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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

OECD *Economic Studies* is produced twice yearly. Many of the articles derive from papers produced for the Organisation's intergovernmental Committees, in particular those serviced by the Economics Department of the OECD Secretariat. Nonetheless, articles also drawn from work by other parts of the Secretariat, or by consultants and other non-OECD authors, may be included. Most of the articles are in the area of applied economic and statistical analysis, generally with an international or cross-country dimension.

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This article examines various efficiency and equity aspects related to the skill acquisition of young people and older adults. The analysis suggests that human capital investment is associated with significant labour-market gains for individuals, including higher post-tax earnings and better employment prospects, which exceed the investment costs, mainly foregone earnings and tuition fees, by a significant margin. It also shows that the net benefits are strongly influenced by policy related factors, such as study length, tuition subsidies and student support. Overall, the estimates reported in the article indicate that there are strong incentives for the average student to continue studying beyond the compulsory schooling age, and also point to the benefits of such investment in education for society as a whole. However, the net gains fall with age, mainly reflecting a shorter period to take advantage of the benefits that come with education. Finally, the article notes that students in higher education tend to come from more affluent backgrounds and that they benefit from large public subsidies, whereas young people from disadvantaged backgrounds are less likely to participate in tertiary education and thus benefit from public subsidies.

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Despite recent cuts, the tax-to-GDP ratio in most EU countries remains much higher than in other economies. The tax mix is also different, with high tax wedges on labour and a stronger reliance on consumption and environmentally related taxes. While there is not much room for cutting taxes significantly without downsizing public spending, further re-balancing the tax burden away from labour could contribute to better employment

performance. Greater reliance on property taxes, which are low by international standards, less use of reduced VAT rates and tax incentives targeted to specific saving vehicles should be considered. EU countries' experience in reforming their tax system may also provide useful insights for other regions where international integration is deepening. The free movement of goods, people and capital within the EU area, combined with the advent of the single currency, has also affected the design of national tax systems and has brought to the fore a number of international taxation issues.

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INCOME DISTRIBUTION AND POVERTY IN THE OECD AREA: TRENDS AND DRIVING FORCES

Michael Förster and Mark Pearson

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INTRODUCTION

There have been rising concerns that economic forces are causing income inequality to rise, creating a difficult challenge for policy makers. However, policy mistakes can be avoided only if trends in income distribution are well understood and that has not been the case for the OECD area since few comparative statistics have been available. Furthermore, the distribution of income is affected by many factors and the trends driving changes in *e.g.* joblessness, earnings, capital income and family size are complex and sometimes off-setting. However, some idea of which factors may be key can be gleaned by comparing country experiences in order to see which trends are truly global, which affect only economies and societies of a particular type, and which are country specific, perhaps reflecting contingent policy choices.

There is an increasing literature of *national* empirical analyses of income distribution and poverty trends in OECD Member countries. The main impression gained from these studies is that of a broad stability during the decade of the 1970s and increasing polarisation since the 1980s, starting in the Anglo-Saxon countries and followed by many continental European countries in the 1990s. Those studies, however, make use of different definitions and concepts of income and inequality and often focus particularly on earnings rather than other components of household income. The final distribution of income (“disposable incomes”) is the result of a complex set of relationships, including family formation and dissolution, longevity and fertility, as well as the more obvious trends in earnings, taxes and the returns on capital.

The present article uses comparable data and definitions to look at over 20 OECD countries, a coverage sufficient to determine whether one can truly speak of “OECD-wide” trends, rather than a few country-specific tendencies.¹ Unlike previous comparative studies, inequality trends are examined for a majority of OECD countries and this study also considers the working-age population separately from the retirement-age population, looks in more detail at the distribution of different cash transfers, and analyses both relative and “absolute” poverty.² The second section documents recent trends in the overall distribution of disposable income in OECD countries, as well as identifying population groups who were among the winners and losers. The third section analyses the driving forces underlying these trends, including the frequently off-setting trends in the

distribution of market-based incomes and the redistributive impact of taxes and transfers. The conclusion assembles 12 stylised facts that emerge from this analysis and provide important context for making policy choices in this difficult area.

MAIN TRENDS IN THE DISTRIBUTION OF DISPOSABLE INCOMES AND POVERTY

Overall trends in income distribution

Over a longer time-span, there has been no clear general trend in final income inequality. Table 1 summarises the evidence on trends in the distribution of income, based on the movements in the value of the Gini concentration coefficient of income (see the box on the definition of income for an explanation of the methodology followed). In the ten countries for which a relatively long time span can be considered, from the mid-1970s to the mid-1990s, there are four countries where the income distribution widened, three countries where it narrowed, and it

Table 1. Overall trends in income inequality: summary results for the entire population

	Down a lot	Down	Down a bit	No change	Up a bit	Up	Up a lot
Mid-1970s to mid-1990s	Greece		Canada Finland	Japan Mexico Sweden	Australia	Netherlands United States	United Kingdom
Mid-1970s to mid-1980s	Greece	Finland	Canada Japan Mexico Sweden		Netherlands	Australia United States	United Kingdom
Mid-1980s to mid-1990s			Australia Denmark Hungary Ireland	Austria Canada France Greece United States	Belgium Germany Japan Mexico Sweden	Finland Netherlands Norway United Kingdom	Italy Turkey

Notes:

Up a lot: significant rise in income inequality (more than 12 per cent increase).

Up: rise in income inequality (7 to 12 per cent increase).

Up a bit: modest rise in income inequality (2 to 6 per cent increase).

No change: -1 to +1 per cent change.

Down a bit: modest decrease in income inequality (2 to 6 per cent decrease).

Down: decrease in income inequality (7 to 12 per cent decrease).

Down a lot: significant decrease in income inequality (more than 12 per cent decrease).

No comparable data is available for countries not included.

The results are based on the values of the Gini coefficient for all countries in three reference years which may vary among countries. For Hungary the period refers to 1991-1997.

Source: OECD questionnaire on distribution of household incomes (2000).

Box. The definition of income

The income concept used in this paper is that of *equivalent disposable household income per individual*. The income unit is the household, defined as a group of persons sharing a set of common resources. Incomes are recorded on an annual basis and all possible types of cash income have been grouped into four categories:

- i) Gross earnings: the salary income of the household from dependent employment (excluding employers' contributions to social security, but including sick pay paid by social security).
- ii) Gross capital and self-employment incomes: financial gains, real estate rents, occupational pensions and all kinds of private transfers as well as self-employment incomes (but not including imputed income from owner occupation).
- iii) Social security transfers: all kinds of cash transfers from public sources.
- iv) Taxes: direct income taxes and employee social security contributions paid by households.

Household disposable income is defined as total market income (i + ii) plus transfers from general government (iii), less income taxes and social security contributions (iv).

The analysis has been conducted for individuals rather than households and their personal income has been defined as equivalent disposable income and calculated as follows: First, the sum of the disposable incomes of all household members equals household disposable income. Household disposable income then is adjusted for differences in household size to obtain *equivalent household disposable income*. This adjustment recognises some "economies of scale" of consumption within the household. In particular, household disposable income is divided by the square-root of the number of persons in the household: for example, the equivalent income of a four-person household is household income divided by two. (This is usually referred to as "equivalence-scale elasticity" of 0.5. A higher elasticity value assumes less economies of scale in consumption, until the elasticity value of 1.0 which assumes no economies of scale.) Third, equivalent household income is attributed equally to all individuals in the household, even though the incomes they receive as individuals may be different. Children and spouses are assumed to benefit equally from household income. Finally, individuals are ranked by the (ascending) levels of their *equivalent disposable income* (Atkinson, *et al.*, 1995).

remained stable in the remaining three. In five of the ten countries, movements in the first decade (declines in Finland, Japan, Mexico and Sweden; increase in Australia) tended to be offset by opposite movements in the second. However, there are signs of a more general trend across OECD countries in more recent

times. According to the Gini coefficient, from the mid-1980s to the mid-1990s³ inequalities decreased only slightly in four of the 20 countries for which trend data are available, remained stable in another five, but increased in the other 11 countries, in half of them by considerable amounts.

Different measures of inequality can give different results, and a careful reading of the table in the Annex shows that during the mid-1980s to the mid-1990s, inequality among the entire population increased unambiguously – *i.e.* four different indicators of inequality pointed to a rise – in just eight of the 20 countries for which multiple trend data are available. In all other countries, inequality indicators moved in different directions. This implies that in no country an unambiguous trend towards greater income *equality* was recorded (see annex). Of course, real incomes have grown in most countries. In 15 of the 21 countries considered, the mean income of each decile in the most recent year lies above that for earlier years. In other words, the bottom 10 per cent in the mid-1990s are better off *on average* than the bottom 10 per cent in the mid-1980s; the second 10 per cent in the mid-1990s have higher average incomes than their counterparts in the mid-1980s, and so on up the income distribution. There are relatively few exceptions – Australia, Canada, Italy, Norway and Turkey and, in particular, Hungary.⁴ This does not mean that all parts of the income distribution gained in overall prosperity to the same extent. In particular, the general pattern has been that the three lower deciles did not share in overall growth to the same extent as higher decile groups. In Germany, Greece, Mexico, the Netherlands, the United Kingdom and the United States, the average incomes of the bottom deciles were just about the same in the mid-1990s as they had been in the mid-1980s. A more significant increase of real mean incomes for the lower three income deciles (15 per cent or more) took place in Austria, Belgium, Denmark, France, Ireland and Japan.

Changes in aggregate inequality can hide other trends. If, for instance, groups in the middle deciles lose ground whilst both bottom and top incomes increase their shares, one can speak of a “hollowing out” of the distribution. Table 2 shows that this was generally not the case during the past decade, with a “hollowing out” occurring only in Belgium and, very marginally, in France and the United States. A widening of the income distribution could happen if the poor become relatively poorer; the rich have relatively more; or a combination of the two. Table 2 suggests that the second of these possibilities has predominated: there has been a trend for those at the top of the income distribution to receive a greater proportion of household income. In 13 of the 20 countries the top income quintile now has a greater proportion of household income than in the mid-1980s, substantially so in Belgium, Finland, Italy, Mexico, Norway and Turkey. Persons at the bottom of the income ladder lost ground relative to the average in eight countries, these losses being largest in Italy.

Table 2. **Gains and losses of income share by income quintile: entire population, mid-1980s to mid-1990s**

	Bottom quintile	Middle quintiles	Top quintile
Australia	=	=	=
Austria	=	=	=
Belgium	=	---	+++
Canada	=	=	=
Denmark	+	=	-
Finland	=	---	+++
France	=	-	+
Germany	-	=	+
Greece	=	=	=
Hungary	+	=	=
Ireland	+	=	=
Italy	---	-	+++
Japan	-	=	+
Mexico	=	---	+++
Netherlands	-	=	+
Norway	-	-	+++
Sweden	-	=	+
Turkey	-	---	+++
United Kingdom	-	-	+
United States	=	-	+

+++ Increase of more than 1.5 percentage point in the share of final disposable income received by the decile group.

+ Increase of between half and 1.5 percentage point.

= -0.5 to +0.5 percentage point change.

- Decrease of between half and 1.5 percentage point.

--- Decrease of more than 1.5 percentage point.

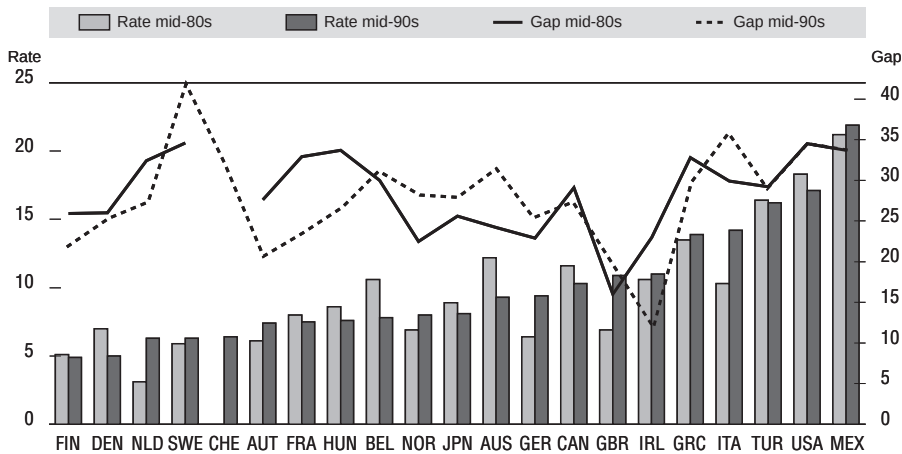
The results are based on percentage point changes of quintile shares in disposable income.

Source: Calculations from OECD questionnaire on distribution of household incomes (2000).

Overall trends in poverty

The changes in the distribution of income are reflected in changes in poverty in the countries concerned. "Poverty" is very difficult to define and measure, particularly when making comparisons across countries. People in different countries have different needs, social and family networks, and governments may provide some services without charge which in other countries would require purchase. A given level of income may support very different standards of living in different countries. But much is nevertheless revealed even if all we do is to look at those households which have low incomes.⁵ Although no-one could pretend that such a measure is ideal, we can at least reconcile ourselves to using such a measure on the grounds that low income in itself may not be sufficient to cause hardship, but it is at least a necessary element of poverty.

Figure 1. **Income poverty rates and poverty gaps in 21 OECD countries, mid-1980s and mid-1990s**



Notes: Poverty thresholds are defined as 50 per cent of median adjusted disposable income in each period in each country. Poverty rates defined as number of persons in households below the threshold in per cent of the total population. Poverty gap defined as average shortfall of low incomes in per cent of the poverty threshold.

Source: OECD questionnaire on distribution of household incomes (2000).

The most common measure of income poverty is the number of people with incomes below a given threshold. Figure 1 defines this threshold using a relative measure (“relative” means that the poverty thresholds in each country refer to a percentage of the median with regard to each country *and each year*). People are said to be in income poverty if their incomes are below 50 per cent of the median disposable income of households, after adjusting for household size.

There has been, on average, little change in poverty levels over time (Figure 1). From the mid-80s to the mid-90s, income poverty at the 50 per cent level fell in six countries, rose in five, and stayed approximately the same in nine. However, opinion varies as to what level of income should be considered “poor”, and poverty estimates can be very sensitive to the particular threshold chosen. Förster and Pellizzari (2000) present results for three alternative poverty lines: the number of persons living in households below 40 per cent, 50 per cent and 60 per cent of the median disposable income in each country, with much smaller declines in the number of “very poor” with incomes less than 40 per cent of the median – only in France and Ireland were reductions in poverty mainly in the number of “very poor”. Looking at the global picture, however, the basic pattern of changes

shown in the table is not misleading: falls in poverty at the 50 per cent level are usually accompanied by falls in poverty at both the 40 per cent and 60 per cent level [exceptions being Ireland and the United States, where reductions in the number of “very poor” have taken place at the same time as the number of those below the 60 per cent threshold stayed constant (the United States) or even increased (Ireland)].

The *number* of people with a low income is only one way of measuring poverty. It says nothing as to the average income level of the poor which could be very close or far beyond a given threshold. Another relevant measure is therefore the intensity of poverty – the income gap ratio – which measures how far below the poverty line is the average poor person, in per cent of the poverty line. This is shown in the lines in Figure 1. On average across 21 OECD countries, the incomes of the poor are some 28 per cent below the poverty threshold of 50 per cent of the median in the mid-1990s, with lower ratios in Austria, Finland, the United Kingdom and, in particular, Ireland and higher ratios in Italy, Mexico, Sweden and the United States. In general, income gap ratios have followed the movements of the poverty head-count rates. This means that in countries in which the proportion of the poor in the population decreased, the average income as a proportion of the poverty line of the remaining poor decreased, and *vice versa*. A few exceptions are noteworthy: in Australia and, to a lesser extent, Belgium and the United States, the income gap widened although poverty rates fell (in other words, fewer people are “poor”, but those who remain have particularly low incomes) and in Austria and the Netherlands, the inverse was the case. Apart from Australia, poverty intensity increased significantly in Italy, Norway and Sweden. On the other hand, a large reduction of the income gap ratio occurred in Ireland.

These poverty estimates refer to percentages of the median income in each of the years considered. Of course, in many countries there have been large increases in average incomes (and in a few others, average household incomes have fallen). Because in most countries incomes have been increasing, poverty rates compared with a fixed level of income have generally fallen. Poverty below constant thresholds – *i.e.* fixed in real terms at the beginning of the period – increased from the mid-1980s to the mid-1990s in only a few countries (Hungary, Italy and Turkey – in Hungary and Turkey, because real mean incomes fell over the period). The most striking case is Hungary: against the background of a deep recession at the beginning of the transition restructuring (1990 to 1993/94), real median income and, hence, the relative poverty threshold fell by one-third. As a consequence, relative poverty rates remained broadly stable while poverty rates under a constant threshold tripled. In all other countries, real incomes increased over the period and poverty below constant thresholds stayed the same or fell, particularly so in Finland and Greece (between the mid-1970s and the mid-1980s) and Ireland (from the mid-1980s onwards).

The trouble with comparing “how many people are poor and to what extent” in different years is that we are not comparing the same people. These results have to be put in the context of income dynamics. Talk of there being fewer people in poverty in the mid-1990s compared with the mid-1980s implies that a few of those who were poor have clawed their way above the threshold. In fact, of course, it is perfectly possible that *none* of those who were poor in the mid-1980s remained so ten years later, because as people’s circumstances change, so they move up and down the income distribution. To some extent, comparisons of “head-counts” of low incomes at a point in time depersonalises the concept of poverty. Poverty is, however, a very personal state, and the amount of time that people spend below an income threshold is very important in determining living standards.

