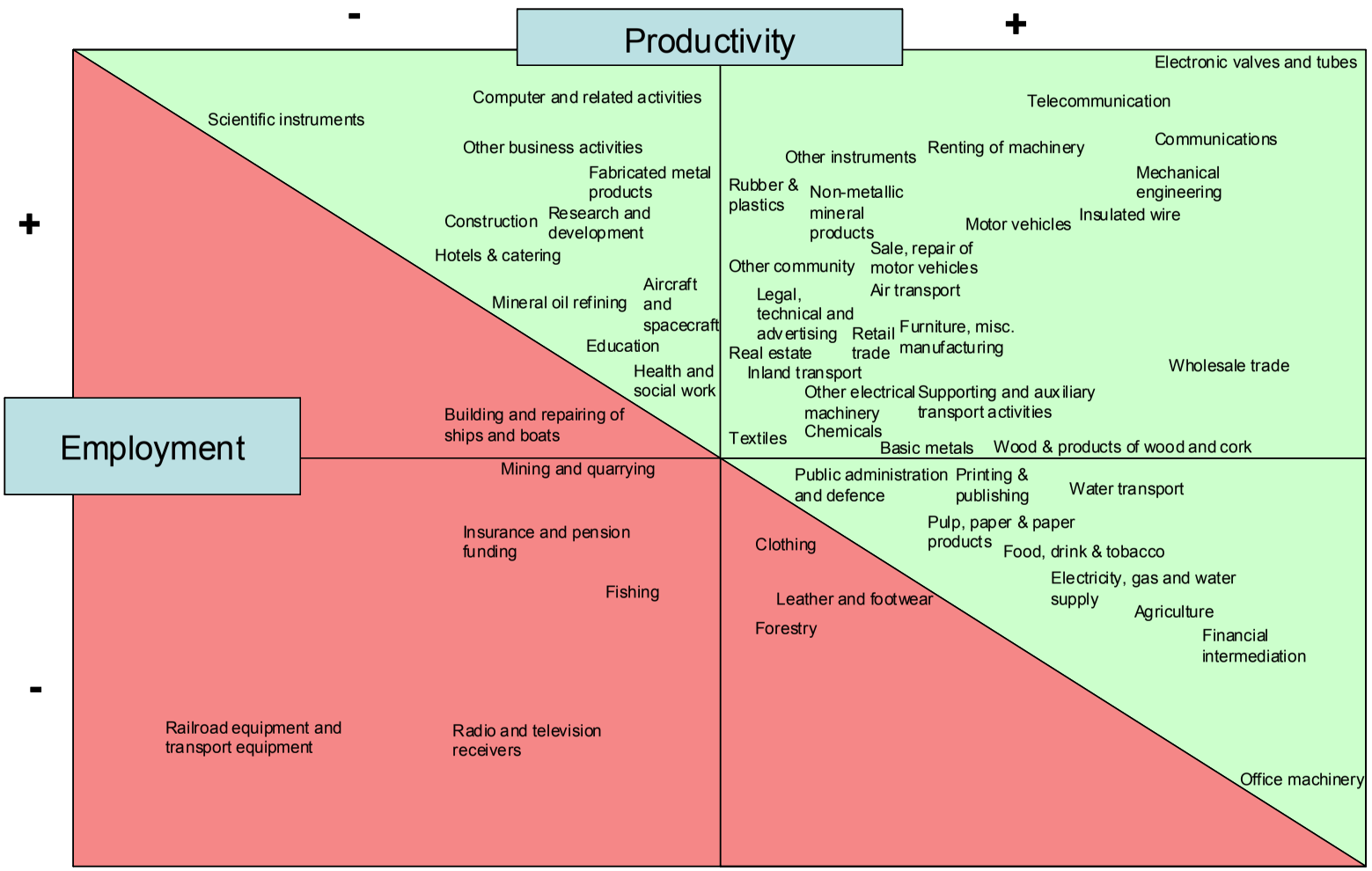
Figure 7.2 **Real GDP growth and its relation to the industry structure impact**



As a country's GDP growth can be divided into the growth of hours worked and the growth of the GDP per hours worked, it could be interesting to study the separate industries to understand if a particular industry showing a positive productivity growth rate creates more value added or if it just employs less labour to produce the same value added as earlier. This decomposition for Finland can be seen in Appendix 7.

As can be seen in Appendix 7, there are some industries in which the decline of productivity is connected to fast employment growth, for example in computer and related activities during 1995–2001, where the value added grew by 14.56% but employment increased by 15.66% and as a result productivity declined by 1.11%. There are also areas in which productivity growth is related to declining employment in a way that results in diminishing value added, like clothing. The following figure (7.3) illustrates the groups and the position of every industry in them for the period 1995–2001. Both productivity and employment grow in the upper right corner; both decline in the lower left corner. The colours represent the sum of both these effects: red indicates that the value added growth is negative; green indicates that it is positive. The order of industries approximates the reality but their distances do not correspond with the real ones.

Figure 7.3 **Combined employment and productivity effects in Finland 1995–2001**



7.2 Profitability of firms

The profitability development of a firm depends to a quite large extent on the growth rates of its productivity and labour costs. Especially in the manufacturing industries, the development of export prices also has to be taken into consideration. In this section we assess these two factors and their relationship with the industry structure.

7.2.1 Labour costs

The relative labour costs are compared in the following table. After the mid-1990s the competitiveness of the euro countries improved due to the weak euro, which can easily be seen in the table.

Table 7.2 **Compensation levels compared to the US level**

	Labour compensation per hour as % of US level			
	1980	1990	1995	2001
Austria	71.0	86.7	114.1	67.2
Belgium	117.7	120.4	140.9	87.8
Denmark	96.3	111.4	121.1	86.2
Finland	74.8	118.7	112.1	73.7
France	112.0	115.7	124.5	79.6
Germany	98.7	108.8	137.0	85.2
Greece	36.6	34.6	39.2	27.8
Ireland	56.5	70.8	72.2	65.2
Italy	67.1	91.9	77.0	55.4
Netherlands	98.7	99.6	120.6	79.4
Spain	64.1	77.5	70.0	46.5
Sweden	130.6	128.9	106.5	72.5
UK	74.2	88.4	89.3	87.8
EU-14	83.8	96.1	102.9	71.0

Source: ICOP

As Table 7.2 shows, there are huge variations between the EU countries. There are also large industry-level differences behind these aggregate levels. The relative values are available for the manufacturing industries. The values of Finland and the EU-14 compared to the US level can be seen in Table 7.3. Here again the impact of the weak euro can be seen clearly: the competitiveness of Finnish and European industries clearly improves between 1995 and 2001.

Table 7.3 **Labour compensation in Finland and the EU-14 relative to the US level**

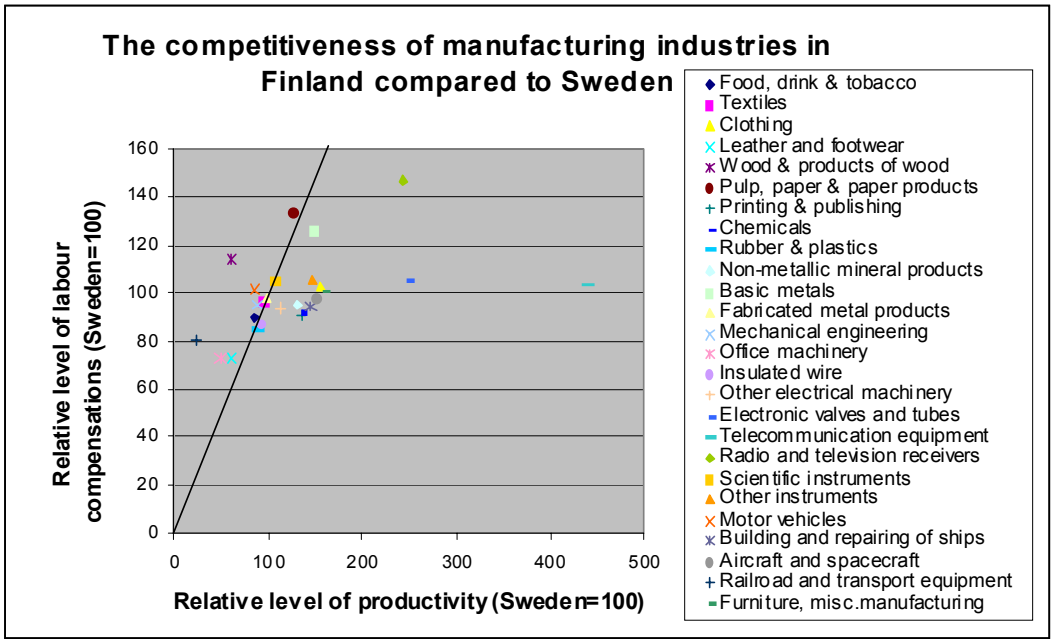
	Labour compensation per hour as % of US level							
	Finland				EU-14			
	1980	1990	1995	2001	1980	1990	1995	2001
Food, drink & tobacco	77.6	130.3	124.1	83.9	80.6	96.7	102.0	73.0
Textiles	91.6	136.3	135.0	81.7	91.4	105.1	108.2	73.9
Clothing	99.5	156.3	148.8	91.7	90.7	101.0	105.6	70.3
Leather and footwear	89.3	126.7	118.0	68.3	83.0	91.6	88.1	56.1
Wood & products of wood and cork	84.2	141.2	136.6	93.1	78.6	96.4	105.1	72.8
Pulp, paper & paper products	89.4	139.6	137.2	97.9	90.3	104.1	109.6	78.7
Printing & publishing	91.8	144.2	126.9	80.8	100.4	109.9	118.2	81.9
Chemicals	67.6	97.3	85.3	55.3	94.7	98.1	105.7	69.2
Rubber & plastics	80.9	130.9	126.0	85.9	106.6	118.1	120.0	85.6
Non-metallic mineral products	74.4	124.7	116.6	78.6	78.6	94.2	105.0	74.8
Basic metals	66.3	117.8	113.6	84.9	75.4	99.5	111.0	83.5
Fabricated metal products	71.3	117.8	109.8	76.6	74.7	91.0	101.8	74.7
Mechanical engineering	73.4	117.7	112.8	70.9	87.7	101.0	112.2	73.2
Office machinery	70.5	104.1	83.0	47.2	118.8	124.4	129.1	72.8
Insulated wire	58.3	104.6	95.0	62.1	67.8	89.2	93.0	60.4
Other electrical machinery and apparatus nec	71.9	115.3	107.8	70.1	96.6	115.7	122.2	79.4
Electronic valves and tubes	65.6	80.0	66.8	41.3	85.0	77.9	81.3	51.6
Telecommunication equipment	105.0	130.2	126.1	75.5	141.6	128.3	143.2	84.4
Radio and television receivers	55.4	77.3	74.3	53.2	87.3	89.3	86.4	52.3
Scientific instruments	74.1	98.4	90.4	53.9	98.9	93.3	101.2	61.6
Other instruments	63.0	99.3	92.4	56.9	62.3	77.4	72.3	62.8
Motor vehicles	49.5	81.8	71.3	54.4	69.1	89.2	88.7	73.8
Building and repairing of ships and boats	82.0	131.5	126.7	65.1	73.4	107.2	115.8	70.8
Aircraft and spacecraft	63.1	104.4	106.9	58.9	80.2	90.9	100.1	78.1
Railroad equipment and transport equipment	81.9	132.1	127.4	82.4	65.4	86.9	100.6	89.9
Furniture, misc. manufacturing; recycling	88.4	129.6	121.7	76.8	95.8	97.9	105.2	71.6

Source: ICOP

The relative competitiveness of a country depends not only on the relative cost of labour cost also on the relative level of productivity. Figure 8.4 illustrates this kind of comparison between Finland and Sweden in the year 2001. The diagonal line illustrates the points where the relative percentage productivity level and the labour compensation level are the same. For example, if the productivity in some industry in Finland is 80% of the Swedish level, the labour compensation level is too only 80% of the Swedish level. On the left side of the diagonal the relative labour compensation level is higher than the productivity level. This means that the farther the industry is situated from the top-left corner, the better its competitiveness is when it comes to the unit labour cost. There are a couple of points that are worth noting. Telecommunications is the industry situated closest to the bottom-right corner, meaning that it is the most competitive industry when compared to the Swedish industries. Naturally the competitors of any industry

come from various countries and thus the comparison between Finland and Sweden does not tell how the Finnish products will manage in the world market. On the other hand, the pulp and paper industry, which managed well compared to the US level in terms of productivity, does not seem to have managed all that well when compared to the Swedish level.

Figure 8.4 **The competitiveness of Finnish industries compared to the Swedish industries varies**



When the relative compensation levels are divided by the relative productivity levels, we get the values of the relative unit labour costs (see Table 7.4). The unit labour costs are smaller values than the compensation levels when the productivity level in the country in question is higher than in the US. For example, the relative unit labour cost in Ireland decreased dramatically between 1995 and 2001 partly because of the increasing relative productivity level. In 2001 the cost was only about 35% of the US level. Because the wage compensation values are converted to a common currency, a country's competitive position depends not only on its productivity level and compensation level but also on the market exchange rate.

Table 7.4 **Relative unit labour cost compared to the US level**

	Relative unit labour cost as % of US level			
	1980	1990	1995	2001
Austria	112.5	118.3	146.2	84.1
Belgium	133.0	104.1	121.4	76.6
Denmark	82.5	111.4	124.6	95.0
Finland	101.3	131.9	109.5	72.9
France	108.0	109.6	118.5	78.0
Germany	98.3	114.6	148.4	102.8
Greece	78.8	103.2	128.2	99.0
Ireland	165.2	99.3	79.4	35.2
Italy	72.6	99.4	83.6	70.1
Netherlands	105.1	92.2	109.3	81.3
Spain	107.6	105.6	94.6	76.3
Sweden	138.1	136.3	108.4	88.2
UK	118.8	115.1	110.1	114.2
EU-14	99.1	109.2	116.9	88.1

Table 7.5 shows the relative unit labour costs at the industry level in Finland compared to the EU-14 level, which is a weighted average of the country values. For the year 2001 the unit labour costs are on a lower level in 16 industries and a higher level in 10 industries. As can be seen, the relative position of most of the Finnish industries has improved since 1990.

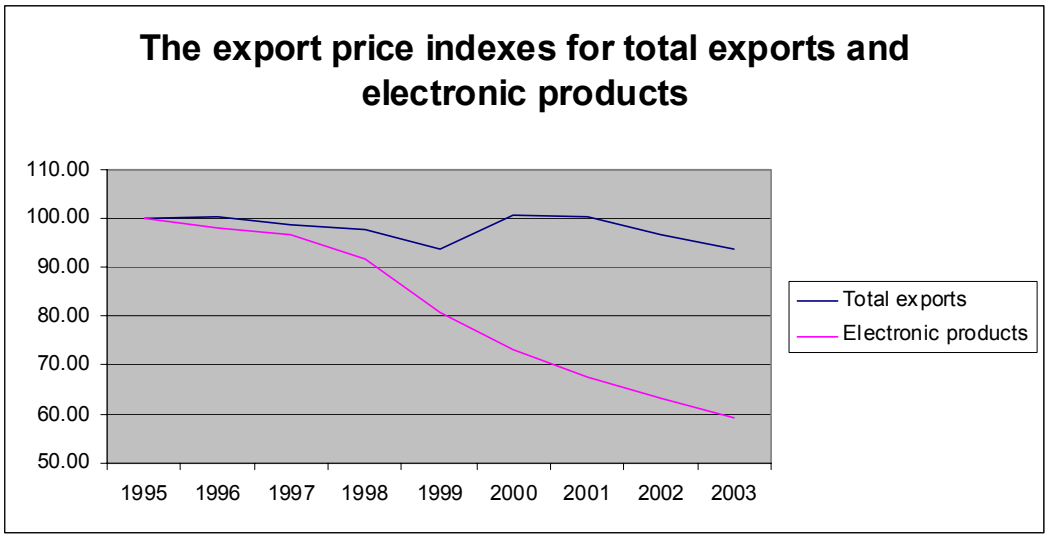
Table 7.5 **Unit labour costs in Finland relative to the EU-14 level**

	Relative unit labour cost as % of EU-14 average			
Industry	1980	1990	1995	2001
Food, drink & tobacco	136.6	169.6	127.5	104.4
Textiles	142.8	169.5	124.4	120.2
Clothing	136.4	172.9	182.8	204.8
Leather and footwear	191.4	231.9	219.8	194.5
Wood & products of wood and cork	115.1	124.1	96.2	83.1
Pulp, paper & paper products	82.8	95.5	72.1	72.0
Printing & publishing	104.1	132.4	98.4	87.3
Chemicals	60.4	93.5	84.8	83.5
Rubber & plastics	96.8	108.8	97.1	99.3
Non-metallic mineral products	109.5	150.1	118.5	113.0
Basic metals	93.2	109.4	87.8	73.9
Fabricated metal products	140.4	135.4	98.3	101.6
Mechanical engineering	115.7	123.5	98.4	96.2
Office machinery	229.3	85.7	133.1	141.1
Insulated wire	98.6	152.5	113.3	87.0
Other electrical machinery and apparatus	99.1	113.7	82.8	86.9
Electronic valves and tubes	165.1	165.4	145.3	117.1
Telecommunication equipment	111.1	92.3	67.6	46.2
Radio and television receivers	161.2	106.8	138.0	127.8
Scientific instruments	122.1	122.2	91.3	92.7
Other instruments	98.3	110.4	97.5	76.5
Motor vehicles	86.1	122.5	116.9	88.9
Building and repairing of ships and boats	73.2	101.6	62.3	63.1
Aircraft and spacecraft	130.4	145.3	91.7	65.7
Railroad equipment and transport equipment	128.3	87.0	150.0	269.6
Furniture, misc. manufacturing; recycling	105.3	119.2	93.4	87.2

7.2.2 Export prices

Export prices have been declining in recent years in Finland. This is mainly due to the falling prices in electronics manufacturing, which consists mostly of telecommunications equipment manufactured by Nokia. The following figure illustrates the situation. The quickly falling prices in electronic products pull the general price index down because their share of the total exports is approximately one fourth.

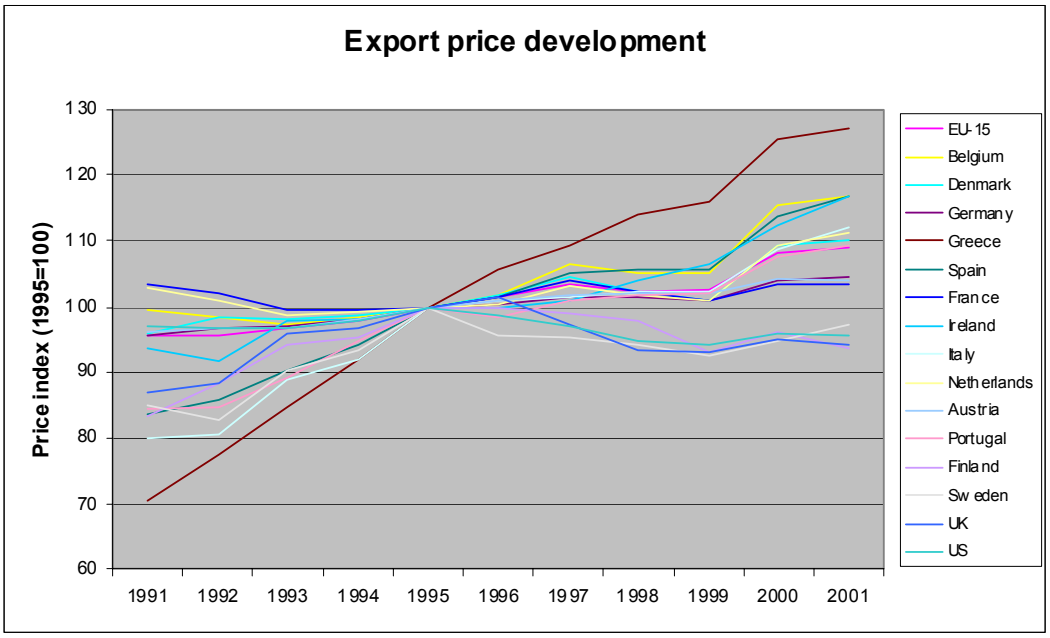
Figure 7.5 **The falling price of electronics pulls the export price index down in Finland**



Source: Statistics Finland

When the productivity growth leads to lower export prices, the potential for raising the labour compensation shrinks. But is this phenomenon unique in Finland or is there a similar relationship between productivity growth and export prices also in other countries? The price indexes are compared in Figure 7.6. The indexes are based on the national currencies. After 1995, the export prices were declining in four countries: in Finland, Sweden, the UK, and the US. Between the years 2000 and 2001 the prices in Sweden already rose while they still decreased slightly in the UK and the US and clearly in Finland.

Figure 7.6 **Export prices have decreased in the UK, the US and in Finland**



Source: Eurostat

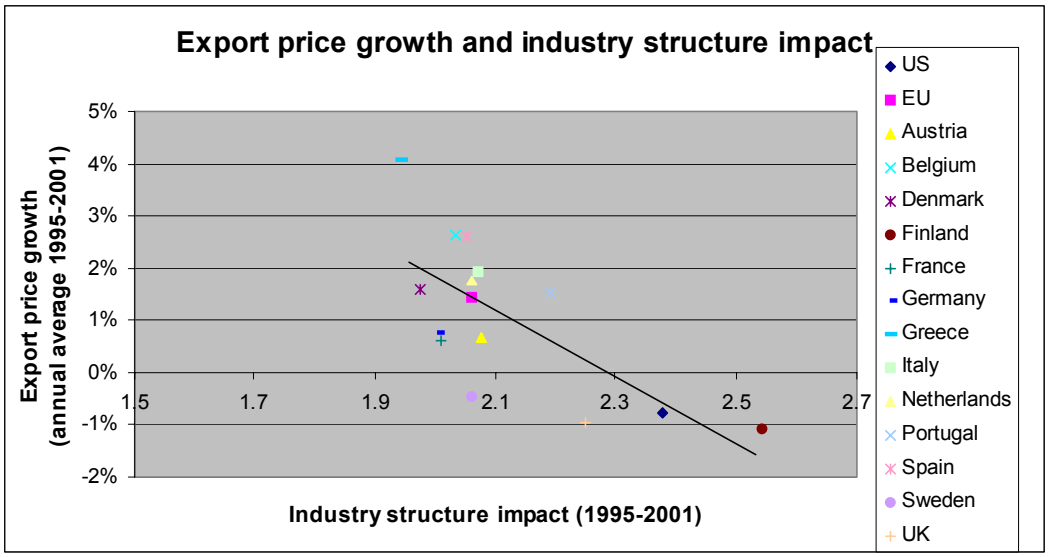
As the situation in Finland would seem to suggest, it is plausible that the industry structure has an influence on the export prices. If there is a negative connection between the export price growth and productivity growth at the industry level, the country's overall productivity growth can be tied up with declining export incomes.

Unfortunately, industry-specific export prices were not available when conducting this study. Consequently the relationship between industry structure and export prices had to be examined by comparing country-specific export price indexes and aggregated industry structure components.

Considering relative export prices, the possible relationship between the change in aggregate export prices and the industry component was investigated. Chart 7.7 indicates that there is a negative correlation between the industry structure component and export prices in manufacturing. The more the production is concentrated on fast-growing high-tech industries, the slower the growth is in export prices.[4]

[4] It should, however, be noted, that Ireland does not follow this logic.

Figure 7.7 **Export price growth rates correlate negatively with the impact of industry structure**



It seems that strongly increasing productivity can lead to diminishing export prices and thus its positive contribution to income generation and to the growth of the nominal GDP is smaller than one could prima facie assume.

It should, however, be noted that the price index comparisons include remarkable uncertainties due to the methodological problems as noted in section 2. Because there are various methods available in creating the price indexes, the indexes are not fully comparable. The problem is especially severe for the high-tech products, where there are many possible ways of calculating deflation.

We have now found out that export prices can indeed be affected by industry structure: when the share of industries with high productivity grows, the export prices seem to fall. Next we study the relationship between industry structure and labour compensation.

7.3 Labour income development

In section 7.2 we studied labour compensation from the viewpoint of capital income and company profitability. In this section we study labour compensation, its growth and relative level in real terms to understand the relationship between the real incomes and their development and the industry structure.