Low income head-counts both massively underestimate and at the same time overestimate the problem of poverty. Oxley *et al.* (2000) and OECD (2001) take the same concept of low incomes – 50 per cent of median household income after adjusting for family size – and follow the same people over a period of six years, or more for a restricted sample of countries. These studies show that:

- On average, at any moment in time, between 6 and 20 per cent of the population in the countries considered have low incomes.
- A larger part of the population than suggested by “static” poverty rates is touched by income poverty over a six-year period, namely between 12 and 40 per cent.
- Only around 1-2 per cent of the population is continuously poor throughout the six years in Canada, Germany, the Netherlands and Sweden. The proportion in the United Kingdom and the United States is significantly higher.
- This means that between 2/3 (in the United States and the United Kingdom) and 6/7 (in the Netherlands) of all those who have low incomes at any point in time, will not be poor at some other time in the six years.
- Even in Sweden, nearly 12 per cent of the population will have low incomes at some point during the six years. In the United Kingdom, this ratio reaches nearly 40 per cent of the sample.
- Persistent poverty is closely associated with the lack of earned income.

“Winners” and “losers” of relative income changes

The classical life-cycle pattern would predict that income increases when individuals enter working life; continues to rise as individuals gain experience in the labour market and accumulate capital assets and declines when moving into retirement. Broadly speaking, this is indeed the pattern found in most countries. Table 3 shows that children are, on average, a little under 10 per cent poorer than

Table 3. **Relative disposable incomes, by age groups**

Average income of entire population = 100

	Children	Young	Young adults	Adults	Older adults	Younger senior citizens	Older senior citizens
	Age 0-17	Age 18-25	Age 26-40	Age 41-50	Age 51-65	Age 65-75	Age 75+
Australia, 1984	87	130	..	107	..	72	..
Australia, 1994	86	122	..	112	..	68	..
Austria, 1983	90	110	104	117	109	82	79
Austria, 1993	90	109	101	116	108	91	80
Belgium, 1983	..	..	..	..	..	..	..
Belgium, 1995	105	83	102	118	108	83	71
Canada, 1985	88	102	103	116	110	91	84
Canada, 1995	88	100	100	114	114	99	95
Denmark, 1983	100	105	109	114	103	74	60
Denmark, 1994	97	97	104	119	113	79	65
Finland, 1986	98	97	103	116	103	80	74
Finland, 1995	101	88	102	114	108	82	75
France, 1984	95	102	106	112	103	86	82
France, 1994	95	97	100	115	109	94	82
Germany, 1984	93	98	102	113	109	85	81
Germany, 1994	91	96	99	118	110	93	77
Greece, 1988	94	104	108	111	102	84	79
Greece, 1994	98	104	110	113	100	80	72
Hungary, 1991	99	109	103	119	96	81	77
Hungary, 1997	93	111	104	109	104	88	81
Ireland, 1987	87	130	105	103	112	85	83
Ireland, 1994	89	117	109	112	111	77	71
Italy, 1984	90	107	106	106	108	82	78
Italy, 1993	89	103	105	109	108	85	82
Mexico, 1989	84	119	113	114	115	99	78
Mexico, 1994	83	113	114	128	121	91	75
Netherlands, 1984	89	104	102	109	112	93	84
Netherlands, 1995	89	97	105	114	112	90	79
Norway, 1986	96	105	104	118	109	78	60
Norway, 1995	98	94	101	120	117	84	61
Sweden, 1983	101	71	105	119	119	91	70
Sweden, 1995	99	60	100	120	127	96	78
Turkey, 1987	89	109	100	117	116	103	106
Turkey, 1994	85	111	103	127	119	89	102
United Kingdom, 1985	90	114	105	124	105	74	72
United Kingdom, 1995	86	112	106	123	108	80	74
United States, 1985	82	99	104	118	121	99	84
United States, 1995	84	94	102	118	124	99	82
Average 17, mid-1980s	92	105	105	114	109	86	78
Average 17, mid-1990s	91	100	104	117	112	88	78

Notes: For Australia, the group "adults" refers to age 26-65, and the group "younger senior citizens" to age above 65. For calculating relative income changes, population shares have been kept constant at the beginning of the period.

Source: OECD questionnaire on distribution of household incomes (2000).

the population average. The richest age group are individuals aged 41 to 50 (and indeed this is true within every country, other than the United States and Sweden). Beyond 65, average incomes are 10 per cent below the population average, falling to 20 per cent below average for those aged over 75.

However, the changes in this distribution have been significant. In nearly all countries people aged 41-50 have seen an increase in incomes relative to the average of all age groups between the mid-1980s and mid-1990s. Even more strikingly, in most countries, elderly age groups also benefited from changes in the income distribution, in particular those just before or just after retirement: relative incomes of those aged 51 to 65 increased by 3 percentage points on average, and relative incomes of those aged 66 to 74 increased 2 percentage points (falls in incomes beyond the age of 65 being found in Australia, Greece, Ireland, Mexico, the Netherlands and Turkey). However, relative incomes of those aged 75 and over increased by less, if at all.

In stark contrast, younger age groups lost ground during the past ten years: relative incomes of children decreased by approximately 1 percentage point, on average, and those of persons aged 18 to 25 by 5 percentage points. This latter development is linked to delayed labour market entry of younger people due to longer education periods and/or unemployment.

There are large differences in standards of living across different family types. Persons living in households with only one adult generally have lower relative incomes than those living in households with two or more adults (Table 4). The gap between the incomes of the two types of households has not become smaller over time. Lone parents have – by far – the lowest relative incomes, usually between half to two-thirds the level of the average income of the entire working-age population. Only in three Nordic countries, Austria and Greece did they have relative incomes above two-thirds of the average. Their income position relative to the rest of the population has declined in recent years in half the countries. Relative incomes of persons living in two-adult households with children did not move very much (except in Austria and Greece where they increased and in Mexico where they decreased). Those living in two or more adult households without children improved their income position in six countries, particularly in Mexico but lost ground in another four countries, particularly in Austria.

These patterns in the distribution of income are replicated to some extent when looking at poverty rates. Taking the average of all countries, people aged under 25 and over 65 have higher than average poverty rates. The only two countries in which poverty rates of *all* ages increased were the Netherlands and the United Kingdom, and relative poverty declined across all age groups in Australia. Elsewhere, the age profile of poverty has shifted. Overall, whereas the probability

Table 4. **Relative disposable incomes, by family types**

Average income of working-age population = 100

	Single adult, with children	Single adult, no children	Two adults, with children	Two adults, no children
Australia, 1984	53	99	92	131
Australia, 1994	57	92	93	129
Austria, 1983	63	93	95	121
Austria, 1993	87	85	98	110
Belgium, 1995	69	126	85	125
Canada, 1985	50	90	94	121
Canada, 1995	57	85	94	120
Denmark, 1983	61	77	101	113
Denmark, 1994	59	75	100	115
Finland, 1986	75	75	100	113
Finland, 1995	76	75	100	112
France, 1984	73	95	96	113
France, 1994	66	94	97	113
Germany, 1984	55	87	95	113
Germany, 1994	57	90	95	112
Greece, 1988	68	104	95	112
Greece, 1994	82	98	97	107
Italy, 1984	57	97	91	118
Italy, 1993	52	93	91	118
Mexico, 1989	75	133	87	151
Mexico, 1994	62	124	85	161
Netherlands, 1984	60	90	92	121
Netherlands, 1995	55	80	93	123
Norway, 1986	65	81	99	115
Norway, 1995	67	73	99	117
Sweden, 1983	76	77	101	126
Sweden, 1995	72	74	101	131
Turkey, 1994	65	107	91	169
United Kingdom, 1985	59	87	94	124
United Kingdom, 1995	51	92	93	127
United States, 1985	46	100	92	130
United States, 1995	49	99	93	127
Average 15, mid-1980s	62	92	95	122
Average 15, mid-1990s	63	89	95	121

Notes: Two adults refer to two and more adults. For calculating relative income changes, population shares have been kept constant at the beginning of the period.

Source: OECD questionnaire on distribution of household incomes (2000).

of the younger age groups being poor has been rising relative to the average since the mid-1980s, for the older age groups it has generally been declining (particularly in Canada, Denmark and France). At the same time, as already described, the number of people in the younger age groups has been declining and the number of older persons has been rising. As a result, despite a higher proportion of young people having low incomes, the proportion of poor people who are young has not changed much.

Child poverty has risen in about half of all countries, and declined in half. Child poverty has moved sharply up the political agenda in many countries, reflecting much greater concern about the effects of poverty in childhood on future life-chances. It is becoming relatively common for countries to set targets for reducing child poverty. Children are, in general, represented in the poor population as much as in the entire population. The exceptions are the four Nordic countries, with child poverty rates well below the average for the population, and Canada, Hungary, the Netherlands, the United Kingdom and the United States, where child poverty exceeds the average (Oxley *et al.*, 2001). There are some remarkable differences between countries. In Hungary, Italy, Mexico, Turkey, the United Kingdom and the United States persons in families with children have a considerably higher poverty risk than those families without children. The other extreme is Belgium and the four Nordic countries where *childless* families are more likely to experience poverty than families with children.

On average, single parents are represented three times as often in the poor population than in the working-age population as a whole. This over-representation has however been decreasing over time in about half the countries and this decline was especially notable in Australia, Canada, Germany and the four Nordic countries. Poverty rates of lone parents, however, remain high in almost all countries studied. In some countries (Canada, Denmark, Germany, Netherlands, United Kingdom) their poverty rates are as much as four times higher than for the total working age population. A remarkable exception is Sweden. In this country, poverty rates for persons living in single parent households fell significantly during the past 10 to 20 years, and are today at the same low level as for the entire population, and slightly lower than for the working-age population.

Whilst the *chance* of being poor varies sharply across groups, this information is not enough to give a full picture of poverty. Lone parents are particularly likely to be poor, but they remain a relatively small part of the poor population. Persons in families with children made up around one-third or less of the poor population in the four Nordic countries and Belgium, but a majority in the other countries, and more than 70 per cent in Hungary, Italy, Mexico, Turkey, the United Kingdom and the United States. Single parents account for 20 per cent to 25 per cent of the poor population in Australia, Canada, Denmark, the Netherlands, Norway and

the United States, and over one-third of those with low incomes in the United Kingdom. On the other hand their share is below 5 per cent in Greece, Italy and Mexico and negligible in Turkey.

DRIVING FACTORS OF CHANGING INCOME DISTRIBUTIONS

The distribution of income and the level of poverty can best be understood as being determined by two factors: differences in market income and the redistributive impact of fiscal and social policy. In policy discussions, most attention is given to the effects of taxes and transfers, *i.e.* how much governments take from one group and give to another. This is indeed of great importance, and there are large differences in the extent of this redistribution of income across countries. However, before looking at how government redistributes income, it is important to understand why it is that some groups have little income other than income transfers, and why others have sufficient incomes for governments to tax them for redistribution.

The analysis in the following two sections is confined to the working-age population, in order to abstract from changes that took place in shares of public and private pensions.⁶ These sections explore the extent to which shifts in components of disposable income (market income, transfers and taxes) and trends in employment concentration within and across households contributed to changes in income inequality. What is particularly interesting is that whereas governments have taken different approaches to redistribution over the past ten or 20 years (in some countries redistribution has increased, in others it has not), there is a common, underlying trend in the distribution of income *before* taxes and transfers towards increasing inequality.

Driving factors: I. Market incomes

Market income distribution

In many national studies, the distribution of market income has been described as widening, and gross earnings have been identified as the main contributor to increased overall income inequality. Table 5 confirms this picture. It shows the allocation market income and its two components – gross earnings and capital/self-employment income – across three income groups: the bottom three deciles (“lower incomes”), the four middle deciles (“middle incomes”), and the top three deciles (“higher incomes”). The shares of earnings and other market incomes going to the lower incomes are small: the poorest 30 per cent of the population receive between 6 and 12 per cent of total market income in most countries. While it should not be surprising that very few people in the bottom

Table 5. **Distribution of market income: proportion of different sources of income received by different income groups of the working-age population**

	Share of earnings, mid-1990s			Share of capital and self-employment income, mid-1990s			Share of total market income, mid-1990s		
	Poorest 30%	Middle 40%	Richest 30%	Poorest 30%	Middle 40%	Richest 30%	Poorest 30%	Middle 40%	Richest 30%
Australia	6.3	36.7	57.0	13.8	32.3	53.9	7.4	36.0	56.6
Belgium	7.4	38.8	53.8	7.2	16.0	76.7	7.4	33.8	58.8
Canada	9.2	36.7	54.1	11.2	29.3	59.5	9.6	35.5	54.9
Denmark	11.1	39.0	49.9	13.5	27.3	59.2	11.4	37.8	50.8
Finland	7.5	36.8	55.7	18.4	31.9	49.7	10.2	35.6	54.2
France	10.7	35.7	53.6	12.1	20.8	67.1	10.9	33.5	55.6
Germany	12.2	37.4	50.4	9.2	28.3	62.5	11.9	36.3	51.8
Greece	9.6	36.7	53.6	14.2	31.4	54.4	11.7	34.3	54.0
Hungary	8.5	34.0	57.5	8.8	22.6	68.6	8.6	32.0	59.4
Ireland	4.8	34.9	60.3	8.9	27.1	63.9	5.7	33.2	61.1
Italy	10.4	37.2	52.4	5.9	20.3	73.8	9.0	31.9	59.1
Mexico	5.3	24.8	69.9	9.1	22.7	68.2	6.4	24.1	69.4
Netherlands	9.9	38.3	51.8	10.8	30.7	58.6	10.0	37.1	52.8
Norway	11.6	41.0	47.4	8.7	21.2	70.1	11.0	37.3	51.7
Sweden	8.8	37.3	53.9	16.1	30.0	53.9	9.3	36.9	53.9
Turkey	12.3	35.5	52.2	6.0	18.2	75.8	8.0	23.9	68.1
United Kingdom	6.9	36.3	56.7	11.3	28.6	60.0	7.8	34.9	57.4
United States	8.9	35.1	56.0	9.2	26.2	64.6	8.9	33.9	57.1
Average (13)	9.0	37.2	53.8	11.2	26.4	62.4	9.3	35.3	55.4
Change mid-1980s to mid-1990s	-1.7	-0.5	2.2	-2.8	-0.7	3.5	-1.7	-0.6	2.3

Notes: Data for Greece, Hungary, Mexico and Turkey refer to market incomes net of taxes and are therefore not entirely comparable with the results from the other countries. They are excluded from the average.

For calculating the average of percentage point changes, Belgium has also been excluded due to lack of mid-1980s data. Income groups were built on the basis of final disposable adjusted income.

Source: OECD questionnaire on distribution of household incomes (2000).

deciles have much income from capital, it is striking that nearly one-third of the working-age population has so little income from labour. This suggests that barriers to working play a critical role in explaining low incomes, a linkage that is examined in greater detail below. In contrast, the richest 30 per cent of the population have something between 50 per cent and 60 per cent of all market income, the exceptions being Mexico and Turkey, where the richer part of the population commands an even greater share of market income.

Furthermore, the trend has been for the top 30 per cent of the population to receive an ever larger proportion of capital and labour income, the only exception being Ireland. At the same time, those with incomes at the bottom of the distribution have seen a relative decline in market income in all countries; and those in

the middle of the distribution in most countries, as well. Among market incomes, the dispersion of capital and self-employment incomes increased particularly rapidly, although country patterns are much more diversified than for earnings.

This pattern of a widening distribution of market income predates the mid-1980s, going back to the 1970s in many, albeit not all, countries. The *underlying* trend in the distribution of market income has been towards a widening. Whatever governments have been doing to taxes and transfers in order to make economies and societies more or less equal according to political preferences⁷ has been happening against this background of the richer groups getting relatively richer, and the poorer groups receiving relatively less income from their efforts in working or saving.

There have been some recent trends in the economy which have widened the distribution of market incomes. Unemployment was higher in most countries in the mid-1990s than in the mid-1980s and 1970s. Those with particularly valuable skills in the new economy have been able to command very high rates of remuneration. The rate of return on capital has been high in the 1990s. But these “explanations” are only part of the story. After all, unemployment may have been high, but because female employment had continued to rise, employment rates were nearly as high as they had ever been.

The main contributor to increased overall income inequality has been the distribution of gross earnings across households. The shares of earnings going to the lower income groups has fallen in practically all countries. In addition, capital and self-employment income has also become more unequally distributed, although because such income is small in comparison with earnings, the overall effects are less important.

The importance of the earnings distribution and employment polarisation

Talking about widened earnings distribution as the cause of widened market income distribution just pushes the key question back further: what has been causing the widening in the earnings distribution? An important part of the answer lies in the allocation of employment across and within households. “Work” is becoming more concentrated in some households. In other words, there are more households where all adults are working, more households where no adults are working, and fewer households where there is at least one adult working and one adult not working. This process – the simultaneous increase in both workless and fully employed households – has been described as a process of “employment polarisation” by Gregg and Wadsworth (1996). OECD (1998) found this process being at work in nine of 11 European OECD Member countries.

Table 6 divides the population where the head of the household is still of working-age into three groups: those where every adult who is present in the

Table 6. **Changes in households' employment concentration**
 Percentage point change in the distribution of working-age households

	Population shares		
	Fully employed	Workless	"Mixed"
Australia, 1984-1994	5.2	1.7	-7.0
Austria, 1983-1993	13.7	0.6	-14.4
Canada, 1985-1995	1.9	1.9	-3.8
Denmark, 1983-1994	-0.4	2.5	-2.0
Finland, 1986-1995	-0.8	4.1	-3.3
France, 1984-1994	4.1	1.1	-5.2
Germany, 1984-1994	0.1	1.4	-1.5
Greece, 1988-1994	8.4	-1.3	-7.1
Italy, 1984-1993	0.2	4.7	-4.9
Mexico, 1989-1994	5.7	0.8	-6.5
Netherlands, 1984-1995	14.4	1.6	-16.1
Norway, 1986-1995	2.0	4.8	-6.8
Sweden, 1983-1995	-1.2	3.4	-2.2
United Kingdom, 1985-1995	4.8	0.6	-5.4
United States, 1985-1995	3.1	-0.6	-2.5
Average change	4.1	1.8	-5.9
Average levels mid-1990s	64.7	9.8	25.5

Notes: "Fully employed households" are households in which all adult persons have an employment; "workless households" households in which no person has an employment; and "mixed households" two or more adult households with only one earner. Data refer to households with a head of working-age. Changes are percentage point changes.