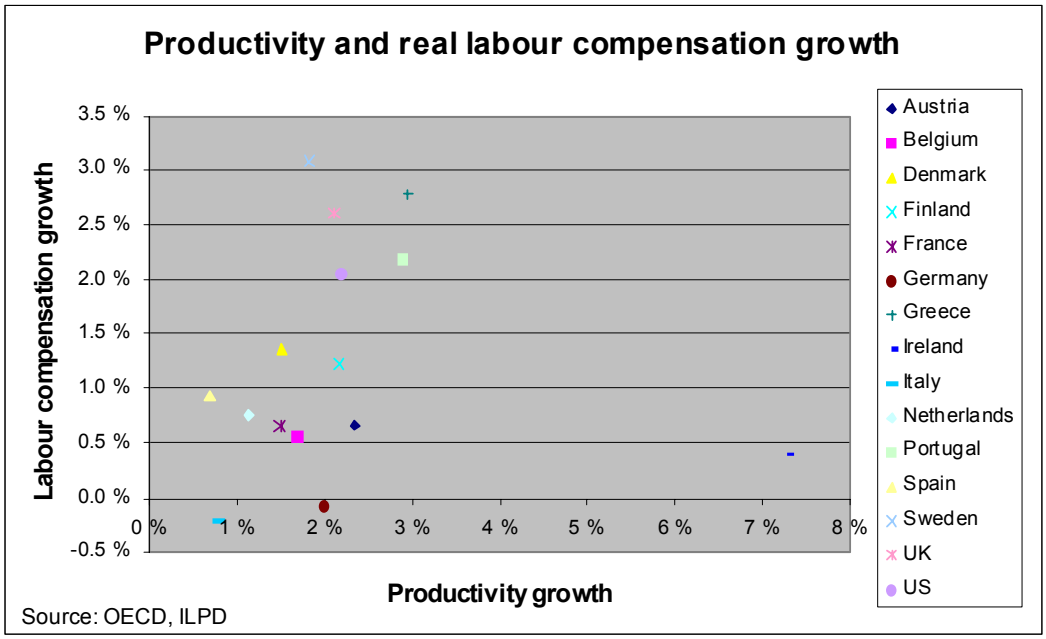
7.3.1 Growth of labour compensation

Productivity growth enables labour compensation to grow. Junka (2003) compares the rates of productivity growth and the real compensation growth and concludes that the income share of capital has increased at labour's expense. While the labour compensation' share of the gross value added in Finland was 64.2% in 1990, it was ten years later only 54.1%. This fact has been used to back up the requirement for wage increases.

But as Forsman and Hukkinen (2003) argue, companies' ability to pay higher wages is not uniform across industries. As we saw in section 5, telecommunication equipment manufacturing contributes remarkably to labour productivity growth in Finland, almost 25% in the period from 1995 to 2001. Thus the average productivity growth rate does not tell about other industries' ability to pay higher labour compensation. In fact, the average annual productivity growth rate without telecommunications would have been in 1995–2001 about 1.6% instead of 2.17%.

Figure 7.8 illustrates the relationship between average annual productivity growth and real compensation growth rates between 1995 and 2001. As can be seen, the labour compensation has grown more slowly than the productivity in almost all the countries for which data was compiled during the period studied. The real compensation growth rate has been higher in Spain, Sweden and the UK whereas in other countries the productivity growth rate has been higher. The relationship between the growth rates is ambiguous. It seems to be positive, but Ireland is a clear exception.

Figure 7.8 **Productivity growth and real labour compensation growth 1995–2001**

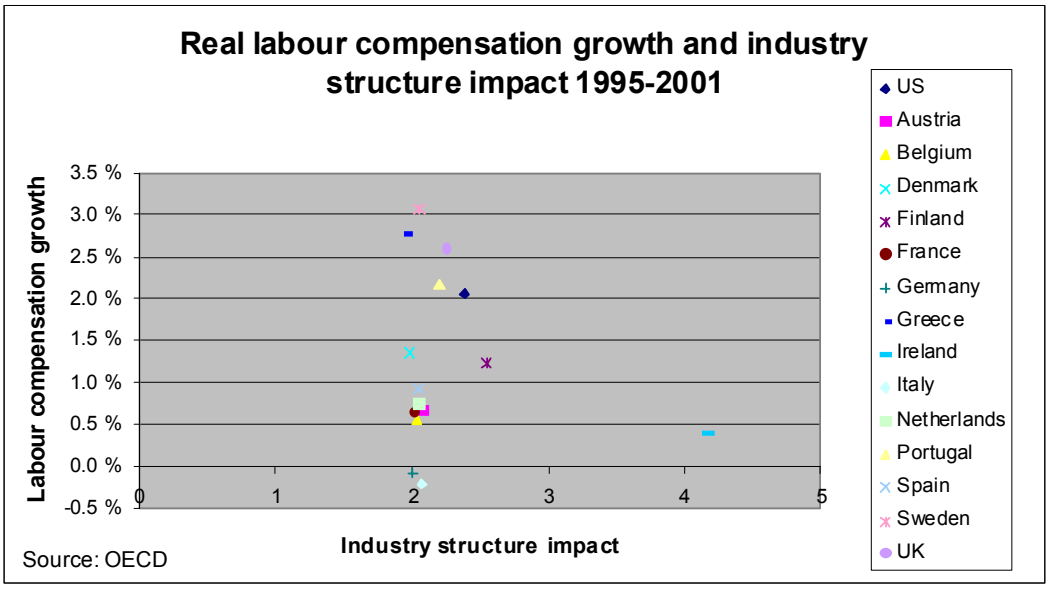


The differences between the countries cannot be explained easily. In some countries wages are determined in centralized negotiations and in the others at the workplace. The negotiation power of labour unions is affected by the unemployment rate, etc. It's clear that in those countries where the wage increases are decided in national negotiations, the wage growth rates are mainly not affected by the productivity growth rates of individual industries if they deviate largely from the average rate.

It is, however, reasonable to assume, that the productivity growth rates at the industry level have some kind of positive relationship with the compensation growth rates. The centralized decisions do not prevent firms in the high productivity industries from raising salaries more than agreed. It is therefore possible and even probable that the industry structure affects the compensation growth rate.

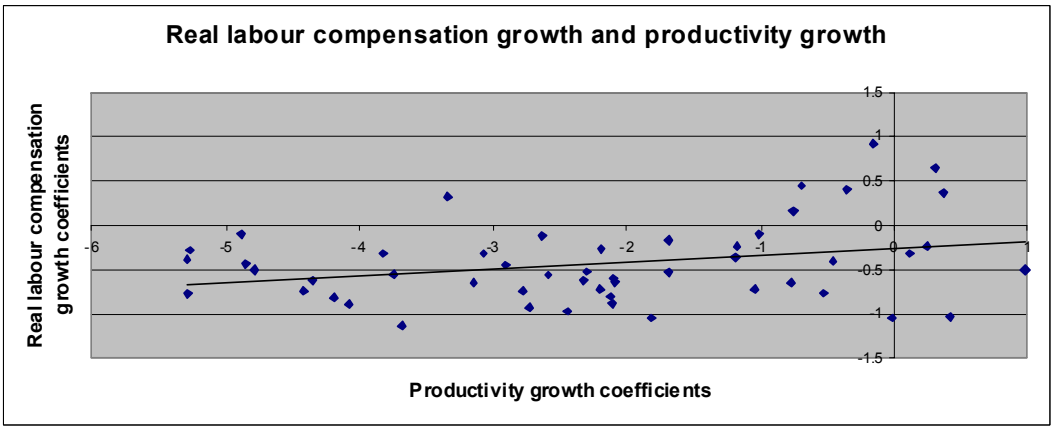
The question was studied first by plotting the growth rates of the real compensation against the industry structure impact. This figure should indicate if the different developments across the countries could be explained with their different industry structures when it comes to the productivity growth rates. As can be seen in Figure 7.9, the relationship between the industry structure impact and the real labour compensation rate is not at all unambiguous. It cannot even be said, whether the relationship is positive or negative.

Figure 7.9 **Real labour compensation growth and industry structure impact 1995–2001**



Still, there can be differences in the labour compensation growth rates between the industries. As a second stage, a regression analysis was conducted. In the regression the real labour compensation growth rates were explained with country-specific factors, year-specific factors, and industry-specific factors as in the case of productivity earlier (for coefficients and their significances see Appendix 8). The regression coefficients for each industry were then compared with the productivity growth coefficients in a scatter diagram (see Figure 7.10).

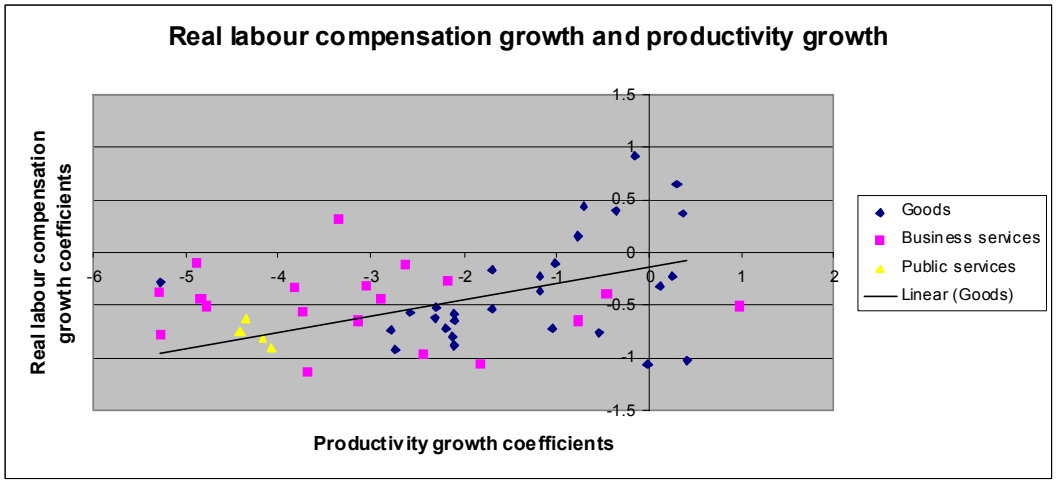
Figure 7.10 **Real compensation growth and productivity growth coefficients**



When the data points of the high productivity industries (telecommunications, office machinery, and electronic valves and tubes) are excluded, the relationship between real compensation growth and productivity growth is estimated to be 0.08, meaning that when the productivity in one industry is one percentage point higher than in another industry, the real compensation growth in that particular industry is about 0.08 percentage points higher. Thus the relation between the productivity growth and the real compensation growth is positive as expected but very weak indeed.

It is possible, that the relationship between the productivity growth and the compensation growth rate is affected by the variation across sectors. The productivity growth values tend to be underestimated in public services, as was noted in section 2.3. In addition, the compensation growth rates in the public sector services are lower than compensation in private manufacturing independent of the productivity growth values. The following figure illustrates the sectoral differences by distinguishing the service sectors with a different colour. It is easy to see that the service sector industries usually have lower productivity growth and compensation values. When the regression line is drawn ignoring the service sector industries, the relationship between the productivity growth and the real compensation growth is, however, stronger (the slope is about 0.15 instead of 0.08). This could indicate the fact that the compensation growth rates are following the productivity growth rates more closely in market than in public sector industries. (See Figure 7.11.)

Figure 7.11 **Real labour compensation growth and productivity growth coefficients divided by sector**

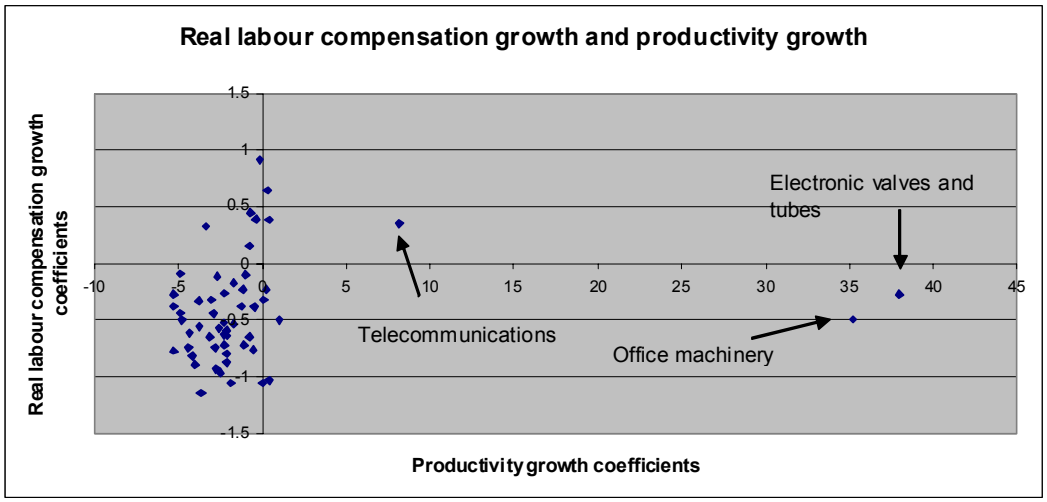


In Finland companies' ability to pay wages has not increased at the same rate as the aggregate profitability because Nokia is responsible for the major part of the productivity growth but employs only relatively few people. Can this kind of

development be seen also in other countries? It could be the case that when the productivity growth is concentrated in some very fast-growing industries, the growth of compensation slows down.

Indeed, the very high productivity industries behave in this respect interestingly. Their coefficients can be seen in Figure 7.12. It shows that the high productivity growth rates have not led to growth in labour compensation in those industries. When this is the case, the industry structure impact has an ambivalent impact on the labour compensation growth. As Figure 7.13 shows, the percentage share of the compensation growth of the GDP growth might be decreasing as the share of high-tech industries grows.

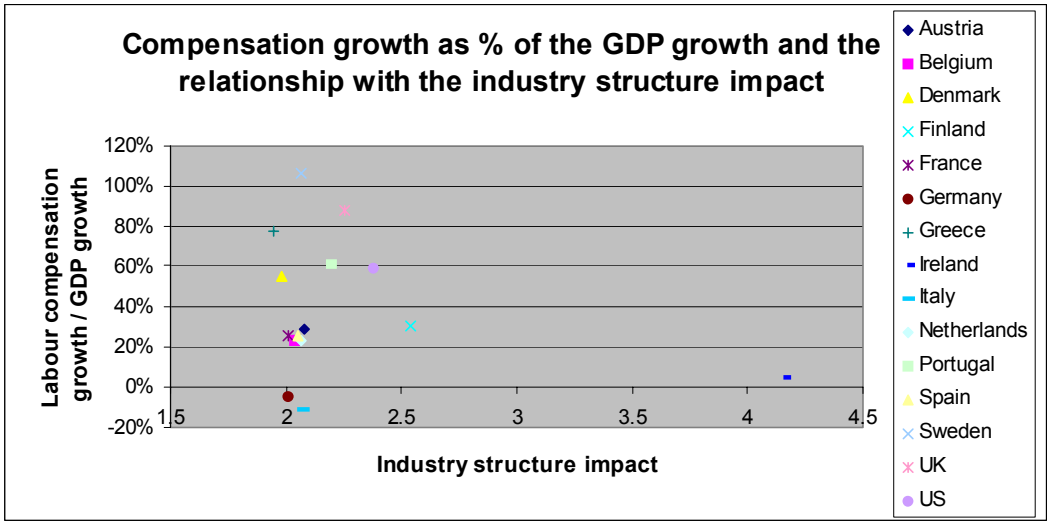
Figure 7.12 **Real labour compensation growth and productivity growth coefficients: high productivity growth industries included**



The low growth rates of labour compensation in office machines and electronic valves and tubes are explainable by looking to the source of their productivity growth. In these industries a large part of the productivity growth comes from the quality improvement that is connected to the quickly sinking prices. The figure concerning office machine manufacturing in Ireland that we saw in section 2 illustrates this fact very well. Even though the deflation method used leads to very high productivity growth rates between 1995 and 2001, the current value added rises only a bit. The improving quality of computers does not bring more money in and thus the salaries can grow only moderately. This, however, does not explain totally the very slow labour compensation growth rates in Ireland because the strong productivity growth there is a broad phenomenon, as Figures 5.3a–g showed. In the US, the productivity growth is, on the other hand, concentrated only in a relatively few industries. But as many of them are service sector

industries that employ lots of people, this development does not affect the labour compensation growth rates as much as the concentration in the high-tech industries would do.

Figure 7.13 **Labour compensation growth, as % of the GDP growth seems to decline when the share of high-tech industries grows sufficiently**



It is clear that if the productivity growth is centred only in a few industries, and especially when these industries employ relatively few people, the average wage level does not rise accordingly. There is more room for wage increases if the growth is equally distributed. And naturally the export prices have an impact here too: when the productivity growth leads to sinking export prices, companies' ability to pay higher salaries decreases.

7.3.2 Level of labour compensation

In addition to the compensation growth rates, we can also compare the compensation levels. Level data is again available only for manufacturing industries. Now we are no longer interested in the competitiveness of the companies but want to compare the relative purchasing power of the labour compensation in different countries. To be able to do this, the compensation values that were discussed in section 7.2 are divided by the relative consumer price level indexes (see Tables 7.6 and 7.7).

Table 7.6 **The relative purchasing power of labour compensation by country**

	The purchasing power of the labour compensation as % of US level		
	1991	1995	2001
Austria	76.1	85.2	80.7
Belgium	103.6	108.3	105.1
Denmark	76.1	76.3	81.2
Finland	68.2	73.0	73.8
France	93.3	92.2	92.9
Germany	94.4	100.6	98.1
Greece	39.4	41.3	40.5
Ireland	60.6	64.2	69.2
Italy	80.4	78.7	71.5
Netherlands	90.8	96.0	94.1
Spain	72.8	70.1	67.3
Sweden	80.9	74.6	76.2
UK	87.3	88.2	94.6
EU-14	84.6	86.6	84.4

Between 1995 and 2001 the relative purchasing power of labour compensation increased in Denmark, Finland, France, Ireland, Sweden and the UK and decreased in Austria, Belgium, Germany, Greece, Italy, the Netherlands and Spain. Belgium was the only country in which the level exceeded the US level. However, because the employees tend to work longer hours in the US, the purchasing power per employee is relatively higher in the US.

When comparing the purchasing power levels by industries, we can see large differences too (see Table 7.7). In the pulp and paper industry, the Finnish and US real wage levels are almost the same (the Finnish level is 98.1% of the US level), while for electronic valves and tubes the Finnish level is only about 41.4% of the US level. The Finnish real compensation levels are lower than the US levels in every industry. In the EU-14 there are some years and industries that have higher real wage levels than in the US.

Table 7.7 **The relative purchasing power of labour compensation by industry**

	Relative purchasing power of the labour compensation as % of the US level					
	Finland			EU-14		
	1991	1995	2001	1991	1995	2001
Food, drink & tobacco	72.9	80.7	84.1	81.6	85.9	86.8
Textiles	81.2	87.9	81.9	95.6	91.1	87.9
Clothing	93.4	96.8	91.9	90.8	88.9	83.6
Leather and footwear	76.4	76.8	68.5	81.0	74.2	66.7
Wood & products of wood and cork	81.5	88.9	93.3	84.8	88.5	86.5
Pulp, paper & paper products	83.0	89.3	98.1	92.5	92.3	93.6
Printing & publishing	82.0	82.5	81.0	96.7	99.5	97.3
Chemicals	53.6	55.5	55.4	87.2	89.0	82.3
Rubber & plastics	76.3	82.0	86.1	103.0	101.0	101.8
Non-metallic mineral products	72.1	75.8	78.8	84.3	88.5	88.9
Basic metals	68.7	73.9	85.1	90.0	93.4	99.3
Fabricated metal products	66.7	71.5	76.8	80.5	85.7	88.8
Mechanical engineering	66.9	73.4	71.0	88.0	94.5	87.0
Office machinery	51.1	54.0	47.4	113.7	108.7	86.5
Insulated wire	58.1	61.8	62.2	77.5	78.3	71.9
Other electrical machinery and apparatus nec	65.7	70.2	70.2	99.2	102.9	94.4
Electronic valves and tubes	43.2	43.5	41.4	68.1	68.5	61.3
Telecommunication equipment	73.7	82.1	75.6	111.9	120.6	100.3
Radio and television receivers	44.5	48.4	53.3	75.8	72.7	62.2
Scientific instruments	52.3	58.8	54.0	79.5	85.2	73.2
Other instruments	56.5	60.2	57.0	69.8	60.9	74.7
Motor vehicles	49.0	46.4	54.6	81.0	74.7	87.7
Building and repairing of ships and boats	75.5	82.5	65.3	91.4	97.5	84.2
Aircraft and spacecraft	54.2	69.6	59.0	83.3	84.3	92.8
Railroad equipment and transport equipment	73.1	82.9	82.6	70.4	84.7	106.9
Furniture, misc. manufacturing; recycling	73.7	79.2	77.0	86.3	88.6	85.1

Sources: ICOP, Eurostat

Table 7.7 shows the differences between relative levels when the values are compared to the US value. It is also possible to compare the values within one country to see how the wage levels differ between industries (see Table 7.8). The statistical parameters at the end of the table illustrate the well-known fact that incomes are more evenly distributed in Finland.

Table 7.8 **The relative labour compensation level by industry compared to the country average**

	Relative labour compensation as % of the country average								
	Finland			EU-14			US		
	1991	1995	2001	1991	1995	2001	1991	1995	2001
Food, drink & tobacco	94.0	93.3	90.9	84.9	83.5	82.0	88.0	84.3	79.8
Textiles	77.4	78.3	73.5	73.5	68.4	69.1	65.0	65.0	66.3
Clothing	70.1	65.9	66.7	54.9	51.0	53.1	51.2	49.6	53.6
Leather and footwear	71.2	67.3	67.1	60.8	54.7	57.2	63.5	63.9	72.4
Wood & products of wood and cork	84.6	84.2	84.1	71.1	70.5	68.2	70.8	69.1	66.5
Pulp, paper & paper products	128.3	127.5	134.1	115.2	111.0	111.9	105.3	104.2	100.9
Printing & publishing	111.8	104.9	103.9	106.3	106.4	109.3	93.0	92.7	94.7
Chemicals	110.4	111.4	115.2	145.0	150.4	149.7	140.6	146.4	153.6
Rubber & plastics	94.2	93.0	93.8	102.6	96.5	97.0	84.2	82.7	80.5
Non-metallic mineral products	98.1	94.6	91.0	92.4	92.9	89.8	92.7	91.0	85.3
Basic metals	111.2	112.9	113.9	117.6	120.2	116.1	110.5	111.5	98.8
Fabricated metal products	93.5	90.8	89.0	91.0	91.6	89.9	95.6	92.7	85.5
Mechanical engineering	103.1	104.9	104.0	109.4	113.7	111.4	105.1	104.2	108.0
Office machinery	104.5	98.5	97.3	187.7	166.7	155.6	139.5	132.9	151.8
Insulated wire	107.0	101.6	99.5	115.1	108.4	100.5	125.6	119.9	118.1
Other electrical machinery and apparatus nec	96.8	96.9	98.4	118.0	119.6	115.6	100.5	100.8	103.4
Electronic valves and tubes	88.9	84.6	91.6	113.0	112.3	118.5	140.3	142.1	163.2
Telecommunication equipment	99.9	105.0	119.0	122.3	129.9	138.1	92.4	93.3	116.2
Radio and television receivers	89.9	94.4	110.1	123.4	119.6	112.3	137.7	142.4	152.5
Scientific instruments	93.4	99.2	96.0	114.5	121.0	113.8	121.8	123.0	131.2
Other instruments	105.2	110.0	103.1	105.0	93.7	118.1	127.1	133.4	133.5
Motor vehicles	97.4	99.1	92.7	129.9	134.3	130.3	135.7	155.8	125.4
Building and repairing of ships and boats	111.5	106.7	88.6	108.8	106.3	99.9	100.6	94.4	100.2
Aircraft and spacecraft	113.2	141.1	114.6	140.2	144.0	157.6	142.4	148.0	143.3
Railroad equipment and transport equipment nec	109.2	108.0	89.1	84.8	92.9	100.8	101.8	95.0	79.6
Furniture, miscellaneous manufacturing; recycling	80.2	80.2	76.7	75.7	75.5	74.1	74.2	73.9	73.6
Average	97.9	98.2	96.3	106.3	105.2	105.4	104.0	104.3	105.3
Minimum	70.1	65.9	66.7	54.9	51.0	53.1	51.2	49.6	53.6
Maximum	128.3	141.1	134.1	187.7	166.7	157.6	142.4	155.8	163.2
Standard deviation	13.6	16.2	15.6	27.9	27.7	27.4	28.6	28.7	30.6

8 Conclusions

Productivity growth has decelerated in the EU-15 since the mid-1990s. Since the development has been the opposite in the US, the productivity level gap between the EU-15 and the US has widened. While the average annual productivity growth rate was between the years 1995 and 2001 2.19% in the US, it was 1.62% in the EU-15. However, there are large differences between EU countries in the productivity development: the average annual productivity growth rate between

the years 1995 and 2001 varied from 0.7% in Spain to over 7% in Ireland. In Finland the rate was 2.17%.