Source: OECD questionnaire on distribution of household incomes (2000).

household is working; those where no adult in the household is working, and "mixed" households where one adult is working and the other adult(s) is (are) not. The share of those living in households where there is full employment increased in all but three of the 15 countries. The share of people in workless households also increased in most countries, and the share of persons in "mixed" households (those with two or more adult households with only one earner) declined in all 15 countries during the ten-year period. Overall, the evidence suggests that employment polarisation took place in ten countries. Exceptions are the Nordic countries, where the share of persons in fully-employed households slightly decreased and Greece and the United States, where the proportion of those in workless households decreased.

Of course, the *quantity* of work across households is only part of the story. The *wage rates* that people get when they work must be added to the equation in order to explain changes in earnings distribution. Here the story varies across countries. As described in OECD (1996), there has been little common trend across countries in wage rates of those in full time work. Large increases in earnings dispersion certainly

have taken place in some countries (the United Kingdom, the United States), but not in others (Canada, Finland, Germany). But of course trends in earnings are inextricably related to trends in employment. Low-skilled (low-wage) workers are much more likely to be without work than higher-skilled (high-wage) workers.

In order to assess the possible effects of employment concentration for trends in income distribution, aggregate changes in inequality can be decomposed into three parts,⁸ on the basis of the three employment groups (persons in fully employed, workless and “mixed” households):

- first, a “within group” inequality effect: if inequality in one of the three groups increases, overall inequality would increase, population shares held constant;
- second, a “between group” effect: if two groups had the same internal distribution, but the difference between the average incomes of the groups widens, overall inequality would increase, population shares held constant;
- finally, a “structural” effect, brought by the changing shares of each of the three groups in the population.

In ten of the 15 countries considered, the “within group” effect was the main contributor to changes in overall inequality, both up and downwards: Austria, Canada and Denmark for decreases in inequality, and Australia, Finland, Italy, Mexico, the Netherlands, Norway and the United Kingdom for increases. This means that in a majority of countries, changes in overall inequality were driven by increased (or decreased) income dispersion *within* different households’ employment categories. The effect of growing disparities *between* the three employment categories played a major role only in Germany and the United States, pushing overall inequality up. The structural effect, *i.e. changing shares* among the three employment categories, made a significant contribution to inequality reduction in France and Greece. This effect was also somewhat important in the Nordic countries, but playing an inequality-increasing role there.

Poverty rates for those living in households with two or more earners are very low (under 1 per cent of two-earner households in Austria, Belgium, Denmark, Germany, Norway and Sweden and under 6 per cent in all countries other than Mexico and Turkey, where the poverty rate exceeds 13 per cent) and these rates have been on a downward trend since the 1980s. On the other hand, poverty rates for those in workless households are very high – over 18 per cent in all countries other than Belgium and Denmark, and over 40 per cent in Canada, Germany, Ireland and the United States. The poverty rate of workless households has generally been increasing (but did actually decrease considerably in Australia, Denmark, Norway and Sweden). In most countries, people in workless households are represented three to five times as often in the poor population than they are in the total working-age population.

The importance of work in explaining income distribution and poverty changes can be seen as the primary cause of many changes in the relative income of particular groups. Why has the position of youths declined? At least in part because employment rates have declined. What explains the very low income of lone parents? The very low employment rates are often the key factor. Hence the striking result referred to above that lone parents in Sweden are not at greater risk of poverty than others in the population is explained mainly by the fact that a large majority of Swedish single parents are working: almost nine out of ten, whereas in most other countries the share of single parents who are working is between 50 and 70 per cent. Poverty rates for single parents who do not work are very high in all countries and, with the exception of Mexico, are at least twice as high as those for working single parents. In Canada, Germany, Italy, the United Kingdom and the United States, more than 60 per cent of non-working single parents are poor.

Driving factors: II. Transfers and taxes

Across the income distribution, most household income is market income – income which comes from work, or from the returns to investment. However, governments tax that income and distribute cash transfers, so altering *disposable* income. This is illustrated in Figure 2, which compares changes in the distribution of market incomes over the past ten years with changes in the distribution of disposable incomes. When juxtaposing these trends, it can be seen that in almost all countries the gains of the highest income quintile are substantially higher for market income than for disposable income. By contrast, market income shares for the lowest quintile (and most often for both lowest quintiles) declined substantially (exceptions being Ireland and, to a lesser extent, the United States). In a great majority of countries, the workings of tax/transfer systems resulted in disposable household incomes falling by less than the fall in market incomes for the lower quintiles, and in four countries the falling trend of market incomes actually was reversed (Australia, Canada, Denmark and France). However, in Italy and the Netherlands, both market and disposable income fell by the same amount for the lowest quintile and in Germany the income losses of the lowest quintile were higher after than before taxes and transfers.

(Re)distributive patterns of family and unemployment benefits

Benefit systems redistribute income. But they do not primarily redistribute from rich to poor. Rather, they redistribute from young to old, from those who work to those who do not, and from childless families to families with children. In most countries (Australia and New Zealand being exceptions), most benefits are based not on the income of the individual or family, but on the circumstances of the family and the individuals that make up the family more generally.

Figure 2. **Gains and losses by income quintiles: market income and disposable income**
Working-age population, mid-1980s to mid-1990s

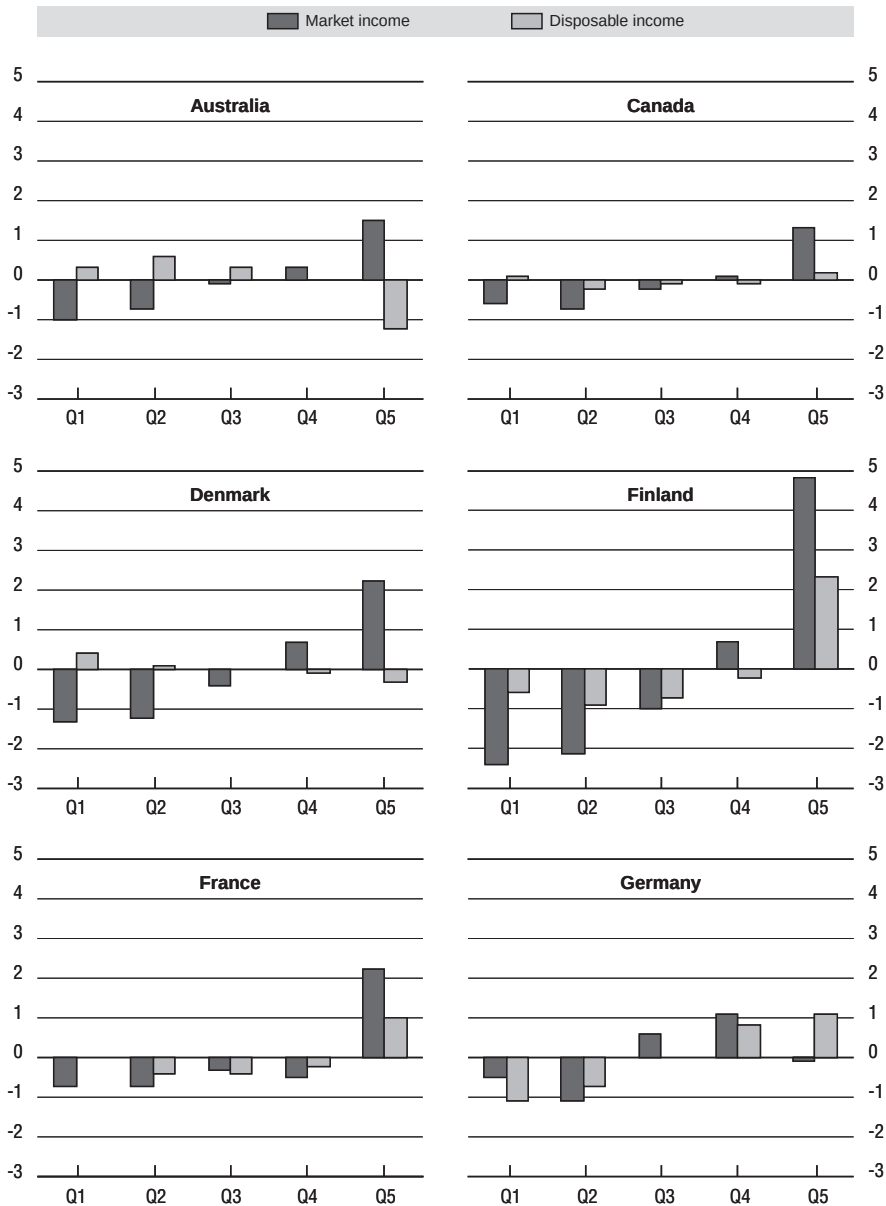


Figure 2. **Gains and losses by income quintiles: market income and disposable income** (*cont.*)

Working-age population, mid-1980s to mid-1990s

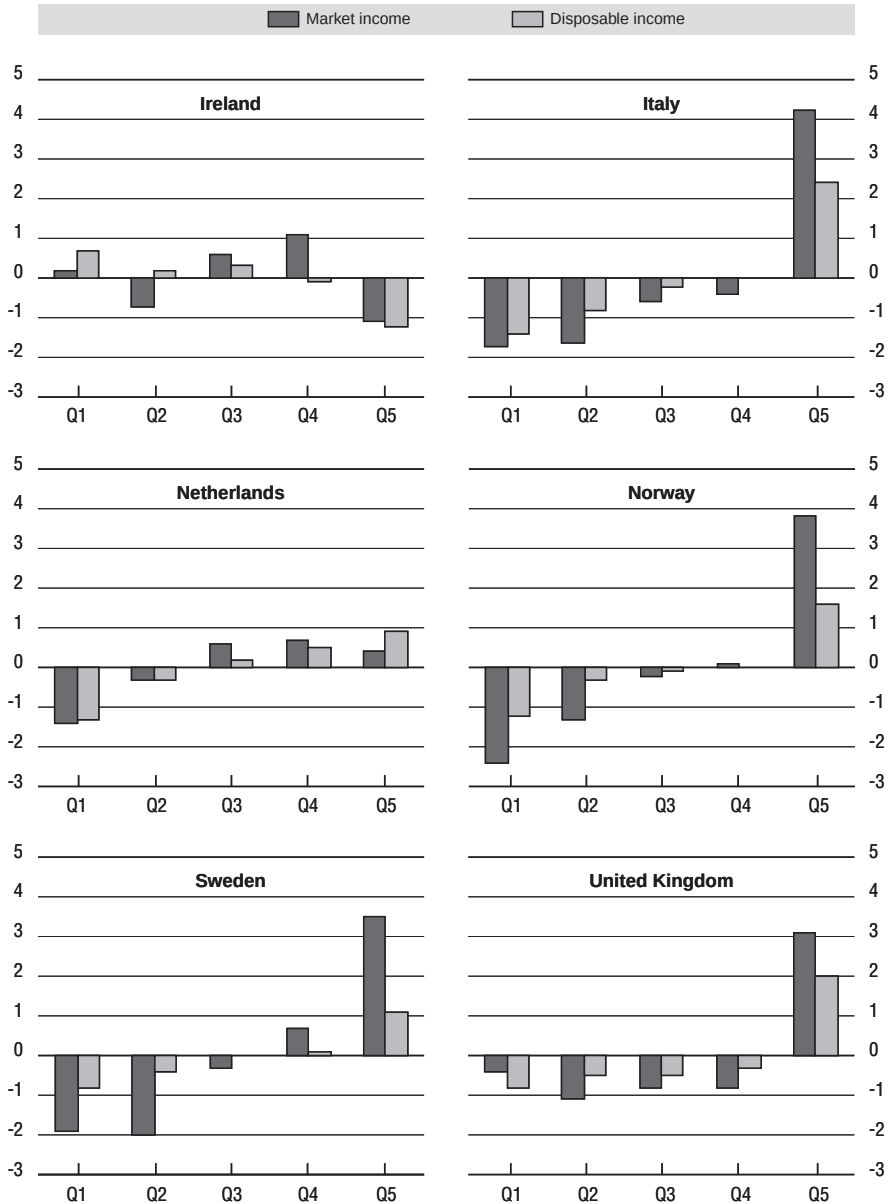
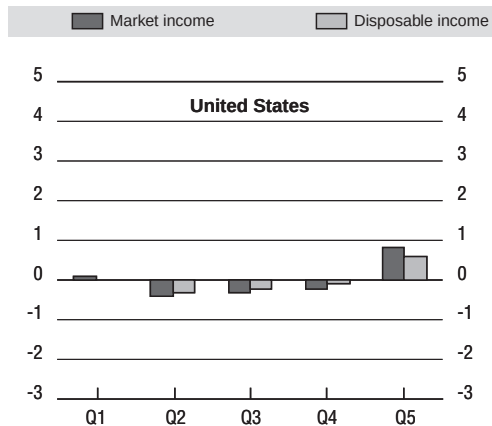


Figure 2. **Gains and losses by income quintiles: market income and disposable income (cont.)**

Working-age population, mid-1980s to mid-1990s



Note: Q1 corresponds to the lowest income quintile, Q5 to the highest income quintile. Quintiles were built on the basis of final disposable adjusted income. Changes are in percentage points and sum up to 0.

Source: OECD questionnaire on distribution of household incomes (2000).

Even so, the distribution of non-pension transfers altogether was slightly progressive in all OECD countries studied in the mid-1990s – progressive in the sense that higher transfer shares are going to poorer than to richer income groups. In most countries, between one-third and 40 per cent of those transfers went to the lower income groups in the working-age population (bottom three deciles), and between 20 per cent and 25 per cent to the higher income groups (top three deciles). The progressive pattern was stronger in Australia, Ireland, the United Kingdom and the United States where 50 to 60 per cent went to the lower income groups, and only 10 to 20 per cent to the higher incomes. All these countries rely on means-tested benefits to a greater extent than most other countries, so this pattern is not surprising – it simply confirms the effect of these policies in restricting benefit entitlements of higher-income groups.

Non-pension transfers in particular have become more progressively distributed over the past ten years: this has happened in 12 of the 16 countries where such data are available. In ten of those countries, the lower three deciles of the income distribution were the sole beneficiaries of this trend, and in two Nordic countries – Finland and especially Sweden – middle-income groups also benefited from this trend in distribution. In two Southern European countries – Greece and Italy – the middle-income classes benefited considerably from these changes

at the expense of both lower- and higher-income groups. Canada and, in particular, the United States stand apart. In these countries a change towards a less progressive distribution of non-pension transfers among the working-age population took place.

Förster and Pellizzari (2000) compared the distributional patterns of two of the most important benefits among non-pension transfers: family cash benefits, and unemployment benefits.⁹ For *family cash benefits*, two groups of countries emerge:

- Australia, Canada, Denmark, France, Ireland, the Netherlands, the United Kingdom and the United States all show a progressive distribution of family cash benefits; moreover, most of these countries (the exceptions being Denmark, the Netherlands and the United States) also clearly moved towards a more progressive distribution during the last decade;
- in Austria, Belgium (data for 1995 only), Finland, Hungary, Norway and Sweden in the mid-1980s, family cash benefits seemed to be distributed more equally across the income distribution with an emphasis on the middle class; a distributional pattern sometimes described as “targeted to the middle classes”. However, Hungary moved towards a progressive pattern in the 1990s.

By 1995, in all countries considered except Belgium, the proportion of family benefits going to the bottom three deciles was higher than the proportion going to the top three income deciles. Family benefits, therefore, played a role in the redistribution of incomes to lower segments among the working-age population.

As to *unemployment benefits*, the country patterns are different:

- unemployment benefits show a clear progressive pattern in seven countries: Australia, Austria, Belgium, Finland, Hungary, Ireland and the United Kingdom. In Hungary, they became considerably more progressively distributed over the years, while their distribution became somewhat less progressive in the United Kingdom. In Ireland, changes favoured lower middle and middle income groups and in Australia and Finland, no significant change occurred;
- in the remaining seven countries, unemployment benefits are almost equally distributed across income groups of the working-age population. This is particularly the case in the Netherlands. In Canada, Norway, Sweden and, to a lesser degree, Denmark, the distribution of unemployment benefits showed some signs of a “targeting to the middle class”. And in France and the United States, the distribution of these benefits moved from such a pattern to a slightly regressive one.

Taken together, family cash benefits seemed to be a more important tool for redistributing incomes from higher to lower segments than unemployment benefits in Canada, Denmark, France, the Netherlands and the United States, whereas the inverse was the case in Austria, Belgium, Finland and Hungary. In Australia, Ireland and the United Kingdom, both benefits played an important redistributive role. Only in Norway and Sweden were both benefits more middle-income class oriented. This has to be seen against the background that, in a majority of the countries considered here, the prime aim of those benefits is not a redistribution of incomes towards lower income groups but the maintenance of the income status in case of child rearing and compensation for loss of employment, regardless of income status.

Overall effects of tax/transfers among the working-age population

Just because a benefit system is proportional (in the sense that benefits are equally distributed across the population) does not mean that it plays no role in redistributing income. Poor households (by definition) have less other income than richer ones, so the higher is the level of a benefit, the greater will be the reduction in inequality, even if everyone receives exactly the same amount of benefit. It follows that just because a benefit system is not particularly targeted on the poor, it cannot be concluded that the effects on poverty are necessarily small.