In this study we have seen that an industry perspective is needed to understand the reasons behind the productivity development differences between EU countries and the US. Productivity growth acceleration in the US and deceleration in the EU must be examined at the industry level because of the huge productivity development variations across the industries.

While there are a large group of industries in which the productivity grows at a high rate in every country examined, there are also those that develop relatively badly in all countries. We have seen that the productivity growth differences between industries are large and that the industries follow similar trends across countries to some extent. There are, however, differences between countries: while most of the European countries manage well in traditional manufacturing industries, the productivity acceleration in the US is largely due to the strongly developing market services. The most important contributors to growth in the US are some ICT-producing manufacturing industries and market services that use ICT intensively. Especially wholesale and retail trade are important: they have been the most important contributors to productivity growth acceleration in the US since 1995. Besides in ICT-using services and ICT-producing manufacturing, productivity developed on average more weakly in the US than in the EU-15. The growth was, however, so strong in these industry groups, that the average US growth rate exceeded the productivity growth rate of the EU-15.

In Finland the most important contributor to productivity growth is the manufacturing of telecommunication equipment. Also some service sector industries are important: communications, real estate activities and financial intermediation each contributed remarkably to the annual productivity growth between 1995 and 2001. These three service sector industries were also the most important contributors to growth at the EU level.

Productivity growth deceleration was quite a widespread phenomenon in the EU-15 and in Finland. When compared to the growth rates in 1990–1995, growth decelerated in the period 1995–2001 in 45 industries in the EU-15 and accelerated in only 10 industries. In Finland productivity growth decelerated in 41 industries and accelerated in 14 industries. The largest contributor to deceleration in Finland was unquestionably the construction sector, which contributed nearly twice as much to the deceleration as the second largest contributor, retail trade.

After decomposing the productivity development into country, industry and year components, the impact of industry structure on productivity growth was analysed. The average productivity growth was noted to be surprisingly low in Finland considering the industry structure, which would suggest an even higher average growth rate. When the impact of industry structure on various economic indicators was analysed, it was noticed that an industry structure that leads to strong productivity growth seems to lead to falling export prices. Although under

normal conditions the productivity growth implies GDP growth, the sinking export prices slow GDP growth down. It was also found that the relationship between labour productivity growth and labour compensation growth is relatively weak. Thus a large part of the utility from labour productivity growth does not benefit the employees. When the winners of productivity growth are the foreign consumers or investors, the employees' share of the utility decreases: the share of labour compensation of the GDP falls.

The results of this study reveal that the relationship between strong productivity growth and welfare development within one country is not straightforward. Thus the aggregate rates do not tell much about a country's potential to raise its living standard. To be able to better assess this, one should also know how widespread a phenomenon the growth actually is and in which sectors the highest growth rates occur. In a highly competitive world market, the benefit from the productivity growth in manufacturing moves easily through lower export prices to consumers.

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Appendix 1

Industries covered in this study

Agriculture
Forestry
Fishing
Mining and quarrying
Food, drink & tobacco
Textiles
Clothing
Leather and footwear
Wood & products of wood and cork
Pulp, paper & paper products
Printing & publishing
Mineral oil refining, coke & nuclear fuel
Chemicals
Rubber & plastics
Non-metallic mineral products
Basic metals
Fabricated metal products
Mechanical engineering
Office machinery
Insulated wire
Other electrical machinery and apparatus nec
Electronic valves and tubes
Telecommunication equipment
Radio and television receivers
Scientific instruments
Other instruments
Motor vehicles
Building and repairing of ships and boats
Aircraft and spacecraft
Railroad equipment and transport equipment nec
Furniture, miscellaneous manufacturing; recycling
Electricity, gas and water supply
Construction
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
Wholesale trade and commission trade, except of motor vehicles and motorcycles

Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods
Hotels & catering
Inland transport
Water transport
Air transport
Supporting and auxiliary transport activities; activities of travel agencies
Communications
Financial intermediation, except insurance and pension funding
Insurance and pension funding, except compulsory social security
Activities auxiliary to financial intermediation
Real estate activities
Renting of machinery and equipment
Computer and related activities
Research and development
Legal, technical and advertising
Other business activities, nec
Public administration and defence; compulsory social security
Education
Health and social work
Other community, social and personal services
Private households with employed persons

Appendix 2

ICT taxonomy

(See O'Mahony et al 2003)

Abbr.	Meaning
ICTPM	ICT-producing manufacturing
ICTPS	ICT-producing services
ICTUM	ICT-using manufacturing
ICTUS	ICT-using services
NICTUM	Non-ICT-using manufacturing
NICTUS	Non-ICT-using services
NICTO	Non-ICT-using industries (other)

	ICTPM	ICTPS	ICTUM	ICTUS	NICTM	NICTS	NICTO
Agriculture							
Forestry							
Fishing							
Mining and quarrying							
Food, drink & tobacco							
Textiles							
Clothing							
Leather and footwear							
Wood & products of wood and cork							
Pulp, paper & paper products							
Printing & publishing							
Mineral oil refining, coke & nuclear fuel							
Chemicals							
Rubber & plastics							
Non-metallic mineral products							
Basic metals							
Fabricated metal products							
Mechanical engineering							
Office machinery							
Insulated wire							
Other electrical machinery and apparatus							
Electronic valves and tubes							
Telecommunication equipment							
Radio and television receivers							
Scientific instruments							
Other instruments							
Motor vehicles							
Building and repairing of ships and boats							
Aircraft and spacecraft							
Railroad equipment and transport equipment							
Furniture, misc. manufacturing; recycling							

	ICTPM	ICTPS	ICTUM	ICTUS	NICTM	NICTS	NICTO
Electricity, gas and water supply							
Construction							
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel							
Wholesale trade and commission trade							
Retail trade							
Hotels & catering							
Inland transport							
Water transport							
Air transport							
Supporting and auxiliary transport activities; activities of travel agencies							
Communications							
Financial intermediation							
Insurance and pension funding							
Activities auxiliary to financial intermediation							
Real estate activities							
Renting of machinery and equipment							
Computer and related activities							
Research and development							
Legal, technical and advertising							
Other business activities, nec							
Public administration and defence; compulsory social security							
Education							
Health and social work							
Other community, social and personal services							

Appendix 3

Negative contributions to productivity growth

Table A3a **The top negative contributors to labour productivity growth in the US compared to the EU and Finland 1995–2001**

	US 1995-2001		EU 1995-2001		Finland 1995-2001	
Industry	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.
Education	-0.205	-8.3	-0.010	-0.6	-0.074	-3.2
Computer and related activities	-0.126	-5.1	0.016	1.0	-0.088	-3.8
Health and social work	-0.090	-3.6	0.039	2.3	-0.137	-6.0
Food, drink & tobacco	-0.084	-3.4	0.016	1.0	0.065	2.8
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	-0.052	-2.1	0.016	0.9	0.019	0.8
Scientific instruments	-0.031	-1.3	-0.031	-1.8	-0.022	-1.0
Construction	-0.030	-1.2	0.034	2.0	-0.156	-6.8
Legal, technical and advertising	-0.027	-1.1	0.045	2.7	0.010	0.5
Other community, social and personal services	-0.027	-1.1	0.001	0.1	0.001	0.0
Mechanical engineering	-0.010	-0.4	0.025	1.5	0.014	0.6

Table A3b **The top negative contributors to labour productivity growth in the EU-15 compared to the US and Finland 1995–2001**

	US 1995-2001		EU 1995-2001		Finland 1995-2001	
Industry	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.
Other business activities, nec	0.001	0.0	-0.059	-3.5	-0.068	-3.0
Scientific instruments	-0.031	-1.3	-0.031	-1.8	-0.022	-1.0
Hotels & catering	-0.009	-0.3	-0.030	-1.8	-0.058	-2.5
Education	-0.205	-8.3	-0.010	-0.6	-0.074	-3.2
Research and development	0.007	0.3	-0.007	-0.4	-0.014	-0.6
Radio and television receivers	-0.001	0.0	-0.002	-0.1	0.001	0.1
Aircraft and spacecraft	0.011	0.4	-0.002	-0.1	0.003	0.1
Mineral oil refining, coke & nuclear fuel	0.001	0.0	-0.001	0.0	0.000	0.0
Fishing	0.004	0.1	0.000	0.0	-0.001	0.0
Insulated wire	0.004	0.1	0.000	0.0	0.005	0.2

Table A3c **The top negative contributors to labour productivity growth in Finland compared to the US and the EU-15 1995–2001**

	US 1995-2001		EU 1995-2001		Finland 1995-2001	
Industry	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.	%-point contrib.	%-contrib.
Construction	-0.030	-1.2	0.034	2.0	-0.156	-6.8
Health and social work	-0.090	-3.6	0.039	2.3	-0.137	-6.0
Computer and related activities	-0.126	-5.1	0.016	1.0	-0.088	-3.8
Education	-0.205	-8.3	-0.010	-0.6	-0.074	-3.2
Other business activities, nec	0.001	0.0	-0.059	-3.5	-0.068	-3.0
Hotels & catering	-0.009	-0.3	-0.030	-1.8	-0.058	-2.5
Fabricated metal products	0.004	0.2	0.019	1.1	-0.023	-1.0
Scientific instruments	-0.031	-1.3	-0.031	-1.8	-0.022	-1.0
Research and development	0.007	0.3	-0.007	-0.4	-0.014	-0.6
Building and repairing of ships and boats	0.003	0.1	0.003	0.2	-0.008	-0.4

Appendix 4

Results of the productivity growth regression analysis

Dependent Variable: Productivity growth
Sample. 19360

Variable	Coefficient	Std. Error	t-Statistic	Prob.
US	3.141327	0.879674	3.571015	0.0004
EU	3.419520	0.879674	3.887259	0.0001
AUSTRIA	4.757346	0.884259	5.380039	0.0000
BELGIUM	5.045831	0.881646	5.723196	0.0000
DENMARK	3.710853	0.883540	4.199982	0.0000
FINLAND	4.594723	0.881192	5.214212	0.0000
FRANCE	3.494040	0.879674	3.971973	0.0001
GERMANY	3.746401	0.879674	4.258853	0.0000
GREECE	3.137586	0.885268	3.544223	0.0004
IRELAND	5.887452	0.888770	6.624267	0.0000
ITALY	3.015783	0.879674	3.428298	0.0006
NETHERLANDS	3.938780	0.881281	4.469379	0.0000
PORTUGAL	4.516466	0.883579	5.111559	0.0000
SPAIN	3.642144	0.879674	4.140336	0.0000
SWEDEN	3.477227	0.879674	3.952861	0.0001
UK	4.554512	0.879674	5.177502	0.0000
FORESTRY	-0.008671	0.998252	-0.008686	0.9931
FISHING	-1.685482	0.965157	-1.746329	0.0808
MINING	0.112523	0.963778	0.116752	0.9071
FOOD	-2.194919	0.963778	-2.277413	0.0228
TEXTILES	-2.087579	0.963778	-2.166038	0.0303
CLOTHING	-1.176416	0.963778	-1.220630	0.2222
LEATHER	-1.684460	0.967257	-1.741481	0.0816
WOOD	-2.317276	0.963778	-2.404368	0.0162
PULP&PAPER	-1.183961	0.963778	-1.228458	0.2193
PRINTING	-2.297041	0.963778	-2.383372	0.0172
MINERAL	-0.153870	0.998263	-0.154137	0.8775
CHEMICALS	0.250914	0.963778	0.260345	0.7946
RUBBER	-2.107189	0.963778	-2.186385	0.0288
NON-METALLIC	-2.103774	0.963778	-2.182841	0.0291
BASIC METALS	-0.526001	0.963778	-0.545771	0.5852
FABRICATED METAL	-2.586316	0.963778	-2.683519	0.0073
MECHANICAL ENGIN.	-2.781477	0.963778	-2.886015	0.0039
OFFICE MACHINERY	35.21411	1.016684	34.63624	0.0000
INSULATED WIRE	0.417992	0.967973	0.431822	0.6659
OTHER ELECTRICAL	-2.121211	0.963778	-2.200934	0.0278
ELECTRONIC VALVES	37.95463	0.981562	38.66757	0.0000
TELECOMMUNICATIONS	8.181240	0.963778	8.488722	0.0000
RADIO&TELEVISION	0.366249	0.994706	0.368198	0.7127

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SCIENTIFIC INSTRUMENTS	-5.271660	0.963778	-5.469789	0.0000
OTHER INSTRUMENTS	0.307279	0.998120	0.307857	0.7582
MOTOR VEHICLES	-1.045007	0.963778	-1.084283	0.2783
SHIP BUILDING	-0.756295	0.987151	-0.766139	0.4436
AIRCRAFT	-0.352743	1.032313	-0.341701	0.7326
RAILROAD	-0.698407	0.964465	-0.724139	0.4690
FURNITURE	-2.726505	0.963778	-2.828978	0.0047
ELECTRICITY	-1.006881	0.963778	-1.044723	0.2962
CONSTRUCTION	-3.686205	0.963778	-3.824746	0.0001
CAR SALES	-3.747122	0.963778	-3.887953	0.0001
WHOLESALE	-2.905889	0.963778	-3.015104	0.0026
RETAIL SALE	-3.143991	0.963778	-3.262154	0.0011
HOTELS	-5.276794	0.963778	-5.475116	0.0000
INLAND TRANSPORT	-1.814220	0.963778	-1.882406	0.0598
WATER TRANSPORT	-0.761171	0.980015	-0.776693	0.4373
AIR TRANSPORT	-0.453585	0.963778	-0.470632	0.6379
SUPPORTING TRANSPORT	-2.444814	0.963778	-2.536699	0.0112
COMMUNICATIONS	0.980344	0.963778	1.017189	0.3091
FINANCIAL ACTIVITIES	-2.184326	0.963778	-2.266421	0.0234
INSURANCE	-5.291398	0.963778	-5.490269	0.0000
AUX.FINANCIAL ACTIVITIES	-3.826248	0.999101	-3.829690	0.0001
REAL ESTATE	-4.787321	0.965157	-4.960146	0.0000
RENTING	-2.632228	0.970861	-2.711232	0.0067
COMPUTER SERVICES	-3.067945	0.963778	-3.183250	0.0015
RESEARCH	-3.346081	0.998263	-3.351904	0.0008
LEGAL	-4.888791	0.963778	-5.072530	0.0000
OTHER BUSINESS	-4.847698	0.963778	-5.029893	0.0000
PUBLIC	-4.072213	0.963778	-4.225262	0.0000
EDUCATION	-4.418914	0.963778	-4.584994	0.0000
HEALTH	-4.355512	0.963778	-4.519209	0.0000
OTHER COMMUNITY	-4.182328	0.963778	-4.339516	0.0000
YEAR 1981	1.608419	0.618576	2.600198	0.0093
YEAR 1982	1.181948	0.618578	1.910750	0.0561
YEAR 1983	1.690122	0.618578	2.732269	0.0063
YEAR 1984	2.581827	0.618397	4.175034	0.0000
YEAR 1985	1.533776	0.618036	2.481695	0.0131
YEAR 1986	0.226464	0.618037	0.366424	0.7141
YEAR 1987	1.129833	0.617858	1.828630	0.0675
YEAR 1988	0.671045	0.617858	1.086084	0.2775
YEAR 1989	0.434135	0.617858	0.702645	0.4823
YEAR 1990	0.005121	0.617858	0.008289	0.9934
YEAR 1991	-0.671703	0.617858	-1.087149	0.2770
YEAR 1992	0.481781	0.618037	0.779534	0.4357
YEAR 1993	0.549587	0.618219	0.888985	0.3740
YEAR 1994	3.004024	0.618037	4.860590	0.0000
YEAR 1995	1.897497	0.617678	3.071984	0.0021
YEAR 1996	0.710174	0.617857	1.149415	0.2504

Variable	Coefficient	Std. Error	t-Statistic	Prob.
YEAR 1997	2.823902	0.617501	4.573113	0.0000
YEAR 1998	0.294932	0.617501	0.477622	0.6329
YEAR 1999	1.217468	0.617680	1.971032	0.0487
YEAR 2000	3.114714	0.618403	5.036707	0.0000
YEAR 2001	-1.285829	0.618224	-2.079875	0.0376

Appendix 5

Results of the productivity growth regression analysis, periods separated

Dependent Variable: Productivity growth 1979–1990

Variable	Coefficient	Std. Error	t-Statistic	Prob.
US	4.178023	0.939946	4.444961	0.0000
EU	4.170248	0.939946	4.436689	0.0000
AUSTRIA	4.870633	0.944933	5.154475	0.0000
BELGIUM	6.254693	0.942673	6.635058	0.0000
DENMARK	4.026208	0.945131	4.259945	0.0000
FINLAND	6.079265	0.941801	6.454939	0.0000
FRANCE	4.291906	0.939946	4.566120	0.0000
GERMANY	4.012967	0.939946	4.269359	0.0000
GREECE	2.581389	0.947285	2.725040	0.0064
IRELAND	6.560287	0.951702	6.893218	0.0000
ITALY	3.863013	0.939946	4.109824	0.0000
NETHERLANDS	5.001811	0.942031	5.309604	0.0000
PORTUGAL	5.284613	0.944542	5.594892	0.0000
SPAIN	5.609218	0.939946	5.967596	0.0000
SWEDEN	4.475503	0.939946	4.761446	0.0000
UK	5.000250	0.939946	5.319720	0.0000
FORESTRY	0.231665	1.139322	0.203335	0.8389
FISHING	-2.094222	1.103142	-1.898416	0.0577
MINING	-1.738555	1.099972	-1.580544	0.1140
FOOD	-2.385643	1.099972	-2.168821	0.0301
TEXTILES	-2.847514	1.099972	-2.588714	0.0096
CLOTHING	-2.337774	1.099972	-2.125302	0.0336
LEATHER	-2.197580	1.099972	-1.997850	0.0458
WOOD	-2.740318	1.099972	-2.491261	0.0127
PULP&PAPER	-1.692324	1.099972	-1.538515	0.1240
PRINTING	-3.123646	1.099972	-2.839750	0.0045
MINERAL	-3.132017	1.139335	-2.748986	0.0060
CHEMICALS	-0.347000	1.099972	-0.315462	0.7524
RUBBER	-2.152841	1.099972	-1.957177	0.0504
NON-METALLIC	-2.014280	1.099972	-1.831210	0.0671
BASIC METALS	0.033162	1.099972	0.030148	0.9759
FABRICATED METAL	-2.984857	1.099972	-2.713574	0.0067
MECHANICAL ENGIN.	-3.201225	1.099972	-2.910278	0.0036
OFFICE MACHINERY	27.99424	1.153848	24.26163	0.0000
INSULATED WIRE	-0.352006	1.109746	-0.317195	0.7511
OTHER ELECTRICAL	-3.104112	1.099972	-2.821991	0.0048
ELECTRONIC VALVES	18.64576	1.122059	16.61746	0.0000
TELECOMMUNICATIONS	18.11756	1.099972	16.47092	0.0000
RADIO&TELEVISION	8.651350	1.139341	7.593295	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SCIENTIFIC INSTRUMENTS	-1.748065	1.099972	-1.589190	0.1121
OTHER INSTRUMENTS	-1.650808	1.149537	-1.436064	0.1510
MOTOR VEHICLES	-2.356164	1.099972	-2.142021	0.0322
SHIP BUILDING	-0.574135	1.118527	-0.513295	0.6078
AIRCRAFT	-0.471331	1.187113	-0.397040	0.6913
RAILROAD	-0.926223	1.099972	-0.842042	0.3998
FURNITURE	-3.336098	1.099972	-3.032893	0.0024
ELECTRICITY	-3.016707	1.099972	-2.742530	0.0061
CONSTRUCTION	-3.934190	1.099972	-3.576627	0.0003
CAR SALES	-4.498065	1.099972	-4.089253	0.0000
WHOLESALE	-3.768197	1.099972	-3.425720	0.0006
RETAIL SALE	-3.816008	1.099972	-3.469185	0.0005
HOTELS	-5.998608	1.099972	-5.453417	0.0000
INLAND TRANSPORT	-3.114162	1.099972	-2.831127	0.0046
WATER TRANSPORT	-2.678093	1.118502	-2.394356	0.0167
AIR TRANSPORT	-2.046635	1.099972	-1.860624	0.0628
SUPPORTING TRANSPORT	-3.150883	1.099972	-2.864511	0.0042
COMMUNICATIONS	-0.921760	1.099972	-0.837984	0.4021
FINANCIAL ACTIVITIES	-3.309959	1.099972	-3.009130	0.0026
INSURANCE	-3.801212	1.099972	-3.455734	0.0006
AUX.FINANCIAL ACTIVITIES	-5.236107	1.141284	-4.587908	0.0000
REAL ESTATE	-5.908663	1.103142	-5.356210	0.0000
RENTING	-4.952014	1.111445	-4.455476	0.0000
COMPUTER SERVICES	-4.218171	1.099972	-3.834798	0.0001
RESEARCH	-3.954447	1.139334	-3.470842	0.0005
LEGAL	-5.357268	1.099972	-4.870367	0.0000
OTHER BUSINESS	-5.664520	1.099972	-5.149693	0.0000
PUBLIC	-4.480255	1.099972	-4.073061	0.0000
EDUCATION	-5.388457	1.099972	-4.898720	0.0000
HEALTH	-5.203255	1.099972	-4.730350	0.0000
OTHER COMMUNITY	-4.926099	1.099972	-4.478384	0.0000
YEAR 1981	1.609178	0.499210	3.223448	0.0013
YEAR 1982	1.160688	0.499215	2.325028	0.0201
YEAR 1983	1.668862	0.499215	3.342975	0.0008
YEAR 1984	2.581438	0.499067	5.172524	0.0000
YEAR 1985	1.537645	0.498776	3.082837	0.0021
YEAR 1986	0.228106	0.498778	0.457331	0.6474
YEAR 1987	1.138480	0.498634	2.283198	0.0224
YEAR 1988	0.679690	0.498634	1.363104	0.1729
YEAR 1989	0.443842	0.498634	0.890116	0.3734
YEAR 1990	0.013767	0.498634	0.027609	0.9780

Dependent Variabe: Growth 1990–1995
Method: Least Squares
Sample: 1 4400
Included observations: 4285

Variable	Coefficient	Std. Error	t-Statistic	Prob.
US	0.767763	1.589426	0.483044	0.6291
EU	2.547056	1.589426	1.602500	0.1091
AUSTRIA	5.590629	1.600210	3.493684	0.0005
BELGIUM	3.141986	1.592385	1.973132	0.0485
DENMARK	2.800834	1.597975	1.752740	0.0797
FINLAND	3.689920	1.592385	2.317229	0.0205
FRANCE	2.025241	1.589426	1.274196	0.2027
GERMANY	1.961913	1.589426	1.234353	0.2171
GREECE	1.389853	1.601895	0.867631	0.3856
IRELAND	4.622785	1.608163	2.874574	0.0041
ITALY	3.324401	1.589426	2.091573	0.0365
NETHERLANDS	2.845848	1.592384	1.787162	0.0740
PORTUGAL	2.931697	1.600692	1.831519	0.0671
SPAIN	2.178117	1.589426	1.370379	0.1706
SWEDEN	2.717975	1.589426	1.710035	0.0873
UK	4.765618	1.589426	2.998326	0.0027
FORESTRY	0.000668	2.005290	0.000333	0.9997
FISHING	-1.409702	1.936042	-0.728136	0.4666
MINING	4.931257	1.936042	2.547082	0.0109
FOOD	-1.254001	1.936042	-0.647714	0.5172
TEXTILES	-1.799859	1.936042	-0.929659	0.3526
CLOTHING	0.006010	1.936042	0.003104	0.9975
LEATHER	-1.584582	1.936042	-0.818465	0.4131
WOOD	-2.464603	1.936042	-1.273011	0.2031
PULP&PAPER	-0.037629	1.936042	-0.019436	0.9845
PRINTING	-2.149190	1.936042	-1.110095	0.2670
MINERAL	6.682854	2.005311	3.332578	0.0009
CHEMICALS	0.805271	1.936042	0.415937	0.6775
RUBBER	-2.325204	1.936042	-1.201009	0.2298
NON-METALLIC	-2.230896	1.936042	-1.152297	0.2493
BASIC METALS	-0.440344	1.936042	-0.227445	0.8201
FABRICATED METAL	-1.610710	1.936042	-0.831960	0.4055
MECHANICAL ENGIN.	-2.151712	1.936042	-1.111397	0.2665
OFFICE MACHINERY	29.73618	2.037898	14.59159	0.0000
INSULATED WIRE	6.117708	1.936042	3.159904	0.0016
OTHER ELECTRICAL	-0.583765	1.936042	-0.301525	0.7630
ELECTRONIC VALVES	37.11650	1.968668	18.85361	0.0000
TELECOMMUNICATIONS	-0.276675	1.936042	-0.142907	0.8864
RADIO&TELEVISION	-4.320333	1.997520	-2.162848	0.0306
SCIENTIFIC INSTRUMENTS	-5.793879	1.936042	-2.992641	0.0028
OTHER INSTRUMENTS	4.059949	2.005269	2.024641	0.0430
MOTOR VEHICLES	0.109652	1.936042	0.056637	0.9548
SHIP BUILDING	-1.211511	1.989979	-0.608806	0.5427