Table 7 summarises the distribution of all benefit payments taken together, together with tax payments and social security contributions of employees across the income distribution of the working-age population. *On average* the bottom 30 per cent of the population do get more than 30 per cent of total benefit payments, but not by much. The top 30 per cent of the population get, on average, over 25 per cent of all benefits. In other words, the benefit system does not have a very different effect on final income inequality from paying everyone in the population a fixed amount of benefit, regardless of income level.

Of course, averages hide a lot of cross-country variation. Australia, the United Kingdom, the Netherlands, Ireland and some of the Nordic countries target payments towards the poorer end of the distribution to a much greater extent than Austria, Hungary, Italy and Greece, where the poorest 30 per cent of the population receive less than 30 per cent of all benefit payments. In Turkey and Mexico, benefits are even more likely to be targeted towards richer groups, reflecting “dual” labour markets – individuals have to be in the “modern” sectors of the economy to qualify for social insurance.

Taxes, on the other hand, are very strongly related to income. Of course, this is not the full story as regards taxes – the figures in the table exclude consumption taxes and social security contributions paid by employers, both of which bear much more heavily on lower income groups than the personal income taxes and

Table 7. **Redistribution by government: proportion of total transfers (taxes) received (paid) by different income deciles of the working-age population**

	General government transfers			Taxes		
	Poorest 30%	Middle 40%	Richest 30%	Poorest 30%	Middle 40%	Richest 30%
Panel A: Distribution of benefits received and taxes paid						
Australia, 1994	62.3	31.1	6.5	3.7	31.1	65.1
Austria, 1993	26.8	40.9	32.3	..	..	..
Belgium, 1995	36.0	41.6	22.5	3.9	32.6	63.5
Canada, 1995	41.5	37.7	20.8	6.2	33.4	60.4
Denmark, 1994	43.4	38.9	17.7	14.1	37.2	48.7
Finland, 1995	43.2	40.4	16.4	9.8	33.4	56.8
France, 1994	35.6	39.3	25.1	8.7	23.5	67.9
Germany, 1994	31.7	37.6	30.7	10.0	36.5	53.6
Greece, 1994	20.9	37.7	41.5	..	..	..
Hungary, 1997	28.7	42.8	28.5	..	..	..
Ireland, 1994	47.1	38.1	14.8	3.3	30.3	66.4
Italy, 1993	20.5	45.0	34.5	6.7	31.0	62.3
Mexico, 1994	13.7	27.2	59.1	..	..	..
Netherlands, 1995	45.8	36.1	18.1	11.7	36.1	52.2
Norway, 1995	45.1	36.6	18.3	10.2	36.1	53.8
Sweden, 1995	33.7	40.5	25.8	11.0	35.8	53.3
Turkey, 1994	15.2	40.2	44.6	..	..	..
United Kingdom, 1995	54.5	33.9	11.7	6.0	32.0	62.0
United States, 1995	41.4	35.5	23.0	6.3	28.4	65.3
Average level	36.2	37.9	25.9	8.0	32.7	59.4
Panel B: Changes in redistribution, mid-1980s to mid-1990s, percentage points						
Australia, 1984-1994	4.2	-0.3	-4.0	-6.6	-3.1	9.8
Austria, 1983-1993	2.3	-0.3	-2.0	..	..	..
Canada, 1983-1994	-0.3	-0.6	0.9	-0.8	-0.7	1.4
Denmark, 1983-1994	5.1	-1.4	-3.7	0.2	-2.2	2.0
Finland, 1986-1995	2.2	1.5	-3.8	-1.1	-1.0	2.1
France, 1984-1994	2.3	0.8	-3.1	-3.8	-2.3	6.1
Germany, 1984-1994	-2.2	0.9	1.3	-1.1	2.9	-1.9
Greece, 1988-1994	4.1	1.8	-5.9	..	..	..
Hungary, 1991-1997	-1.4	0.7	0.7	..	..	..
Ireland, 1987-1994	4.8	-2.9	-1.9	-0.5	-0.5	1.0
Italy, 1984-1993	-5.4	3.3	2.1	-4.1	-1.1	5.2
Mexico, 1989-1994	8.7	-0.5	-8.2	..	..	..
Netherlands, 1985-1995	5.0	-2.2	-2.8	-1.7	0.6	1.1
Norway, 1986-1995	3.2	-1.3	-2.0	-2.9	-1.8	4.6
Sweden, 1983-1995	1.3	0.6	-1.9	-1.3	-0.7	2.0
Turkey, 1987-1994	1.2	-1.6	0.4	..	..	..
United Kingdom, 1985-1995	0.4	1.3	-1.7	-1.3	-3.7	5.0
United States, 1985-1995	-2.0	-0.6	2.6	1.0	-1.4	0.4
Average change	1.8	0.0	-1.7	-1.7	-1.1	2.8

Notes: General government transfers include all public cash transfer benefits. Taxes include all direct income taxes, including employees social security contributions. Income groups were built on the basis of final disposable adjusted income.

Source: OECD questionnaire on distribution of household incomes (2000).

employee social security contributions which are included. But nevertheless, it is readily apparent that taxes have a great effect in equalising incomes across households.

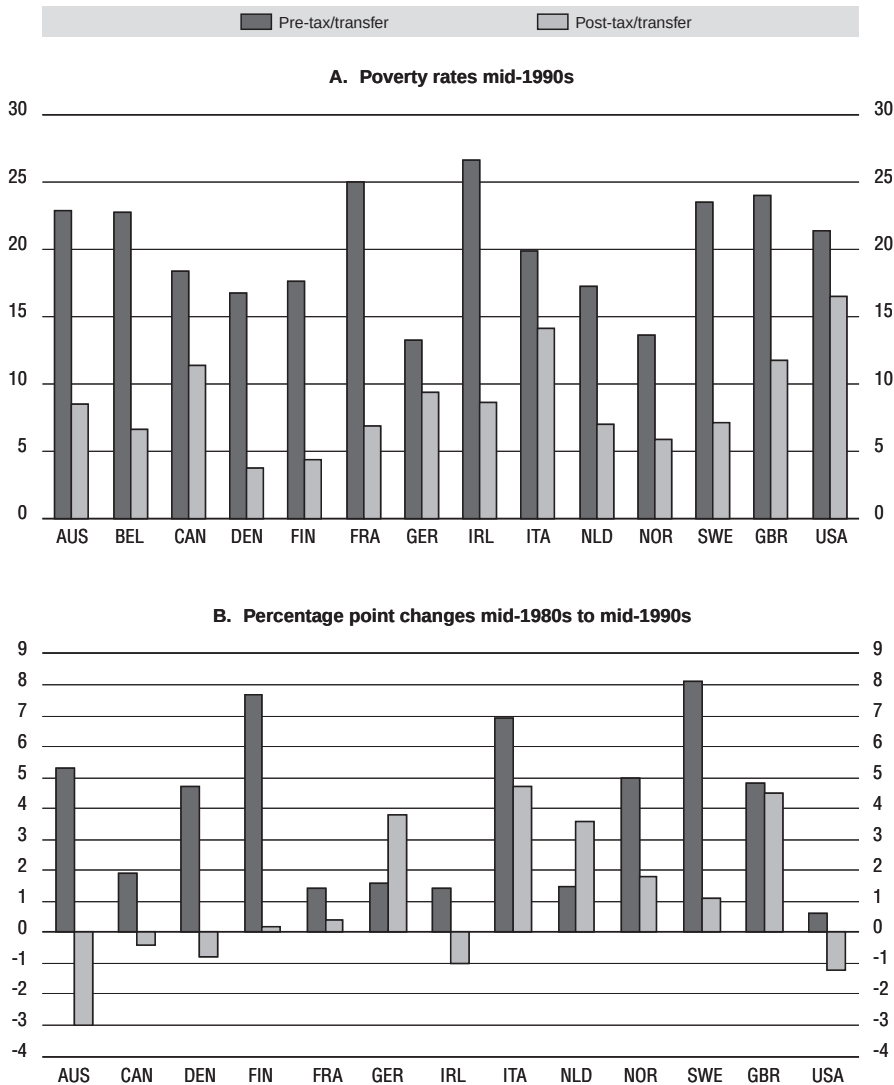
The trend has been towards a greater share of taxation being paid by higher income groups. This is *not* the same as saying that there is greater progressivity in the tax system than previously. In fact, if compared with changes in the distribution of market income, only in Australia, France, Ireland and the United Kingdom has the share of taxes paid by the top 30 per cent gone up significantly *more* rapidly than market income. In the Nordic countries, the increases in taxes paid by the upper income groups was less than the increase in their market incomes – in other words, their average tax rate fell relative to lower income groups.

The analysis above referred to the distribution of a given overall level of non-pension transfers among the working-age population. However, although a specific transfer might be distributed more progressively in one country than in another, its weight for the lower income groups might be higher in another country because of a higher overall level of this transfer. An equally important question therefore concerns the relative importance of those transfer payments in the disposable incomes of lower, middle and higher income groups. Förster and Pellizzari (2000) analysed non-pension transfer shares in the disposable income of income groups. Those shares rose for the working-age population as a whole in the last ten years, from below 10 per cent on average, to 11.4 per cent. The increase for the lower income groups, however, was much stronger: it varied on average across the countries from around one-quarter of their disposable income to around one-third. Those increases were recorded in *all* countries but were strongest in the four Nordic countries (where more than 10 percentage point increases were recorded). This underlines the growing importance of non-pension transfers for lower income groups of the working-age population.

Poverty alleviation through taxes and transfers

Results from earlier analysis based on a smaller sample of five OECD countries (Burniaux *et al.*, 1998, Oxley *et al.*, 1999) showed that tax/transfer systems reduced substantially aggregate poverty rates in those countries. This is confirmed by the results from the present analysis, which are available for 14 countries and which consider poverty among the working-age population. Whereas poverty rates based on pre-tax and transfer incomes amounted to between 14 and 26 per cent in the countries studied, post-tax and transfer rates were considerably lower – between 4 and 17 per cent. Furthermore, this effectiveness tended to strengthen in a majority of countries as is shown in Figure 3. While pre-tax/transfer poverty rates rose in all countries, on average by more than 3 percentage points, post-tax/transfer poverty rates fell in half the countries and

Figure 3. **Poverty rates before and after taxes and transfers, working-age population**



Note: Poverty rates defined as number of persons in households below 50 per cent of median adjusted disposable income in per cent of the total population. Taxes include all direct income taxes including employees social security contributions. Transfers include all public cash transfer benefits.

Source: OECD questionnaire on distribution of household incomes (2000).

decreased by less than the pre-tax/transfer poverty rate in the others, except in Germany and the Netherlands. Absolute rates of reduction in poverty were higher in Australia, Belgium, France, Ireland and the Nordic countries (Norway excepted), and lower in Canada, Germany, Italy and the United States.

Driving factors: III. Underlying demographic changes

Putting the two pieces of the equation together – trends in market income and trends in government tax and transfer policy – gives most of the information necessary to understand the overall picture of income distribution. One last piece of the jigsaw puzzle remains to be inserted: changes in the demographic structure of the population.

There are considerable differences between countries and country groups as to the *levels* of these shares: in the Nordic and the Continental European countries, children are 20 per cent of the population; in the Anglo-Saxon countries, they account for around 25 per cent, and in Mexico and Turkey the share of children in the population is much higher, around 40 per cent.

At the same time, there have been very large changes in the structure of populations in OECD countries. In nearly all countries, the proportion of children in the total population decreased from the mid-1980s to the mid-1990s, on average by some 2 percentage points.¹⁰ Similarly, the share of young people – those aged 18 to 25 – fell in most countries, on average by 1 percentage point. On the other hand, the proportion of persons aged 65 and over increased in all countries but Sweden, on average by over 1 percentage point (Förster and Pearson, 2000).

The changes do not stop there. The fewer children are much more likely to be in households where there is only one adult – the proportion of lone parent families has been increasing. In the Anglo-Saxon countries and the Nordic countries, between 10 and 20 per cent of those households with children live in lone parent households. In the Continental European countries their share is just below 10 per cent, and in the Southern European countries, Turkey and Mexico, below 5 per cent. The proportion of children who are in lone parent households rather than households with two or more adults has also been rising, and is around 25 per cent of the total in Sweden. Within the working-age population, fewer people live in households without children than in households with children, but their share increased from one-third to almost 40 per cent in the ten years from the mid-80s to the mid-90s.

Furthermore, mainly as a consequence of population ageing (but also reflecting an increased preference for living alone among younger age groups), the average household size has also been falling for the last ten to 20 years throughout the OECD area, and is close to being just two people in some of the Nordic

and Continental European countries. The average household size is closer to three in the Southern European countries and still above four in Mexico and Turkey.

Such changes may not sound very significant. In fact, taken together they amount to a huge change in the structure of the population, in many countries to an extent unprecedented in recent times outside of war, famine or epidemic. Here, it is worth noting simply that these demographic trends *directly* affect trends in inequality. If older people have less income than younger people, then as there are more of them in the population, so income distribution will apparently widen. Similarly, if small households are poorer than large ones, so will the trends described above lead to a stretching out of the income distribution, regardless of whether the average income of small households is changing relative to larger ones.

CONCLUSIONS: 12 STYLISTED FACTS ON TRENDS IN INCOME INEQUALITY AND POVERTY

Overall distributional trends and movements at the bottom

- i) There has been no generalised long-term trend in the distribution of disposable household incomes since the mid-1970s. However, during the more recent period (mid-1980s to mid-1990s), income inequality has increased in at least half the countries, while none of the remaining countries recorded an unambiguous decrease in inequality.
- ii) There is no trend towards a “hollowing out” of the income distribution at the expense of the middle-income class. Simultaneous gains of both the lower and higher incomes relative to the middle incomes occurred in only a few countries (Belgium and, marginally, France and the United States during the past decade, and Canada and Finland over the last 20 years).
- iii) Relative poverty rates have remained broadly stable over the last ten years. Some countries have, however, experienced declines (in particular Belgium and Denmark) and some others increases (in particular Italy and the United Kingdom). Poverty rates based on constant thresholds fell in most of the countries in which real incomes increased.

Changes in relative positions of specific social groups

- iv) In those countries where inequalities increased, this happened mostly among the working-age population, whilst there were fewer changes among the retirement-age population.

- v) Changes in income distribution in the past ten years generally favoured the prime-age and elderly age groups, particularly those around retirement age. Younger age groups lost ground, in particular those aged 18 to 25, reflecting delayed labour market entry. Similarly, poverty rates for the elderly fell in all but four countries, youth poverty rates increased, and child poverty rates increased slightly in a number of countries.
- vi) Relative income levels of single parents and persons in workless households are very low and have worsened in a number of countries.

Driving factors

- vii) Market income inequality has widened in every country. The increased dispersion from gross earnings has been the main cause. A variety of factors have explained this, in turn, increased inequality in earnings themselves and a trend towards “employment polarisation” in many countries, leading to a simultaneous increase in “work-rich” and “work-poor” shares of households.
- viii) Capital and self-employment incomes are distributed more unequally than earnings. However, as their share in total disposable income is lower, their contribution to levels and, in most cases, changes in overall inequality is less important than that of earnings (with the notable exception of Italy).
- ix) Joblessness is the main cause of poverty.

Distributional effects of public transfers and taxes

- x) The effectiveness of taxes and transfers in reducing inequality and poverty has increased. As a result, the increase in market income inequality was not, or not entirely, translated into higher inequality of disposable incomes for the working-age population.
- xi) Targeting of benefits has increased. The shares of family cash benefits and/or unemployment benefits going to lower income groups among the working-age population increased in a majority of countries.
- xii) Non-pension transfers form an increasingly large part of the income of low-income households among the working-age population in all countries.

NOTES

1. The full analysis upon which this article is based is reported in Förster and Pellizzari (2000).
2. "Household income" is often used synonymously with "household resources". It is not: households have access to goods and services provided to them at no cost by the state; indirect taxes affect the purchasing power of a given amount of resources; barter, charity and mutual exchange between and within families play a greater or lesser role in different countries. The absolute level of measured income inequality or poverty, however interesting, cannot be used to make reliable cross-country comparisons. But *trends* in income distribution and poverty, if measured on a comparable basis, do permit a number of key findings to be drawn from the analysis.
3. The data for Hungary refer to the period 1991 to 1997.
4. This country experienced a deep recession at the beginning of its economic transition (between 1990 and 1993/94) during which real incomes fell for the population as a whole. At the same time, the distribution of those incomes flattened slightly.
5. This means that other dimensions, such as benefits in-kind, consumption, wealth, deprivation or social exclusion have not been taken into account for the analysis (for a conceptual discussion of using different criteria and methods in the frame of international comparisons, see Förster, 1994).
6. As public transfers are the main component of income for retired persons in most OECD countries, an increasing transfer share in the incomes of the entire population, and effects on inequality, might simply reflect the increased share of pensioners in the population.
7. It should be noted that governments' redistribution is not only confined to taxes and transfers but also influences market distribution directly, *e.g.* via minimum wage policies.
8. Förster and Pellizzari (2000) used the MLD as the summary inequality index which allows for this decomposition. Overall trends on the basis of the MLD differ somewhat with respect to results obtained from other indicators (see annex). For the methodology of the decomposition, see Burniaux *et al.* (1998).
9. Other cash transfers going to the working-age population, such as housing benefits or social assistance payments have not been included in the detailed analysis because information was often not available separately; lumped together, these "other" transfers constitute approximately 10 to 20 per cent of all non-pension transfers in most countries (30 per cent in Sweden and the United Kingdom).
10. Exceptions were Germany, Sweden, the United Kingdom and the United States.

Annex

TREND IN FOUR INCOME INEQUALITY INDICATORS FOR THE ENTIRE POPULATION

	Levels		Absolute change ¹							
	Gini coefficient mid-90s	P90/P10 decile ratio mid-90s	Gini		Decile ratio		SCV		MLD	
			A	B	A	B	A	B	A	B
Australia	30.5	3.9	2.1	-0.7	0.2	-0.4	3.2	1.2	1.8	0.5
Austria	23.8	3.0	..	0.2	..	0.1	..	1.4	..	-0.2
Belgium	27.2	3.2	..	1.2	..	0.0	..	9.1	..	0.4
Canada	28.5	3.7	-0.8	-0.4	-0.6	-0.2	4.0	0.7	-2.5	-1.0
Denmark	21.7	2.7	..	-1.1	..	-0.2	..	0.4	..	-1.5
Finland	22.8	2.8	-2.8	2.1	-0.5	0.1	-3.7	7.8	-3.0	1.2
France	27.8	3.4	..	0.3	..	0.1	..	6.9	..	-0.8
Germany	28.2	3.7	..	1.7	..	0.4	..	-2.2	..	1.6
Greece	33.6	4.7	-7.7	0.0	-2.1	-0.2	-47.9	1.1	-11.5	-0.4
Hungary	28.3	3.4	..	-0.9	..	-0.2	..	1.2	..	-2.9
Ireland	32.4	4.2	..	-0.6	..	-0.1	..	32.0	..	-3.0
Italy	34.5	4.6	..	3.9	..	0.8	..	18.1	..	6.7
Japan	26.5	3.3	-1.4	1.2	-0.1	0.2	-5.8	5.3	-1.0	1.5
Mexico	52.6	11.3	-2.0	2.3	-3.9	1.8	20.8	-28.9	-5.0	-6.4
Netherlands	25.5	3.2	0.7	2.1	0.1	0.4	2.7	2.5	0.6	2.3
Norway	25.6	3.0	..	2.2	..	0.1	..	2.3	..	3.1
Sweden	23.0	2.7	-1.6	1.4	-0.2	0.1	-2.1	8.0	-1.8	2.0
Switzerland	26.9	3.1	..	..	..	..	..	..	..	..
Turkey	49.1	6.8	..	5.6	..	0.3	..	..	..	..
United Kingdom	31.2	4.1	3.8	2.5	0.5	0.5	10.3	8.6	3.1	3.0
United States	34.4	5.5	2.7	0.4	0.8	-0.2	7.7	1.2	3.2	0.5

Notes:

A = Mid-70s-mid-80s.

B = Mid-80s-mid-90s.

For Hungary, the period refers to 1991-1997.

1. Absolute change is the difference in the value of the index.

Source: OECD questionnaire on distribution of household incomes (2000).

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INVESTMENT IN HUMAN CAPITAL THROUGH UPPER-SECONDARY AND TERTIARY EDUCATION

Sveinbjörn Blöndal, Simon Field and Nathalie Girouard

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INTRODUCTION

Human capital is an important determinant of individuals' earning capacity and employment prospects, and therefore plays an important role in determining the level and distribution of income in society. Recent OECD work has confirmed the importance of investment in education as a determinant of economic growth¹ and education is also found to be associated with various non-economic benefits.² Across countries, there is a broad consensus that some degree of government involvement is needed in the provision of educational services. All OECD countries seek to ensure that all young people enter working life with a minimum amount of human capital acquired during the years of compulsory education. However, governments are also heavily involved in the financing and delivery of post-compulsory education where large returns may accrue to the individual and where participation is by choice. This element of discretion highlights the importance of incentives, raises certain equity issues and indeed questions about the appropriate role of government in the provision of such education and training.

This paper examines various efficiency and equity aspects of post-compulsory education.³ The next section assesses current incentives for young people to participate in upper-secondary and tertiary education⁴ immediately following compulsory schooling and the extent to which these incentives are aligned with the returns to society. The following section discusses some equity issues related to post-compulsory education. The final section concludes with some policy implications of the findings reported in the paper.

THE BENEFITS OF POST-COMPULSORY EDUCATION FOR INDIVIDUALS

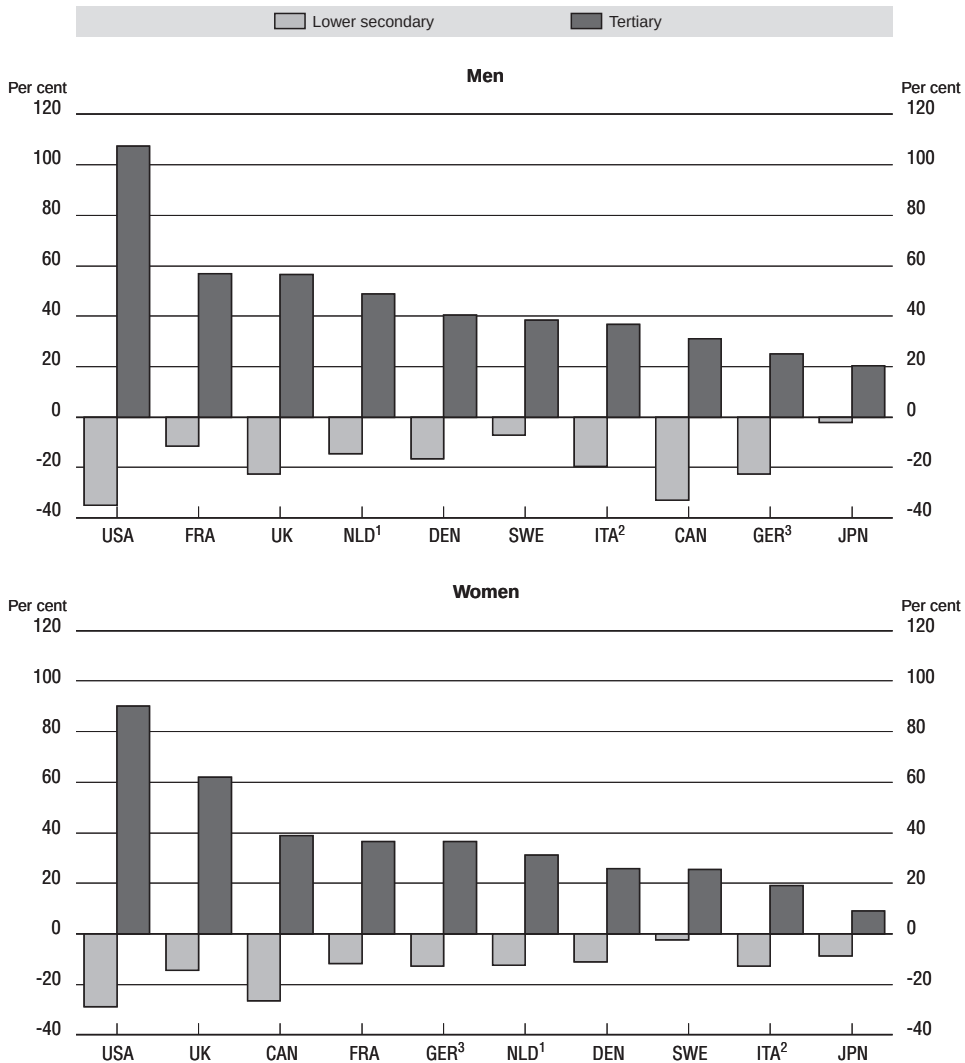
Labour market benefits of additional human capital for individuals

The education wage premium

An important motivation for individuals to invest in education is that the acquired knowledge and skills tend to raise productivity and hence earnings potential. Figure 1 shows that the pre-tax wage premium (post-tax premium in the case of Italy) earned by tertiary graduates is substantial in all countries considered, and particularly high in the United States, France and the United Kingdom. Investment

Figure 1. **Relative earnings of full-time workers by gender and level of educational attainment, 1999/2000**

Per cent deviation from mean earnings at the upper secondary level



Note: Countries are ranked in descending order in terms of the tertiary earnings progression. Wage premia are not standardised for different age and seniority compositions of educational groups across countries.

1. 1997.

2. Annual post-tax earnings.

3. 1998.

Source: National statistical institutes. See Appendix.

in upper-secondary education is also associated with significant wage premia over lower-secondary education, especially in the United States and Canada. This wage pattern is broadly the same for both men and women, although education wage premia tend to be somewhat smaller for women. Some research indicates that changes in the distribution of non-wage benefits tend to reinforce rather than offset observed wage differentials by education level.⁵

In several countries, the pre-tax education wage premium has tended to rise since the early 1980s, suggesting that the significant expansion in the relative supply of educated workers (reflecting fast increases in post-compulsory school enrolment) has failed to keep up with an even stronger increase in relative demand.⁶ There has been a notable decline in the wage of the lower educated relative to more highly educated workers in the United Kingdom, the United States and to a lesser extent in Canada and Sweden. By contrast, wage relativities by educational level have been stable in Japan, Germany and France.⁷

Average wages for broad education groups mask significant dispersion within each group. Indeed, for the two countries depicted in Figure 2, the wage distributions for the three main attainment groups overlap over large ranges, implying that a proportion of individuals receives similar earnings irrespective of their different educational qualifications. The earnings distribution of tertiary-educated persons is particularly wide, reflecting the heterogeneity of tertiary education. For example, arts degrees are typically associated with lower earnings than engineering and science degrees. By contrast, the log-normal earnings distribution for those with lower-secondary education only is much more compressed around a low median.

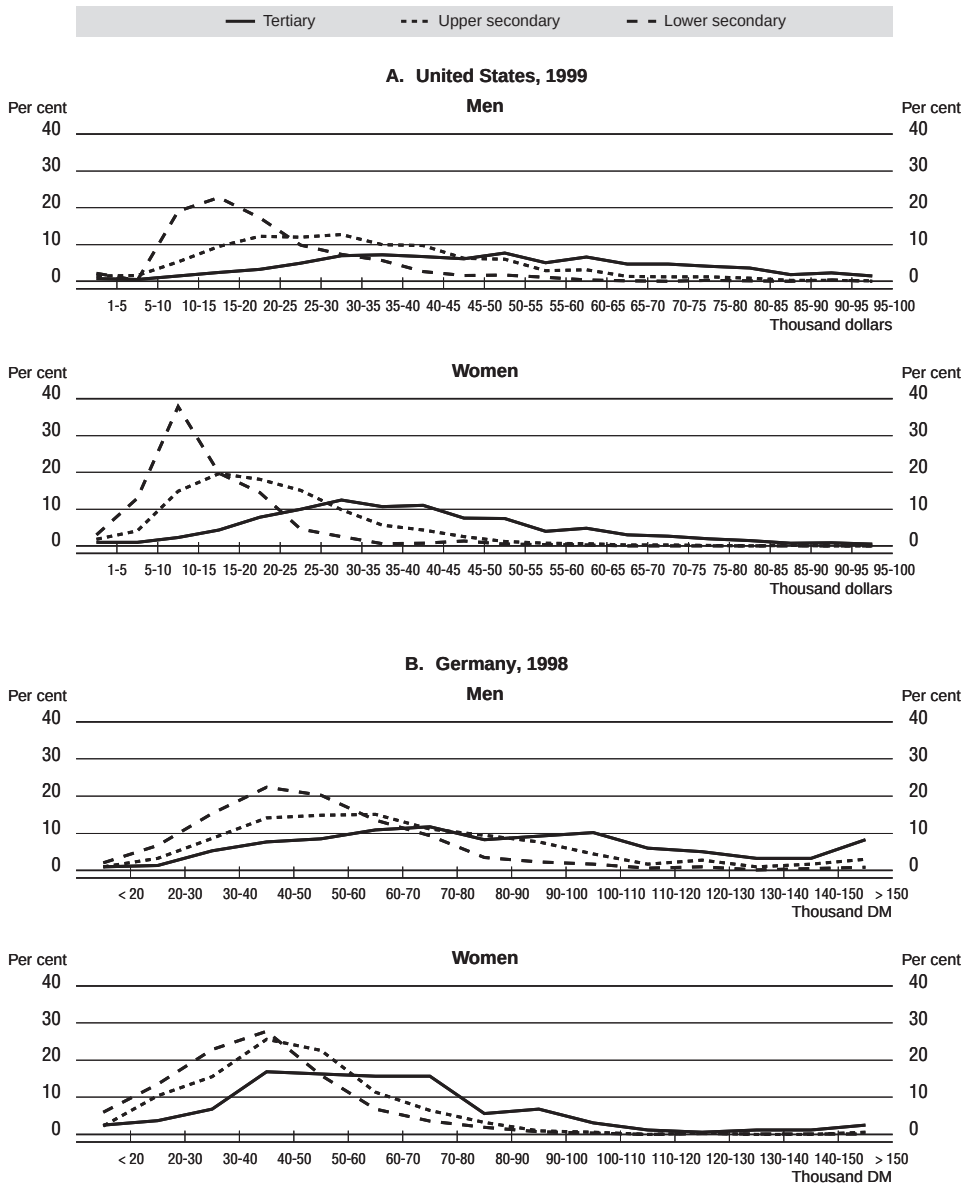
Wage structure by age

Education appears to provide not only an initial earnings advantage but also a wage premium that increases with time spent in the labour market. Figure 3 suggests that in most countries the earnings of tertiary-educated men and women increase more sharply with age than is the case for less-educated workers.⁸ The main exception is Japan where all educational groups register a decline in earnings towards the end of their careers.⁹ The progression of women's earnings towards the end of their working lives is somewhat smaller than for men in some countries which could reflect greater obstacles for them to reach higher levels in the job hierarchy (Blau and Kahn, 2000).

Unemployment risks across different education groups

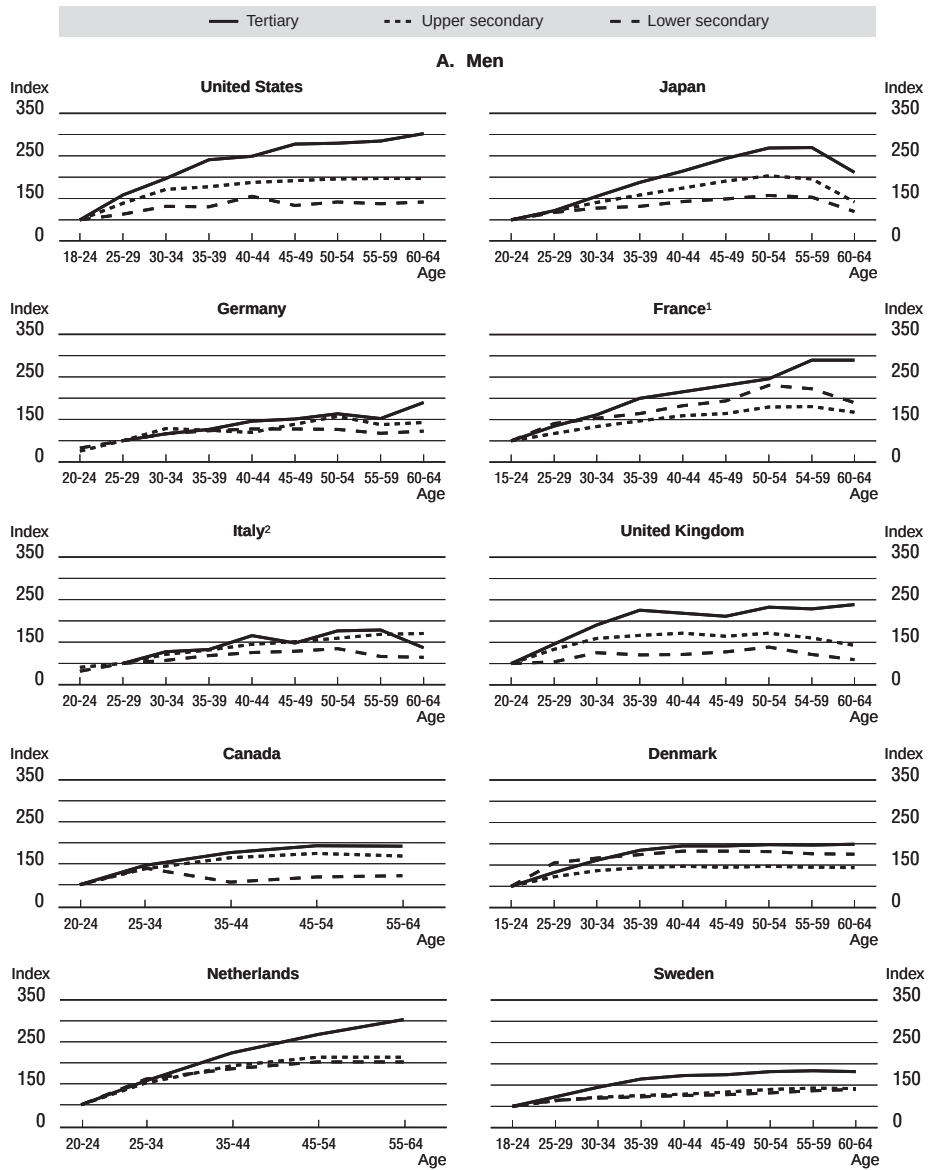
A further important motive behind acquiring more education is to gain a stronger foothold in the labour market and thus lower the risk of unemployment. The reduction in risk is particularly large for those investing in upper-secondary education, whereas the gap in unemployment rates between upper-secondary and university-educated workers is comparatively small (Figure 4). The difference

Figure 2. Distribution of annual earnings of full-time workers in the United States and Germany



Source: Current Population Survey, Bureau of the Census; German Socio-Economic Panel (unweighted sample).