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AIRCRAFT	0.060144	2.074152	0.028997	0.9769
RAILROAD	-0.453861	1.942187	-0.233686	0.8152
FURNITURE	-2.733691	1.936042	-1.412000	0.1580
ELECTRICITY	0.376620	1.936042	0.194531	0.8458
CONSTRUCTION	-3.942399	1.936042	-2.036319	0.0418
CAR SALES	-3.315723	1.936042	-1.712629	0.0869
WHOLESALE	-2.970232	1.936042	-1.534177	0.1251
RETAIL SALE	-3.319645	1.936042	-1.714655	0.0865
HOTELS	-5.042476	1.936042	-2.604528	0.0092
INLAND TRANSPORT	-1.382431	1.936042	-0.714050	0.4752
WATER TRANSPORT	0.769480	1.968663	0.390864	0.6959
AIR TRANSPORT	3.067571	1.936042	1.584454	0.1132
SUPPORTING TRANSPORT	-1.654341	1.936042	-0.854496	0.3929
COMMUNICATIONS	1.649675	1.936042	0.852086	0.3942
FINANCIAL ACTIVITIES	-2.449607	1.936042	-1.265265	0.2058
INSURANCE	-5.149835	1.948515	-2.642954	0.0082
AUX.FINANCIAL ACTIVITIES	-2.621203	2.005266	-1.307160	0.1912
REAL ESTATE	-4.413611	1.936042	-2.279708	0.0227
RENTING	-2.624520	1.955027	-1.342447	0.1795
COMPUTER SERVICES	-3.955032	1.936042	-2.042844	0.0411
RESEARCH	-3.024570	2.005320	-1.508273	0.1316
LEGAL	-4.986104	1.936042	-2.575411	0.0100
OTHER BUSINESS	-4.755774	1.936042	-2.456441	0.0141
PUBLIC	-4.262579	1.936042	-2.201697	0.0277
EDUCATION	-3.886367	1.936042	-2.007377	0.0448
HEALTH	-3.776598	1.936042	-1.950680	0.0512
OTHER COMMUNITY	-3.794463	1.936042	-1.959907	0.0501
YEAR 1992	1.486017	0.591528	2.512167	0.0120
YEAR 1993	1.215053	0.591527	2.054096	0.0400
YEAR 1994	3.670354	0.591360	6.206628	0.0000
YEAR 1995	2.982555	0.591193	5.044978	0.0000

Dependent Variabe: Growth 1995–2001
Method: Least Squares
Sample: 1 5280
Included observations: 4285

Variable	Coefficient	Std. Error	t-Statistic	Prob.
US	3.143987	1.628199	1.930960	0.0535
EU	2.697172	1.628199	1.656537	0.0977
AUSTRIA	3.760010	1.640754	2.291635	0.0220
BELGIUM	4.308999	1.632032	2.640266	0.0083
DENMARK	3.735936	1.635122	2.284805	0.0224
FINLAND	2.445471	1.631997	1.498453	0.1341
FRANCE	3.182223	1.628199	1.954444	0.0507
GERMANY	4.671711	1.628199	2.869251	0.0041
GREECE	5.486382	1.638356	3.348713	0.0008
IRELAND	5.801825	1.647166	3.522308	0.0004
ITALY	1.132295	1.628199	0.695428	0.4868
NETHERLANDS	2.828971	1.631186	1.734303	0.0829
PORTUGAL	6.694784	1.637438	4.088573	0.0000
SPAIN	1.169883	1.628598	0.718338	0.4726
SWEDEN	2.206702	1.628199	1.355302	0.1754
UK	3.488345	1.628199	2.142456	0.0322
FORESTRY	-0.464602	2.040204	-0.227723	0.8199
FISHING	-1.152306	1.969751	-0.585001	0.5586
MINING	-0.395806	1.969751	-0.200942	0.8408
FOOD	-2.518149	1.969751	-1.278410	0.2012
TEXTILES	-0.888510	1.969751	-0.451077	0.6520
CLOTHING	0.049825	1.969751	0.025295	0.9798
LEATHER	-0.577235	1.996871	-0.289070	0.7725
WOOD	-1.534012	1.969751	-0.778785	0.4361
PULP&PAPER	-1.355028	1.969751	-0.687919	0.4915
PRINTING	-0.624896	1.969751	-0.317246	0.7511
MINERAL	-0.525635	2.040221	-0.257636	0.7967
CHEMICALS	0.883580	1.969751	0.448575	0.6538
RUBBER	-1.889958	1.969751	-0.959491	0.3374
NON-METALLIC	-2.153455	1.969751	-1.093263	0.2743
BASIC METALS	-1.601452	1.969751	-0.813023	0.4162
FABRICATED METAL	-2.674235	1.969751	-1.357652	0.1746
MECHANICAL ENGIN.	-2.147657	1.969751	-1.090319	0.2756
OFFICE MACHINERY	53.57655	2.105310	25.44830	0.0000
INSULATED WIRE	-2.981060	1.969751	-1.513420	0.1302
OTHER ELECTRICAL	-0.415414	1.969751	-0.210897	0.8330
ELECTRONIC VALVES	72.78620	2.002935	36.33978	0.0000
TELECOMMUNICATIONS	-3.212383	1.969751	-1.630858	0.1030
RADIO&TELEVISION	-10.11243	2.020780	-5.004223	0.0000
SCIENTIFIC INSTRUMENTS	-11.31419	1.969751	-5.743969	0.0000
OTHER INSTRUMENTS	0.494724	2.008732	0.246287	0.8055
MOTOR VEHICLES	0.495044	1.969751	0.251323	0.8016
SHIP BUILDING	-0.751632	2.040239	-0.368404	0.7126
AIRCRAFT	-0.555308	2.082393	-0.266668	0.7897

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RAILROAD	-0.457682	1.969751	-0.232355	0.8163
FURNITURE	-1.556569	1.969751	-0.790236	0.4294
ELECTRICITY	1.450709	1.969751	0.736494	0.4615
CONSTRUCTION	-3.013072	1.969751	-1.529672	0.1262
CAR SALES	-2.698112	1.969751	-1.369773	0.1708
WHOLESALE	-1.359090	1.969751	-0.689981	0.4902
RETAIL SALE	-1.838967	1.969751	-0.933604	0.3506
HOTELS	-4.211679	1.969751	-2.138179	0.0325
INLAND TRANSPORT	0.141207	1.969751	0.071688	0.9429
WATER TRANSPORT	1.396823	2.002945	0.697385	0.4856
AIR TRANSPORT	-0.661855	1.969751	-0.336010	0.7369
SUPPORTING TRANSPORT	-1.893942	1.969751	-0.961514	0.3363
COMMUNICATIONS	3.947616	1.969751	2.004120	0.0451
FINANCIAL ACTIVITIES	0.129288	1.969751	0.065637	0.9477
INSURANCE	-1.393633	1.969751	-0.707518	0.4793
AUX.FINANCIAL ACTIVITIES	-2.335235	2.040174	-1.144625	0.2524
REAL ESTATE	-3.033876	1.969751	-1.540234	0.1236
RENTING	1.374022	1.969751	0.697561	0.4855
COMPUTER SERVICES	-0.219954	1.969751	-0.111666	0.9111
RESEARCH	-2.339224	2.040225	-1.146552	0.2516
LEGAL	-3.948818	1.969751	-2.004730	0.0450
OTHER BUSINESS	-3.426788	1.969751	-1.739707	0.0820
PUBLIC	-3.165496	1.969751	-1.607054	0.1081
EDUCATION	-3.085202	1.969751	-1.566291	0.1173
HEALTH	-3.283743	1.969751	-1.667085	0.0956
OTHER COMMUNITY	-3.186383	1.974947	-1.613401	0.1067
YEAR 1997	2.020496	0.658498	3.068343	0.0022
YEAR 1998	-0.340114	0.658498	-0.516499	0.6055
YEAR 1999	0.590854	0.658691	0.897012	0.3698
YEAR 2000	1.924833	0.659471	2.918754	0.0035
YEAR 2001	-1.796098	0.659480	-2.723505	0.0065

Appendix 6

Growth rates of real GDP, working hours and productivity

	Real GDP				Total hours				GDP/hour			
	1979–1990	1990–1995	1995–2000	2000–2003	1979–1990	1990–1995	1995–2000	2000–2003	1979–1990	1990–1995	1995–2000	2000–2003
Austria	2.3	2.0	2.7	0.8	0.6	0.3	-0.5	0.1	1.7	1.8	3.2	0.8
Belgium	2.1	1.6	2.7	0.7	-0.6	-0.7	0.0	0.9	2.7	2.3	2.8	-0.2
Denmark	1.8	2.0	2.7	1.3	0.3	-0.4	1.1	-0.6	1.4	2.4	1.6	1.9
Finland	3.3	-0.9	4.7	1.5	0.4	-3.4	1.6	-0.4	2.9	2.6	3.1	1.8
France	2.3	1.1	2.7	1.1	-0.4	-0.4	1.4	-0.1	2.7	1.4	1.3	1.3
Germany	2.1	1.5	1.8	0.3	-0.2	-1.9	-0.3	-1.2	2.3	3.5	2.2	1.5
Greece	1.6	1.2	3.4	4.0	0.6	0.6	0.6	0.5	1.0	0.6	2.8	3.6
Ireland	3.6	4.7	9.8	4.9	-0.5	1.1	3.9	1.4	4.1	3.6	5.8	3.5
Italy	2.3	1.3	1.9	0.9	0.4	-1.0	1.0	1.2	1.9	2.3	1.0	-0.3
Netherlands	2.1	3.0	3.7	0.3	0.4	0.7	3.1	-0.3	1.6	2.3	0.6	0.6
Portugal	3.3	1.7	3.9	0.4	1.5	-1.9	1.4	0.3	1.8	3.6	2.5	0.2
Spain	3.1	1.5	3.8	2.3	0.0	-0.7	4.2	2.6	3.1	2.3	-0.3	-0.3
Sweden	2.0	0.7	3.2	1.5	0.9	-1.3	1.0	-0.3	1.1	2.0	2.2	1.8
UK	2.2	1.7	3.1	2.0	0.2	-1.2	1.0	0.6	2.0	2.9	2.1	1.4
US	2.9	2.4	4.1	1.9	1.6	1.2	2.3	0.0	1.3	1.0	1.9	1.9