Figure 3. The structure of earnings by age and gender

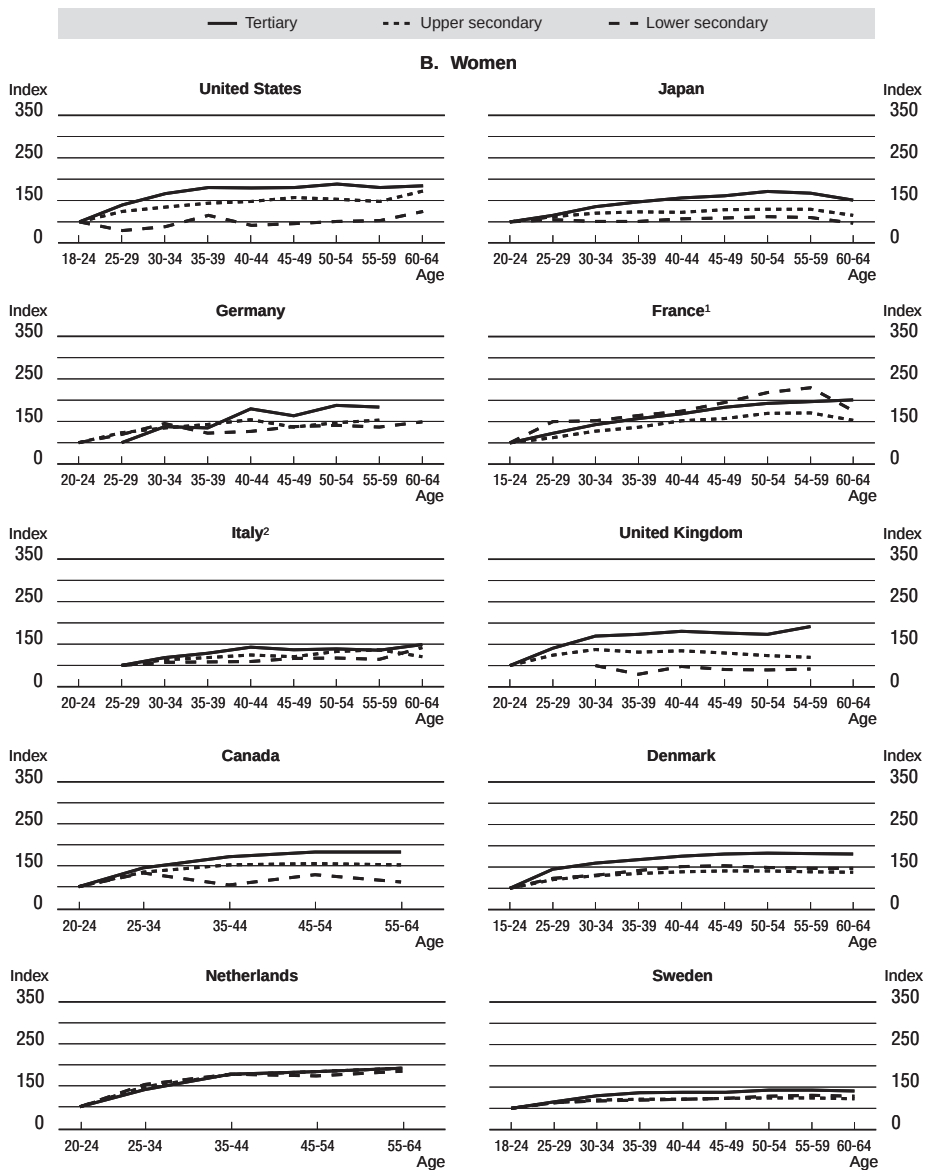


1. Median wage.

2. After tax.

Source: See Appendix 2.

Figure 3. The structure of earnings by age and gender (cont.)



1. Median wage.

2. After tax.

Source: See Appendix 2.

Figure 4. Unemployment by level of educational attainment, gender and age, 1999
Percentage of labour force

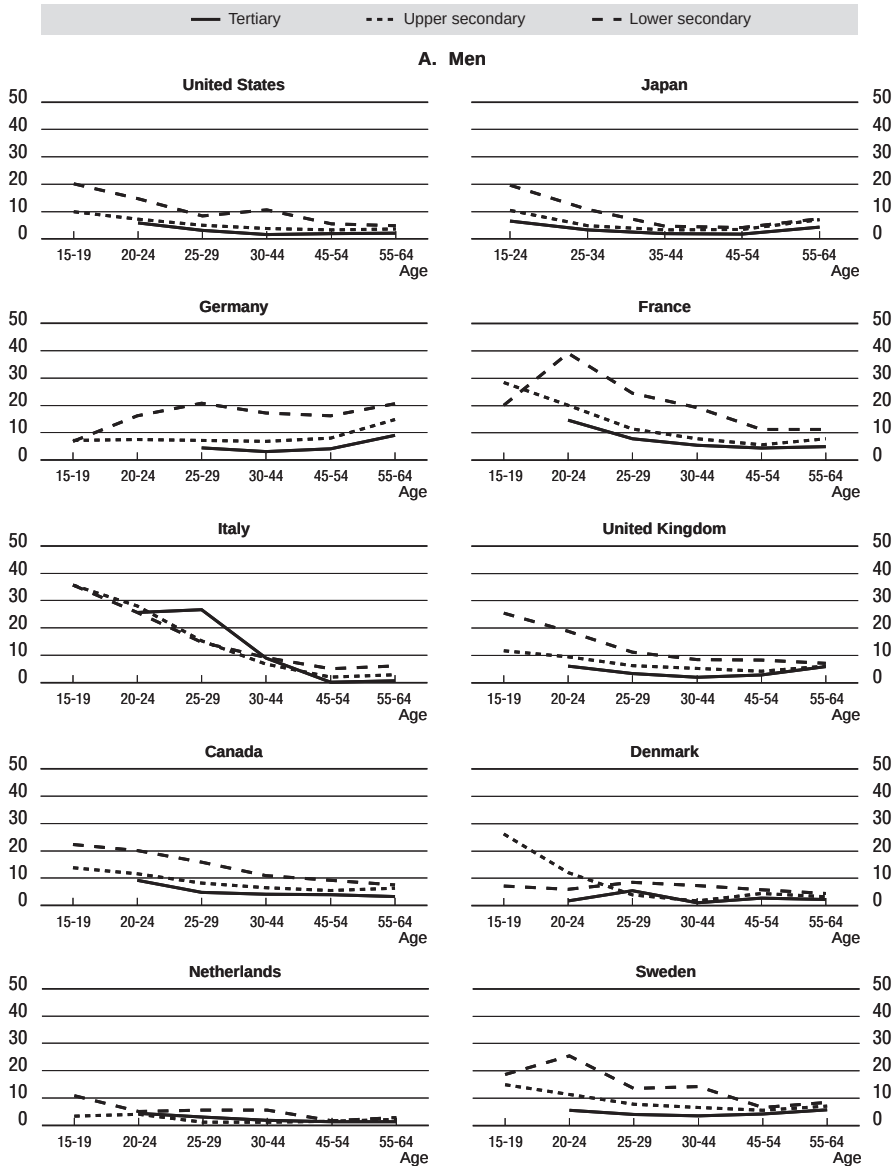
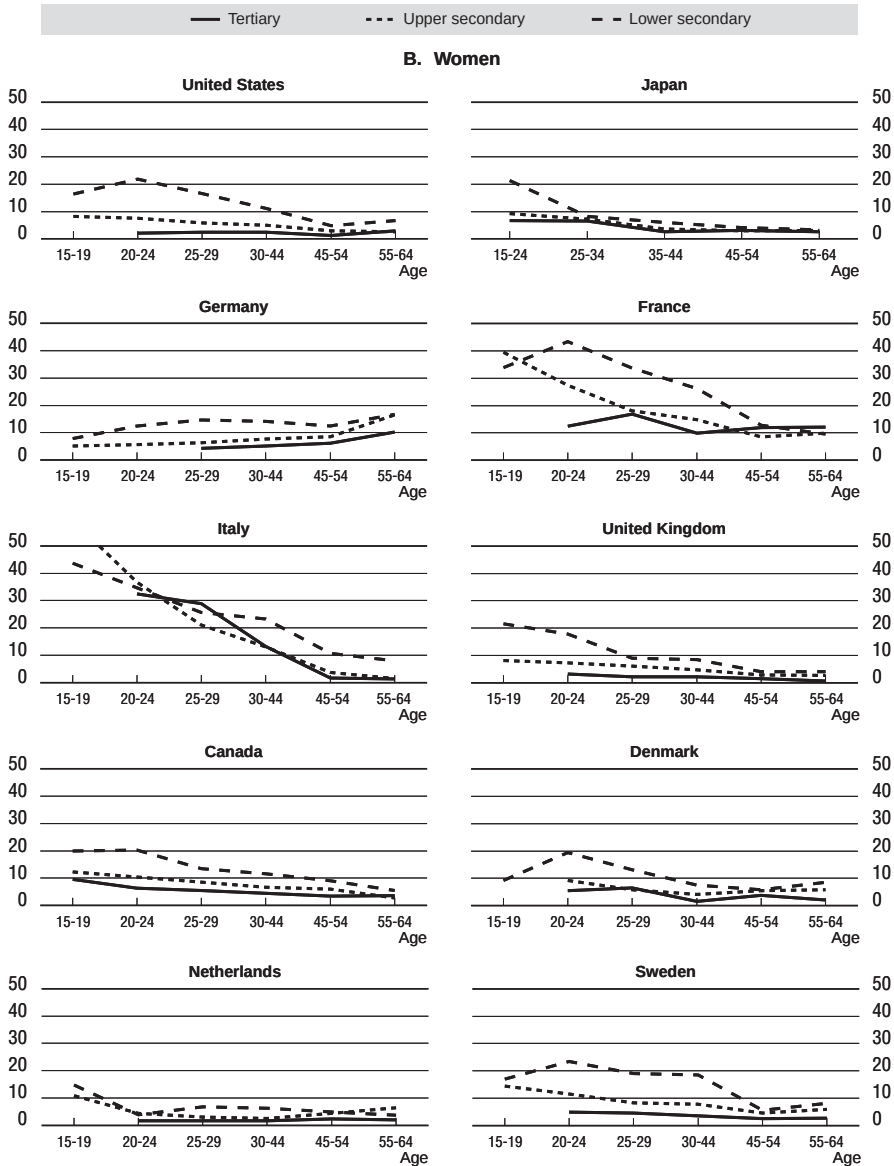


Figure 4. Unemployment by level of educational attainment, gender and age, 1999 (*cont.*)
Percentage of labour force



Source: OECD (2001d).

in unemployment risk across educational categories is notably large for young persons, but it tends to narrow with age. High youth unemployment may also provide a strong incentive for young people to continue their studies beyond the compulsory school-leaving age, as this will tend to reduce the opportunity cost of such activity. Thus, young people (*e.g.* in France, Italy, and Spain) sometimes do not face the choice of being gainfully employed or increasing their human capital, but rather being out of work or in education.¹⁰

Labour force participation by education

Educated workers are more likely to participate in the labour market, and their active working life is generally longer than that for those with lower educational attainment (Figure 5). With very few exceptions, the participation rate for male graduates of tertiary education is markedly higher than that for upper-secondary graduates. The gaps are even wider between those with and without an upper-secondary qualification. And among women, the differences in labour force participation by level of educational attainment are much wider still. While the education-related effects on male participation in the labour force are strongly influenced by differences among the older population, the effects of education on female labour force participation are relatively wide in all age groups.

Policy factors affecting the costs and benefits of additional human capital for individuals

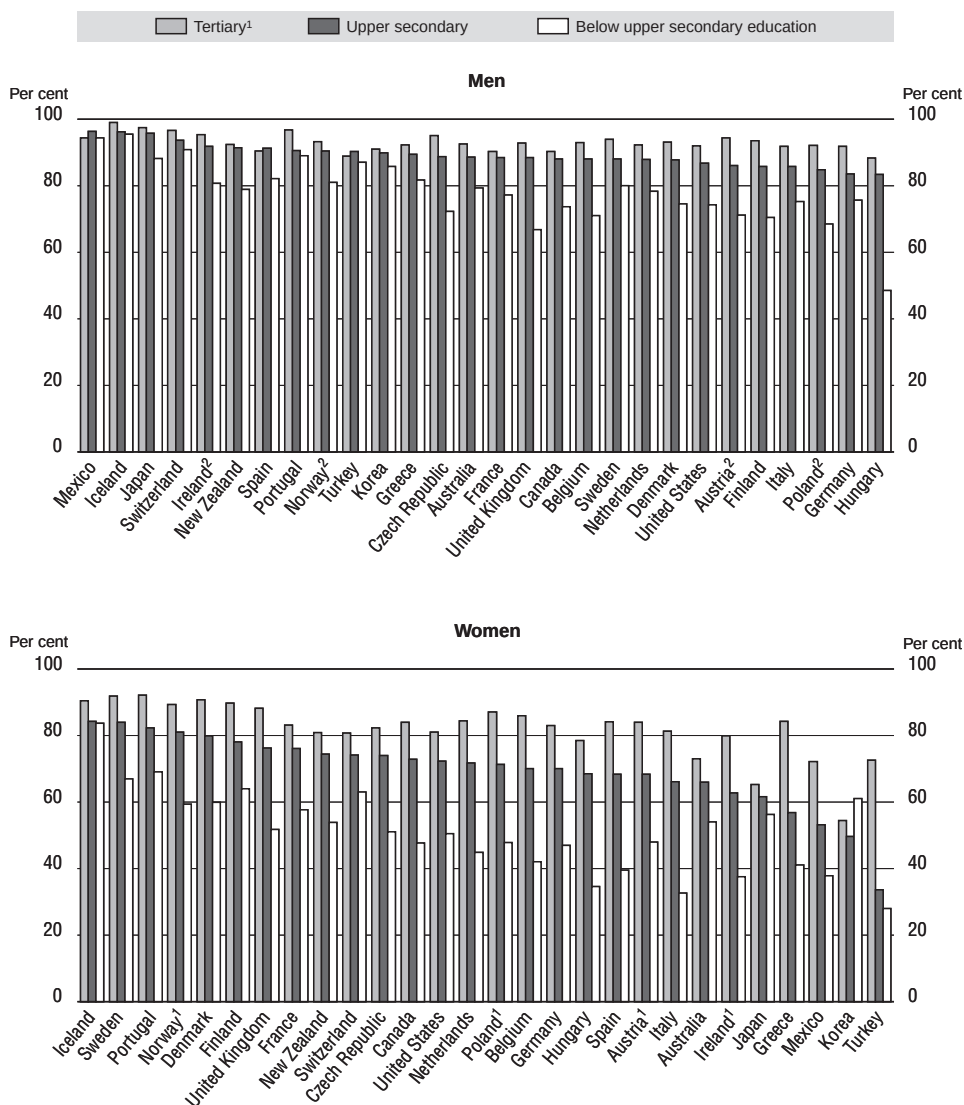
Most policy levers influencing labour market performance also affect incentives to acquire education, but some may have more direct effects. For instance, progressive income taxation reduces the return to human capital investment. Public financial support for education in the form of free or heavily-subsidised tuition increases the incentive to invest in education by lowering the cost of investment. Student loans and grants alleviate financing constraints and often involve a significant subsidy element. Finally, the length of study periods influences financial rewards from human capital accumulation.

Financing of provision and the length of study periods

In most countries, public financing of provision has been the traditional means of encouraging post-compulsory education. Although tuition fees have been introduced in some OECD countries for tertiary and, to a lesser extent, upper-secondary education, educational institutions in most OECD countries provide their services free at the point of delivery, implying a subsidy rate of 100 per cent. At the upper-secondary level the general academic stream is predominantly funded by government in most countries. At the tertiary level, the

Figure 5. **Labour force participation rates (1999)**

For the population 25 to 64 years of age



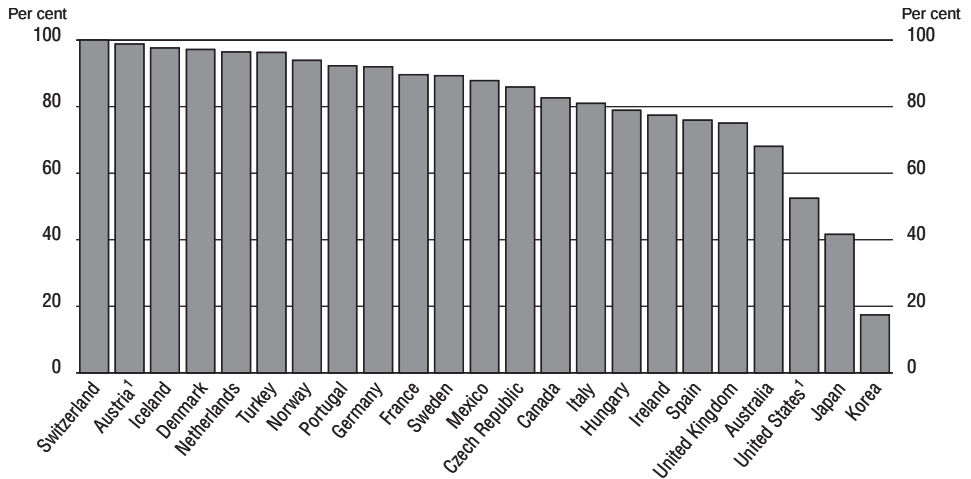
Note: Countries are ranked in descending order of the labour force participation rate with upper-secondary educational attainment.

1. Tertiary type A and advanced research programmes.

2. 1998.

Source: OECD (2000d).

Figure 6. Subsidy rates in tertiary education, 1998



Note: Share of direct public expenditure on educational institutions and total public subsidies to households and other private entities (excluding public subsidies for student's living costs) in total sources of funds (private and public) for tertiary education.

1. Post-secondary non-tertiary is included in tertiary or missing.

Source: OECD (2001d).

average subsidy rate ranges from 50 per cent or less in Japan, Korea and the United States to close to 100 per cent in some European countries such as Austria, Denmark, Iceland, the Netherlands and Switzerland (Figure 6).¹¹

Given their importance in determining the opportunity costs of education, the theoretical or minimum length of study periods is another policy variable that influence the financial rewards from human capital accumulation. Thus, very long study periods will tend to discourage investment in education unless they are associated with equivalent extra gains in productive capacity, and hence earnings potential. Standard upper-secondary education programmes in most OECD countries last for two or three years in principle, and the proportion of students that extend their studies beyond the standard length is small. The standard length of tertiary education programmes varies more across the OECD countries, first-degree tertiary education programmes varying from three to five or more years across OECD countries (Table 1).¹² Countries with relatively short first-degree programmes include France and the United Kingdom, while long programmes are normal in Germany and Austria. In a few countries (*e.g.* Germany and Austria, and to a lesser extent the Netherlands and Switzerland), there is a large gap between the theoretical and typical length of first-degree tertiary programmes.

Table 1. The length of standard first-degree tertiary education (years)

	Theoretical length	Typical length
Australia	3	3
Austria	5	7
Belgium (Flanders)	4-7	4-7
Canada	4	5
Czech Republic	3-4	3
Denmark	3	3
Finland	3	3-4
France	3	3-4
Germany	5	6.5
Greece	4-6	4-6
Hungary	5	5
Iceland	3	3-4
Ireland	3-4	4
Italy	4-6	4-6
Japan	4	–
Korea	4	4
Mexico	4-5	4-5
Netherlands	4	5-6
New Zealand	3	3
Norway	4	4
Portugal	4-6	4-6
Spain	4-6	4-6
Sweden	3-4	–
Switzerland	4	5-6
United Kingdom	3-4	4
United States	4	5

Note: The theoretical duration of a programme may not accurately reflect the amount of time that the typical student studying full-time should take to complete the programme in some countries. This is particularly the case where the theoretical duration has a legal basis (*e.g.* it is tied to the amount of time during which a student receives a subsidy) rather than a credit or course hour requirement.

Source: OECD (1999b).

Student loans and grants

Most OECD countries have also sought to support educational activity by offering financial assistance to individuals during their studies beyond compulsory schooling. Indeed, in the absence of government intervention, investment in human capital is difficult to finance through unsecured personal loans. Government financial support is generally limited to tertiary education, but some countries, such as the United Kingdom, Sweden, Denmark and Canada, have also made assistance available to certain students at the upper-secondary level. It is also a common practice in some countries to extend child benefits and

supplements to means-tested benefits if a family member is in post-compulsory education. Private foundations in some countries also offer financial assistance to students as a condition for being tax-exempt. As documented in OECD (2000), student loan and grant arrangements differ significantly across countries in terms of the extent of income and asset testing of both students and their parents, the amount of financial assistance, and the interest rate on and repayment schedules for loans.

As a gauge of the overall subsidy element involved in the various schemes for tertiary students, Table 2 reports the net present value (NPV) of future streams of grants, loans and the associated repayments for an individual coming from a family with average earnings at the start of his or her tertiary studies. As a proportion of the NPV of the overall cost involved with the studies (*i.e.* lost earnings and tuition fees), the NPV of the grants and loans varies significantly across the countries reviewed. The implied subsidy rate is over 20 per cent in the Netherlands, Germany, Denmark and the United Kingdom but around 10 per cent or less in Japan and France.

To the extent that students or their families face liquidity constraints in financing their tertiary education, the amount of loans, irrespective of repayment terms, and grants made available to them, could be a more relevant incentive mechanism than the implicit subsidy rate. There is, in principle, no relationship

Table 2. **Maximum loans and grants for first-degree tertiary students**

	Net present value of future streams of grants, loans and repayments as a percentage of net present value of overall cost involved in the studies ¹ at the start of first-degree study	Loans and grants as a percentage of overall cost involved in the studies ¹ in the penultimate year of first-degree study
United States	15.0	33.0
Japan	7.7	53.4
Germany	24.9	30.8
France	9.9	9.9
Italy	n.a.	n.a.
United Kingdom	22.3	47.3
Canada	18.2	23.2
Denmark	24.3	33.0
Netherlands	29.6	39.6
Sweden	17.5	32.3

Note: The figures refer to students where both parents earn average production worker wages. The students are assumed to be dependent, not have any earnings of their own and take the maximum amount of support available. For the calculation of the net present value of future streams of grants, loans and the associated repayments, the mortgage interest rate is used as a discount rate.

1. The overall cost of studies is defined as the lost earnings plus the tuition fees.

Source: National sources.

between the financial resources made available and their NPV. For example, student loans granted on market terms have a zero NPV by definition, irrespective of how large they are. The example of Japan shows that it is possible to combine low subsidy rates and high loan amounts, the maximum annual loan entitlement being close to a half of the opportunity cost of lost earnings plus fees. The “replacement ratio” is similarly very high in the United Kingdom and in the Netherlands; it ranges from a tenth to a third in the other countries.

The tax system

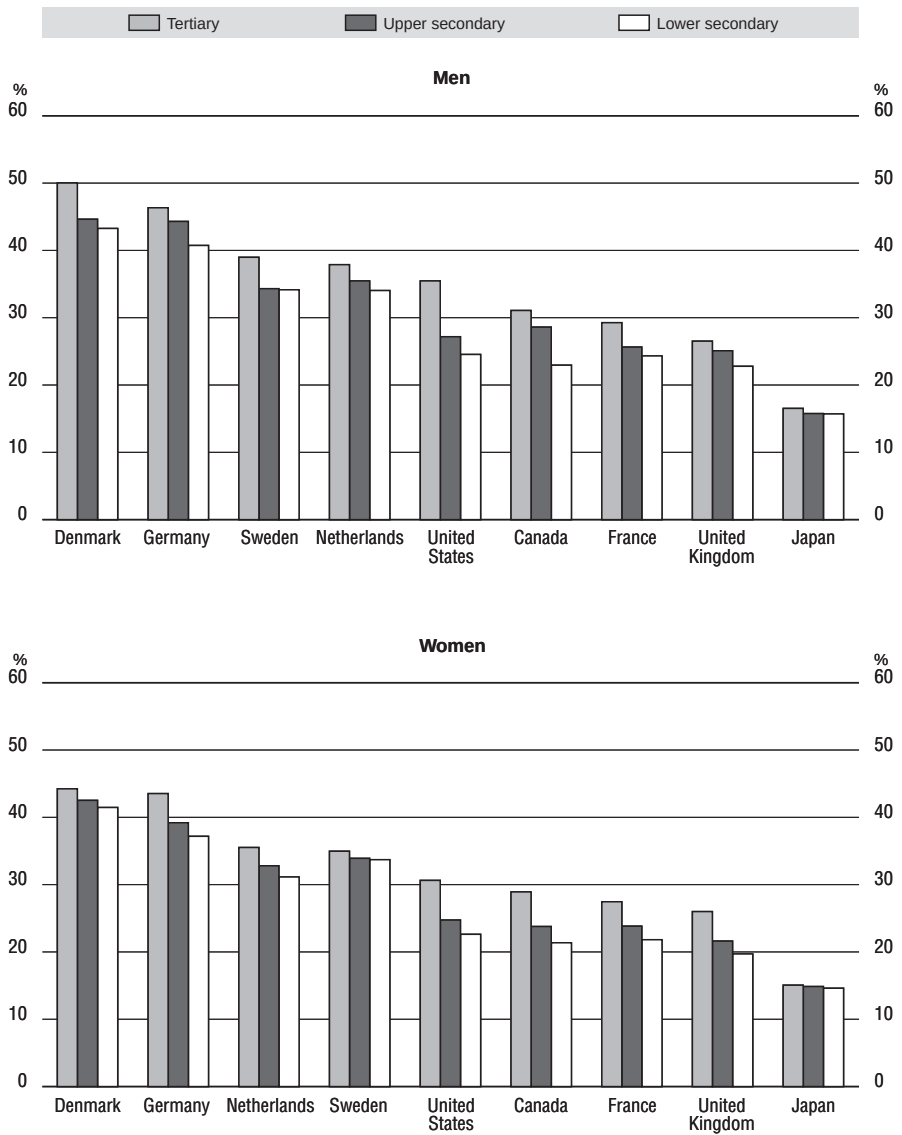
A progressive income tax system implies a tax on the return to human capital and is therefore a disincentive to investment in education.¹³ By taxing the earnings of the better educated at a higher rate than applied to the earnings of the less educated, the pre-tax earnings differentials discussed above overstate the gains from human capital investment. Among the countries depicted in Figure 7, the gap between the average tax rate on the earnings of upper-secondary and that for tertiary graduates is particularly large in the United States mainly because of large earnings differentials. By contract, earned income of lower, upper-secondary and university-educated workers is taxed at a similar marginal rate in Japan.

Internal rates of return to education

Private internal rates of return to invest in education

The overall incentive to invest in human capital that is embedded in the labour market benefits, financial support and tax effects discussed above can be summarised in the private internal rate of return (Table 3). The internal rate of return is defined as the discount rate that equalises the real costs of education during the period of study to the real gains from education thereafter (see Box 1 for a discussion of methodological issues). In its comprehensive form, the costs equal tuition fees, foregone earnings net of taxes adjusted for the probability of being in employment minus the resources made available to students in the form of grants and loans. The benefits are the gains in post-tax earnings adjusted for higher employment probability minus the repayment, if any, of public support during the period of study. The calculations assume that the student is full-time in education¹⁴ and has no work activity, and hence no earnings while studying. The calculated rates of return are likely to be biased upwards as unemployment, retirement and early retirement benefits are not taken into account.¹⁵ Moreover, as the probability of course drop-out has not been taken into account, the reported internal rates are conditional on successful completion of the relevant education programmes. The rate-of-return calculations reported below abstract completely from any non-monetary benefits of education.

Figure 7. Average tax rate¹ by educational attainment, 1999



Note: Countries are ranked in descending order of the average tax rate for tertiary education.

1. Taxes include personal income taxes and social security contributions paid by employees; they correspond to earnings of 15-64 years old.

Source: OECD.

Table 3. Private internal rates of return to education, 1999-2000

Per cent

A. Men											
	United States	Japan	Germany	France	Italy ¹	United Kingdom	Canada	Denmark	Netherlands ²	Sweden	Unweighted average
Tertiary education											
Return based on pre-tax earnings and the length of studies (narrow rate)	18.9	8.0	7.1	13.3	6.7 ³	18.1	8.4	7.9	11.7	9.4	11.4 ⁴
Impact of (in percentage points)											
Taxes	-2.3	-0.3	-1.5	-1.6	..	-2.1	-0.5	-2.1	-2.0	-1.5	-1.5 ⁴
Unemployment risk	0.9	0.9	1.1	2.4	0.5	1.6	1.3	1.0	0.0	1.2	1.1
Tuition fees	-4.7	-2.0	-0.3	-1.1	-0.7	-2.7	-2.3	-0.2	-0.6	-0.7	-1.5
Public student support	2.1	1.3	2.7	1.3	0.0	3.6	1.8	4.8	2.9	3.0	2.4
Comprehensive rate	14.9	7.9	9.1	14.3	6.5	18.5	8.7	11.5	12.1	11.4	11.7
Upper-secondary education											
Return based on pre-tax earnings and the length of studies (narrow rate)	14.4	4.4	10.0	7.5	9.5 ³	12.4	11.9	11.3	6.9	3.9	9.2 ⁴
Impact of (in percentage points)											
Taxes	-0.9	-0.2	-2.1	-1.0	..	-1.5	-1.6	-2.2	-0.2	-0.6	-1.1 ⁴
Unemployment risk	2.9	2.6	2.9	7.0	1.7	4.2	3.6	2.2	1.2	3.1	3.1
Comprehensive rate	16.4	6.8	10.8	13.5	11.2	15.1	13.6	11.3	7.9	6.4	11.3

Note: The rates of return to tertiary education are calculated by comparing the benefits and costs with those of upper-secondary education. In the case of rates of return to upper-secondary education, the calculation compares the benefits and costs with those of lower-secondary education. In Sweden, the theoretical length of standard tertiary courses is used in the calculations rather than the average theoretical length of different programmes. Moreover, earnings differentials for women between upper and lower-secondary levels are not large enough to permit a positive rate-of-return calculation. In the United Kingdom, data on earnings of women up to age 30 with lower-secondary education were not available. In Italy, reliable data on earnings for women were not available.

1. 1998.

2. 1997.

3. Post-tax earnings.

4. Excluding Italy.

Source: Blöndal *et al.* (2001).

Table 3. **Private internal rates of return to education, 1999-2000** (*cont.*)

Per cent										
B. Women										
	United States	Japan	Germany	France	United Kingdom	Canada	Denmark	Netherlands ²	Sweden	Unweighted average
Tertiary education										
Return based on pre-tax earnings and the length of studies (narrow rate)	18.8	8.0	7.0	12.1	16.4	10.6	6.0	9.4	7.4	10.6
Impact of (in percentage points)										
Taxes	-2.0	-0.2	-1.6	-1.7	-2.3	-1.3	-1.1	-1.0	-0.7	-1.3
Unemployment risk	1.4	0.5	0.6	4.8	1.3	1.2	0.7	0.7	1.6	1.4
Tuition fees	-6.0	-2.4	-0.6	-1.7	-2.5	-2.9	-0.1	-0.7	-0.8	-2.0
Public student support	2.7	1.3	3.0	1.9	3.2	2.4	5.6	4.1	3.3	3.1
Comprehensive rate	14.7	7.2	8.4	15.4	16.1	9.9	11.1	12.5	10.8	11.8
Upper-secondary education										
Return based on pre-tax earnings and the length of studies (narrow rate)	10.6	6.6	6.1	10.5	..	10.8	8.3	7.9	..	8.7
Impact of (in percentage points)										
Taxes	-1.3	-0.2	-1.7	-0.7	..	-1.2	-1.4	-1.6	..	-1.2
Unemployment risk	2.5	3.0	2.6	8.1	..	3.1	3.6	2.1	..	3.6
Comprehensive rate	11.8	9.4	7.0	17.9	..	12.7	10.5	8.4	..	11.1

Note: The rates of return to tertiary education are calculated by comparing the benefits and costs with those of upper-secondary education. In the case of rates of return to upper-secondary education, the calculation compares the benefits and costs with those of lower-secondary education. In Sweden, the theoretical length of standard tertiary courses is used in the calculations rather than the average theoretical length of different programmes. Moreover, earnings differentials for women between upper and lower-secondary levels are not large enough to permit a positive rate-of-return calculation. In the United Kingdom, data on earnings of women up to age 30 with lower-secondary education were not available. In Italy, reliable data on earnings for women were not available.

1. 1998.

2. 1997.

3. Post-tax earnings.

4. Excluding Italy.

Source: Blöndal *et al.* (2001).

Box 1. The calculation of private internal rates of return

The internal rate of return in real terms is the discount rate (δ) that equalises the future flows of real benefits (B) and real costs (C) associated with investment in upper-secondary (s) or tertiary (u) education, *i.e.*

$$\sum_{t=a}^{a+l} (1+\delta)^{-(t-a)} \times C^{s,u}(t) = \sum_{t=a+l+1}^{64} (1+\delta)^{-(t-a)} \times B^{s,u}(t)$$

where t is age, a is the typical age at the start of upper-secondary (tertiary) education and l is the standard length of upper-secondary (tertiary) education. The benefits are assumed to last until the age of 64.

The costs of tertiary education are defined as:

$$C^u(t) = [(1 - \tau(E^s(t))) \times (1 - ur^s(t)) \times E^s(t) \times (1+g)^{(t-a)} + F^u(t) \times (1+g)^{(t-a)} - S(t)]$$

where τ is the average tax rate for base-year earnings of a single person with upper-secondary education at age t [$E^s(t)$], $ur^s(t)$ is the unemployment rate for people with upper-secondary education at age t , g is the growth rate of labour productivity in the economy as a whole, $F^u(t)$ is the annual private cost of tertiary education, and $S(t)$ is student grants and loans at age t . The scaling factor at the end of the first term of the right-hand side of the equation is there to project future earnings by the scaling up of base-year earnings in line with the productivity growth rate for the economy as a whole. The costs of upper-secondary education are similarly defined.

The benefits of tertiary education are defined as:

$$B(t) = [(1 - \tau(E^u(t))) \times (1 - ur^u(t)) \times E^u(t) \times (1+g)^{(t-a)} - (1 - \tau(E^s(t))) \times (1 - ur^s(t)) \times E^s(t) \times (1+g)^{(t-a)} - R(t)]$$

where $R(t)$ is the repayment of loans, if any. According to this equation, the benefits are equal to the difference between post-tax earnings adjusted for the unemployment risk for tertiary and upper-secondary educated persons minus the repayment of student support. The benefits of upper-secondary education are similarly defined.

These estimations have several important limitations. They assume stability in the wage premia through the life cycle and are based on average earnings and costs. In practice, there can be considerable variation in rates of return for different fields of study or particular social groups. The rate-of-return calculations do not incorporate unemployment benefits or other social and personal benefits. Differences in retirement incomes for different educational groups are not included in the estimates and they do not take into account broader social benefits flowing from investment in education such as better health or lower crime. Finally, there are no private tuition costs included in upper-secondary education.