Appendix 7

The decomposition of the value added for Finland

	Growth of value added (in constant 1995 prices)			Growth of hours worked			Growth of productivity		
Industry	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001
Total	3.40	-0.59	4.07	0.16	-3.83	1.92	3.25	3.24	2.14
Agriculture	1.46	-5.19	2.49	-3.79	-4.96	-3.52	5.25	-0.23	6.00
Forestry	-0.36	2.49	-0.45	-3.20	-7.01	-2.97	2.84	9.49	2.52
Fishing	1.15	4.65	-2.18	-3.89	-2.86	-1.90	5.04	7.51	-0.28
Mining and quarrying	6.71	2.09	-0.39	-3.55	-2.90	0.00	10.26	5.00	-0.39
Food, drink & tobacco	2.22	1.35	1.49	-1.48	-5.01	-1.74	3.70	6.36	3.23
Textiles	-2.28	-1.11	1.80	-6.32	-9.44	1.15	4.04	8.33	0.65
Clothing	-3.23	-13.16	-3.26	-6.64	-15.25	-3.46	3.41	2.09	0.20
Leather and footwear	-0.65	-6.97	-2.63	-4.47	-10.91	-4.27	3.83	3.95	1.64
Wood & products of wood and cork	1.51	0.19	4.57	-3.39	-5.48	0.24	4.90	5.67	4.34
Pulp, paper & paper products	3.37	4.38	1.94	-2.24	-3.05	-0.82	5.60	7.43	2.77
Printing & publishing	4.50	-1.89	2.39	0.70	-5.78	-0.06	3.79	3.90	2.46
Mineral oil refining, coke & nuclear fuel	1.58	5.30	0.60	-0.78	-0.36	2.00	2.36	5.66	-1.40
Chemicals	4.98	2.41	4.26	0.72	-1.91	0.32	4.25	4.33	3.93
Rubber & plastics	4.01	0.75	4.27	-1.43	-3.11	4.16	5.44	3.85	0.11
Non-metallic mineral products	3.59	-5.86	4.74	-0.24	-10.16	3.34	3.83	4.30	1.39
Basic metals	3.90	5.90	4.03	-1.88	-1.81	0.00	5.77	7.71	4.03
Fabricated metal products	7.32	0.64	6.29	1.35	-4.57	6.58	5.97	5.21	-0.29
Mechanical engineering	4.81	1.11	3.25	0.17	-3.27	2.33	4.64	4.38	0.92
Office machinery	39.36	17.22	16.31	4.51	4.29	-27.42	34.85	12.93	43.73
Insulated wire	-0.98	0.49	7.47	-5.07	-9.35	2.65	4.09	9.84	4.82
Other electrical machinery	5.50	3.70	2.67	-0.14	-1.11	1.00	5.64	4.81	1.67
Electronic valves and tubes	25.08	42.62	64.65	5.22	9.44	4.49	19.85	33.19	60.16
Telecommunication equipment	25.99	23.26	18.01	3.62	15.43	10.91	22.37	7.83	7.10
Radio and television receivers	14.67	-23.85	-10.18	1.69	-16.59	-7.61	12.97	-7.26	-2.57
Scientific instruments	11.25	2.98	0.65	5.42	3.70	8.37	5.83	-0.72	-7.72
Other instruments	4.14	10.02	7.20	0.09	1.01	5.48	4.05	9.01	1.72
Motor vehicles	3.53	-6.20	6.82	0.72	-7.67	2.99	2.81	1.46	3.84
Building and repairing of ships and boats	-2.68	8.37	-0.80	-4.28	-1.44	0.46	1.60	9.81	-1.26
Aircraft and spacecraft	11.62	6.23	2.90	3.67	-5.38	3.11	7.95	11.61	-0.21
Railroad equipment and transport equipment	4.79	-14.94	-20.20	-3.01	-5.23	-7.31	7.81	-9.71	-12.89
Furniture, misc. manufacturing	2.31	-2.48	4.05	-1.69	-6.05	2.55	3.99	3.57	1.49
Electricity, gas and water supply	3.41	2.08	2.57	-0.56	-5.85	-2.79	3.97	7.93	5.35
Construction	2.83	-10.64	4.28	1.29	-10.86	5.09	1.54	0.22	-0.81
Sale, maintenance and repair of motor vehicles	3.68	-3.11	4.83	2.84	-6.80	3.32	0.84	3.69	1.50
Wholesale trade	2.81	-5.38	4.47	-0.69	-3.14	1.78	3.50	-2.24	2.69
Retail trade	4.16	-2.17	3.37	0.44	-6.18	2.05	3.72	4.01	1.32
Hotels & catering	3.34	-2.09	3.28	1.72	-5.94	4.79	1.62	3.85	-1.51
Inland transport	2.71	-0.89	2.94	0.72	-3.51	1.54	1.99	2.61	1.41
Water transport	-1.38	5.38	3.47	-2.45	1.25	-0.26	1.07	4.13	3.73
Air transport	8.41	4.80	4.11	4.12	-0.96	3.16	4.30	5.76	0.95
Supporting and auxiliary transport activities	4.34	2.45	3.18	1.49	-1.09	0.23	2.85	3.53	2.96
Communications	6.97	3.47	13.04	1.37	-2.44	0.72	5.59	5.92	12.32

Industry	Growth of value added (in constant 1995 prices)			Growth of hours worked			Growth of productivity		
	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001	1979–1990	1990–1995	1995–2001
Financial intermediation	6.85	-8.28	3.58	2.16	-7.76	-5.12	4.69	-0.52	8.71
Insurance and pension funding	6.15	-3.47	-3.50	1.20	-1.95	-1.69	4.95	-1.52	-1.80
Real estate activities	3.36	3.06	3.32	1.65	-3.42	2.32	1.71	6.48	1.00
Renting of machinery and equipment	-0.28	-5.49	9.14	2.23	-8.50	7.08	-2.52	3.00	2.06
Computer and related activities	6.93	-0.82	14.56	7.63	0.65	15.66	-0.71	-1.47	-1.11
Research and development	5.18	-0.49	4.33	4.13	0.00	5.04	1.05	-0.49	-0.71
Legal, technical and advertising	6.39	1.74	3.50	6.77	-1.27	2.35	-0.38	3.01	1.15
Other business activities, nec	6.68	-2.89	8.52	6.17	-2.14	10.43	0.51	-0.75	-1.91
Public administration and defence	2.18	-0.57	1.28	1.30	0.35	-0.24	0.88	-0.92	1.52
Education	1.80	0.21	1.96	1.58	0.38	2.35	0.22	-0.16	-0.39
Health and social work	3.38	-1.82	1.97	2.61	-1.18	2.32	0.77	-0.64	-0.35
Other community, social and personal services	3.92	-1.07	3.53	2.71	-0.92	2.99	1.21	-0.15	0.54

Appendix 8

Results of the compensation growth regression analysis

Dependent Variable: Real compensation growth
Sample: 19360

Variable	Coefficient	Std. Error	t-Statistic	Prob.
US	0.173180	0.522772	0.331273	0.7404
EU	1.241222	0.522772	2.374308	0.0176
AUSTRIA	1.292018	0.522772	2.471476	0.0135
BELGIUM	1.622322	0.522772	3.103308	0.0019
DENMARK	1.295924	0.522772	2.478947	0.0132
FINLAND	1.709115	0.522772	3.269332	0.0011
FRANCE	1.415960	0.522772	2.708562	0.0068
GERMANY	1.303401	0.522772	2.493251	0.0127
GREECE	1.437828	0.524388	2.741918	0.0061
IRELAND	3.397565	0.523565	6.489289	0.0000
ITALY	0.619610	0.522772	1.185239	0.2359
NETHERLANDS	0.748804	0.523565	1.430202	0.1527
PORTUGAL	2.896107	0.524518	5.521467	0.0000
SPAIN	1.021053	0.522772	1.953153	0.0508
SWEDEN	0.793715	0.522772	1.518281	0.1290
UK	2.216746	0.522772	4.240369	0.0000
FORESTRY	-1.053208	0.583947	-1.803602	0.0713
FISHING	-0.536796	0.574280	-0.934728	0.3499
MINING	-0.322421	0.574280	-0.561435	0.5745
FOOD	-0.720975	0.574280	-1.255442	0.2093
TEXTILES	-0.643825	0.574280	-1.121099	0.2623
CLOTHING	-0.234133	0.574280	-0.407699	0.6835
LEATHER	-0.170303	0.574280	-0.296551	0.7668
WOOD	-0.626870	0.574280	-1.091576	0.2750
PULP&PAPER	-0.373748	0.574280	-0.650812	0.5152
PRINTING	-0.524837	0.574280	-0.913905	0.3608
MINERAL	0.914378	0.574280	1.592216	0.1114
CHEMICALS	-0.227216	0.574280	-0.395653	0.6924
RUBBER	-0.878609	0.574280	-1.529931	0.1261
NON-METALLIC	-0.590316	0.574280	-1.027923	0.3040
BASIC METALS	-0.767720	0.574280	-1.336839	0.1813
FABRICATED METAL	-0.570958	0.574280	-0.994215	0.3201
MECHANICAL ENGIN.	-0.743528	0.574280	-1.294714	0.1954
OFFICE MACHINERY	-0.492744	0.589665	-0.835633	0.4034
INSULATED WIRE	-1.032389	0.574280	-1.797710	0.0722
OTHER ELECTRICAL	-0.800767	0.574280	-1.394385	0.1632
ELECTRONIC VALVES	-0.278403	0.574280	-0.484786	0.6278
TELECOMMUNICATIONS	0.343045	0.574280	0.597349	0.5503
RADIO&TELEVISION	0.374924	0.574280	0.652859	0.5139
SCIENTIFIC INSTRUMENTS	-0.277502	0.583951	-0.475215	0.6346

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OTHER INSTRUMENTS	0.644004	0.574280	1.121411	0.2621
MOTOR VEHICLES	-0.721311	0.574280	-1.256026	0.2091
SHIP BUILDING	0.156971	0.574280	0.273336	0.7846
AIRCRAFT	0.392418	0.583947	0.672009	0.5016
RAILROAD	0.449198	0.575102	0.781076	0.4348
FURNITURE	-0.929177	0.574280	-1.617987	0.1057
ELECTRICITY	-0.104797	0.574280	-0.182484	0.8552
CONSTRUCTION	-1.145106	0.574280	-1.993986	0.0462
CAR SALES	-0.556018	0.574280	-0.968200	0.3330
WHOLESALE	-0.446835	0.574280	-0.778079	0.4365
RETAIL SALE	-0.650845	0.574280	-1.133324	0.2571
HOTELS	-0.771423	0.574280	-1.343287	0.1792
INLAND TRANSPORT	-1.054266	0.574280	-1.835805	0.0664
WATER TRANSPORT	-0.649506	0.574280	-1.130992	0.2581
AIR TRANSPORT	-0.392404	0.574280	-0.683297	0.4944
SUPPORTING TRANSPORT	-0.965707	0.574280	-1.681596	0.0927
COMMUNICATIONS	-0.504811	0.574280	-0.879033	0.3794
FINANCIAL ACTIVITIES	-0.266022	0.574280	-0.463228	0.6432
INSURANCE	-0.383761	0.579822	-0.661860	0.5081
AUX.FINANCIAL ACTIVITIES	-0.328924	0.583951	-0.563274	0.5733
REAL ESTATE	-0.507892	0.574280	-0.884399	0.3765
RENTING	-0.117660	0.574280	-0.204883	0.8377
COMPUTER SERVICES	-0.323185	0.574280	-0.562766	0.5736
RESEARCH	0.318425	0.574280	0.554476	0.5793
LEGAL	-0.099980	0.574280	-0.174097	0.8618
OTHER BUSINESS	-0.432638	0.574280	-0.753357	0.4512
PUBLIC	-0.899220	0.574280	-1.565822	0.1174
EDUCATION	-0.746450	0.574280	-1.299802	0.1937
HEALTH	-0.620169	0.574280	-1.079907	0.2802
OTHER COMMUNITY	-0.818484	0.574280	-1.425236	0.1541
YEAR 1981	-0.240854	0.364451	-0.660868	0.5087
YEAR 1982	-0.014053	0.364451	-0.038560	0.9692
YEAR 1983	0.336643	0.364451	0.923700	0.3557
YEAR 1984	0.964023	0.364451	2.645135	0.0082
YEAR 1985	0.799650	0.364451	2.194121	0.0282
YEAR 1986	1.987305	0.364451	5.452872	0.0000
YEAR 1987	2.310573	0.364451	6.339871	0.0000
YEAR 1988	1.504657	0.364451	4.128556	0.0000
YEAR 1989	0.601194	0.364556	1.649112	0.0991
YEAR 1990	1.506102	0.364556	4.131335	0.0000
YEAR 1991	1.723812	0.364556	4.728527	0.0000
YEAR 1992	1.007390	0.364452	2.764124	0.0057
YEAR 1993	0.846986	0.364452	2.324001	0.0201
YEAR 1994	0.389069	0.364556	1.067239	0.2859
YEAR 1995	0.593783	0.364556	1.628781	0.1034
YEAR 1996	0.265250	0.364452	0.727806	0.4667
YEAR 1997	1.609925	0.364452	4.417390	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
YEAR 1998	1.054852	0.364452	2.894352	0.0038
YEAR 1999	1.383445	0.364452	3.795961	0.0001
YEAR 2000	1.972103	0.364452	5.411149	0.0000
YEAR 2001	0.915904	0.364452	2.513101	0.0120

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