The estimated private real internal rates of return to upper-secondary and university education differ significantly across the countries listed in Table 3 but are in all cases higher than the real interest rate or the rate of return on investment in physical capital, suggesting that human capital investment is an attractive way for the average person to build up wealth.¹⁶ For tertiary studies, three groups of countries can be identified depending on the estimated values of the “comprehensive” internal rate. Firstly, with its very high rewards from tertiary education, the United Kingdom is in a group of its own. Second, the United States, France, Denmark, the Netherlands and Sweden are characterised by relatively high internal rates of return, ranging from 11 to 15 per cent. Third, in the remaining countries rates are below 10 per cent, with the lowest rates recorded for Italy and Japan. For upper-secondary education, the internal rate is calculated to exceed 10 per cent in all countries listed in Table 3 with the exceptions of Japan, the Netherlands, Sweden and Germany (women). Reflecting somewhat different data sources and methodology, these estimates differ in some cases from earlier OECD estimates of internal rates of return.¹⁷ The internal rates of return reported in Table 3 are confined to human capital investment immediately following compulsory schooling. As discussed in Blöndal *et al.* (2002), the internal rates fall at an increasingly rapid rate as a function of age due to a shorter period to amortise investment costs as the remaining working life becomes shorter, even turning negative for long-lasting tertiary studies for persons aged 50 and over.

As can be seen from Table 3, earnings differentials and the length of education are generally the prime determinants of private internal rates of return. Thus, countries with strong overall incentives to invest in human capital are typically characterised by high education-earnings differentials and/or relatively short education programmes, and *vice versa*. The influence of other factors (elaborated below) does, however, generate notable exceptions to this general pattern. Thus, despite narrow wage differentials and long study periods, Denmark and Sweden offer comparatively strong incentives to acquire university education. And France has strong incentives for young people to invest in upper-secondary education despite relatively small wage gains compared with the length of such education.

The contribution of the other factors can be evaluated by adding them successively to the estimate of the “narrow” rate based only on pre-tax earnings and study length:¹⁸

- *Taxes* reduce the narrow rate by 1½ percentage points on average for tertiary education and 1 percentage point for upper-secondary education in the countries under review. At the tertiary level, the impact of taxes is particularly strong in the United Kingdom, Denmark, the United States, and the Netherlands. At the upper-secondary level, the depressing effect of the tax system is most notable in Germany, due to the strong degree of

progressivity of the tax system over the relevant earning range, and in Denmark, while it is the smallest in Japan.

- *Unemployment risk* differentials increase the internal rate of return for upper-secondary education, the effect averaging more than 3 percentage points for the countries under review.¹⁹ The relatively high unemployment differential in France adds as much as 7 to 8 percentage points to the internal rate of return. For tertiary education, the differential unemployment risks have much less effect on the internal rates of return, adding on average 1 to 1.5 percentage point for men and women, respectively, in the countries included in Table 3.
- *Tuition fees* significantly reduce rates of return to tertiary education in the United States, and, to a lesser extent, in the United Kingdom and Canada. In the continental European countries, the impact is significantly smaller as tuition fees are less common.
- *Public student grant and loan arrangements* at the tertiary level give a significant boost to incentives, adding on average 2½ to 3 percentage points to the internal rates of return in the countries under review, compared with rates of returns excluding such support. The impact is particularly strong in Denmark, while it is weak in Japan and France, and absent in Italy.

Because wage differentials are likely to respond to policy, the contributions of taxes, school fees and student support presented in Table 3 may overstate the importance of these factors in determining internal rates of return to education. Indeed, in the long run the workings of market forces may imply that policy variables have modest effects on the rewards from human capital investment, since wage differentials may tend to adjust to align returns to human capital to those for other productive assets.²⁰ Thus, an increase in school fees may in the long run show up in lower supply of human capital (see Box 2) and correspondingly increased education wage premia, with small, if any, effects on the rates of return. Similarly, an increase in student support could result in a higher supply of human capital and a compensating reduction in education wage premia.

However, since the supply of human capital is relatively inelastic in the short run, policy variables may have powerful effects on rates of return to education for some time. An increase in school fees will therefore tend to depress the rate of return to education during the period in which supply has not fully adjusted, and higher student support and shorter education periods will have the opposite effect. The adjustment period may be protracted. With market incentives mostly acting on the investment decisions of young people, the supply response will depend in part on the size of the youth cohort and it may take several “vintages” of young people, and hence a long time, before supply changes shift the education wage premia significantly.

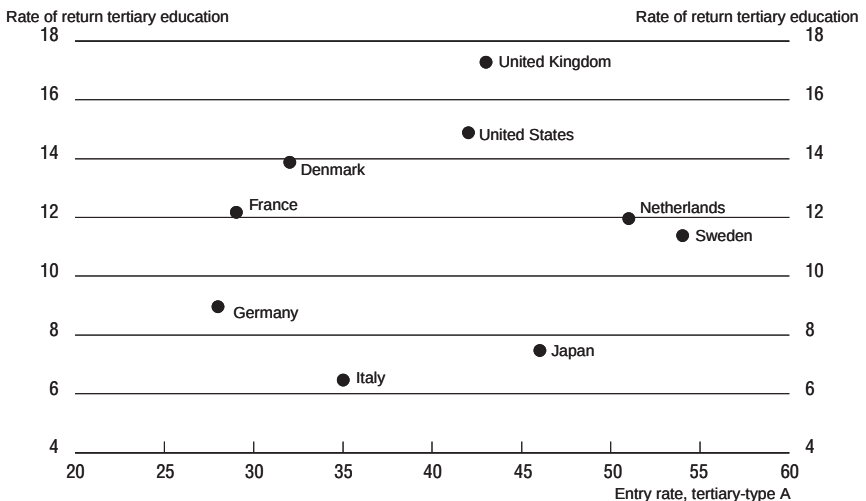
Box 2. Returns to education and enrolment in tertiary education

Schooling could be considered as an optimising investment decision based on future benefits and on the total costs of education. More education is a worthwhile investment for individuals if the private internal rate of return is greater than the market rate of interest plus a required risk premium. There should accordingly be a positive correlation between private internal rates of return and enrolment in tertiary education.

Indeed, as depicted in the figure below, there is some increased tendency for individuals to undertake tertiary education if the return to such education is high. In the United States and in the United Kingdom, high entry rates at tertiary level are associated with a higher rate of return. In Germany and to a lesser extent in France, a lower entry rate is correlated with a lower rate of return. However, the sample of countries is very small and the bivariate correlation is not strong, and high entry rates are sometimes associated with low internal rates of return.

Cross-country correlation between rate of return and entry rate

Men, 1999



Note: The entry rate represents the proportion of a synthetic age-cohort who enters the tertiary level of education irrespective of changes in the population size and differences between countries in the typical entry age.

Box 2. Returns to education and enrolment in tertiary education (cont.)

The decision of students to enrol in tertiary education has been widely examined in the literature.* Some studies have focused on the elasticity of demand for education with respect to earnings while others have concentrated on rates of return to education. The empirical findings reveal significant and highly elastic responses to wages and rates of return. The estimated elasticity of enrolment to earnings in the United States was reported between $\frac{1}{2}$ and $2\frac{1}{2}$ in Tinbergen (1974), at $1\frac{3}{4}$ in Freeman and Hansen (1982) and at about 2 in Willis and Rosen (1979). Using rates of return, Mattila (1982) and Rouse (1994) estimated analogous results for the United States with supply elasticities ranging between 1 and 5. In the United Kingdom, estimates of the supply response for educated labour ranged between $\frac{3}{4}$ in Dolphin (1981) and $1\frac{1}{4}$ in Pissarides (1982).

* For a survey of research on the demand for education, see R.B. Freeman (1986). See also Fredricksson (1997) for a review of the determinants of enrolment in tertiary education in Sweden. The sensitivity of enrolment to changes in cost has been analysed by McPherson and Shapiro (1991) See Sakellaris and Spilimbergo (2000) for a study of the effect of economic fluctuations on investment in higher education for a wide range of countries.

Of the policy variables discussed above, the length of education appears to have a particularly powerful influence in shaping the internal rate of return in the short run. Thus, the calculated high rates of return to tertiary education in the United Kingdom and France are to an important extent due to relatively short standard periods of university studies, whereas the low rates of return in Germany are strongly influenced by comparatively long study periods. Indeed, if the average length of tertiary studies were to be shortened by one year without compromising quality, the internal rate of return for men in the countries under review would increase by 1 to 5 percentage points, if all other factors are held constant. To put such a hypothetical shortening of tertiary studies into perspective, it should be noted that to achieve the same increase via wider wage differentiation would require an increase in the tertiary wage premium of 5 to 14 percentage points.

Social rates of return of investment in education

The benefits to society of additional education should be assessed on the basis of social rates of return. The social internal rate of return needs to reflect the costs and benefits to society of investment in education, and these can differ significantly from private costs and benefits. The direct social cost includes the opportunity cost of people not contributing to production and the full cost of

education provision (rather than just the cost borne by the individual). Moreover, there can be additional indirect costs if the financing of post-compulsory education through taxation involves an efficiency loss for society. The social benefit includes the increased economy-wide productivity associated with the investment in education and a host of possible non-economic benefits, such as lower crime, better health, more social cohesion and more informed and effective citizens.²¹ While data on direct social costs are available for most OECD countries, information about the full range of social benefits is less readily available. For example, the possibility of growth externalities associated with education suggests that the observed earnings differentials might not fully account for the economy-wide efficiency gains even if such externalities may be relatively smaller at the post-compulsory level of education. On the other hand, studies suggest that a (small) part of the wage premium received by better educated individuals is due to the fact that educational attainments signal their inherent abilities to employers, rather than their higher productivity arising from investment in human capital.²² And while the non-economic benefits of education are found to be important,²³ it is often difficult to translate these into monetary values for inclusion in rate-of-return calculations.

In view of the difficulty in constructing comprehensive social rates of return, Table 4 presents estimates of a “narrow” definition that abstracts from any

Table 4. **Narrow estimates of social rates of return to education, 1999-2000**
Per cent

	Upper-secondary education		Tertiary education	
	Men	Women	Men	Women
United States	13.2	9.6	13.7	12.3
Japan	5.0	6.4	6.7	5.7
Germany	10.2	6.0	6.5	6.9
France	9.6	10.6	13.2	13.1
Italy ¹	8.4	—	9.7	—
United Kingdom ²	12.9	—	15.2	13.6
Canada ³	—	—	6.8	7.9
Denmark	9.3	8.7	6.3	4.3
Netherlands	6.2	7.8	10.0	6.3
Sweden ⁴	5.2	—	7.5	5.7

Note: These calculations relate to a narrow definition of the social rate of return which excludes any possible positive external effects due to education. The rates of return to tertiary education are calculated by comparing the benefits and costs with those of upper-secondary education. In the case of the rates of return to upper-secondary education, the calculation is done by comparing the benefits and costs with those of lower-secondary education.

1. In Italy, reliable data on earnings for women were not available.

2. In the United Kingdom, data on earnings of women up to age 30 with lower-secondary education were not available.

3. In Canada, no data are available on expenditure per student at the upper-secondary level.

4. In Sweden, earnings differentials for women between upper and lower-secondary levels are not large enough to permit a positive rate of return calculation.

Source: For sources and methods see Box 1 and the appendix.

externality effects, non-economic benefits and assumes that all wage gains from education represent associated gains in productivity (see Box 3). To the extent that there are sizeable positive externalities related to human capital investment by the average student, these estimates will thus be biased downwards. Since government subsidies mean that the social cost of education is higher than the private cost, social internal rates of return are generally significantly lower than the private internal rates of return. Even so, social internal rates of return are typically well above 5 per cent in real terms for both upper-secondary and tertiary education, suggesting that investment in education may often be a productive use of public funds. The estimates suggest that the social internal rate of return is particularly high at both the upper-secondary and tertiary levels in the United States and the United Kingdom while it is the lowest in Japan at both of these education levels. In France, it is small for upper-secondary education but comparatively high at the tertiary level.

Box 3. The calculation of social internal rates of return

As in the case of the private internal rate of return, the social rate of return is the discount rate that equalises future costs and benefits:

$$\sum_{t=a}^{a+l} (1+\delta)^{-(t-a)} \times SC^{s,u}(t) = \sum_{t=a+l+1}^{64} (1+\delta)^{-(t-a)} \times SB^{s,u}(t)$$

where SC and SB are social costs and social benefits, respectively, and other variables are defined as in Box 1.

The social cost of tertiary education is the opportunity cost of lost output and the direct total cost of providing such education:

$$SC^u(t) = [1 - ur^s(t)] \times [E + ST]^s(t) \times (1+g)^{(t-a)} + [F + G]^u(t) \times (1+g)^{(t-a)}$$

where ST^s is employers' social security contributions for workers with upper-secondary education and G is the annual public cost (*i.e.* excluding private fees) of tertiary education. Compared with the private costs, the social costs exclude taxes and student grants and loans as these items involve transfers between individuals. The opportunity cost is also expanded to include all labour costs and the direct costs include the public subsidies involved in tertiary education.

The social benefits of tertiary education are defined as:

$$SB(t) = (1 - ur^u) \times [E + ST]^u(t) \times (1+g)^{(t-a)} - (1 - ur^s) \times [E + ST]^s(t) \times (1+g)^{(t-a)}$$

As compared with private benefits, taxes and loan repayments are excluded from the social benefit formula, for the reasons discussed above, and productivity is proxied by total labour costs.

The interpretation of the internal rates of return

The private and social internal rates of return reported above are generally well above the real interest rate and the rate of return on other productive assets.²⁴ Given that the return on human capital accumulation is subject to considerable uncertainty (as indicated by the wide dispersion of earnings among the better educated), investors are likely to require a compensating risk premium. However, the size of the premium of the internal rates of return over the real interest rate is higher than would seem to be warranted by considerations of risk alone. The high internal rates of return can be interpreted in two different ways.

One interpretation is that the high rates indicate a disequilibrium in the market for educated workers, with shortages of better-educated workers driving up their earnings. This might imply a temporary situation, where super-normal returns to education would subsequently generate enough supply response to push the rates down into line with returns available on other productive assets. However, the adjustment would depend on the capacity of the education system to respond to the derived increase in demand and the capacity of the labour market to absorb the changing relative supplies of labour. The re-balancing mechanism could also be accelerated by better availability of information to students about the returns to different courses of study, thereby helping them to make more informed choices.

While temporary disequilibrium may account for some of the apparent “excess” returns, part of the super-normal returns may also reflect an equilibrium situation. This second interpretation would be relevant if the marginal rates of return are significantly lower than the average rates and thus closer to marginal rates on alternative productive assets.²⁵ The marginal rate would indeed be lower than the average rate if the students at the margin are of lower ability and less motivated than the average existing students, and thus unlikely to be able to command the average wage premium in the labour market. Indeed, recent empirical studies for the United States indicate that the marginal rate of return is lower than the average rate at the college level, though not at lower levels of education (see Carneiro *et al.*, 2002). On this interpretation, the high internal rates of return would partly reflect economic rents on a scarce resource, namely ability and motivation of individuals.

On either interpretation, incentives for investment in education could be increased, for example, if the standard length of education programmes were to be reduced without compromising quality or if student financial support were to be made more generous. On the other hand, stronger incentives may not elicit a large supply response if there is a serious shortage of young people with the abilities and motivation required to profit from continued education. In this case, the returns at the margin for individuals and society may be very low, even if the

average rate of return is high. Under such circumstances, it might be more appropriate to improve the average abilities of young individuals through interventions at pre-school age and in compulsory schooling, with studies indicating that cognitive and, especially, non-cognitive abilities can be developed into the teenage years (see Heckman, 1999).

EQUITY IN POST-COMPULSORY EDUCATION

In the compulsory phase of education, participation is by definition near universal, and equity issues arise over the extent to which such participation realises the potential of all, regardless of social background or circumstances (see Box 4). In post-compulsory education, the equity issue arises in a quite different form because of the extent of individual variation in participation. Two such issues addressed below are: i) the extent to which the expansion of post-compulsory education has enhanced equality of opportunity in access; and ii) the distribution of costs and benefits of public spending on post-compulsory education.

Expansion of post-compulsory education and the equality of opportunity

Over the past 30 years participation rates in post-compulsory education have increased rapidly. Thus, on average in OECD countries, nearly three-quarters of the younger cohort aged 25-34 have completed upper-secondary education, and one-quarter have completed tertiary education (Table 5). Conversely, among those currently aged 55-64, under half have completed the upper-secondary phase of education, and only one in seven has completed tertiary education.²⁶ Much of the progress is attributable to women catching up with men – the attainment levels of younger men and women aged 25-34 are now very similar. For those aged 55-64, only 6 per cent of women (compared with 12 per cent of their male counterparts) have university degrees and 38 per cent have upper-secondary qualifications (compared with 50 per cent of men). A question arises over whether this overall expansion in educational opportunity has been equitably shared.

Upper-secondary education

Evidence from a number of countries suggests that the minority of young people who fail to complete upper-secondary education tend to come from less affluent backgrounds. Thus, in France in the late 1990s, 62 per cent of the 15-year olds coming from the poorest two deciles of families had to repeat at least one year in school compared with 17 per cent from the richest two decile (INSEE, 2000). In the United States in 1999, over three-quarters of high-school drop-outs came from families with below-median income, and only 8 per cent from the

Box 4. The dimensions of educational equity

The central goal of education is to allow all individuals to develop to their full potential. A realisation of this goal would not remove differences between individuals in educational achievement and the associated benefits. Nor would it necessarily mean access for all to the same educational experiences. However, it would imply access to skill development that would enable each individual to develop his or her full potential. In practice, it will often be unclear whether differences in educational outcomes reflect variation in "full potential" or differentially effective provisions.

Consideration of equity in education must address outcomes as well as access. The question is not whether outcomes vary but whether they do to an extent that is unreasonable and whether the distribution of outcomes is equivalent in groups between which it is not reasonable to expect differences. For example, it is accepted in OECD countries that no factors (genetic, social or cultural) should automatically constrain female educational achievement to a different level or distribution from that of men, and many countries have increased female achievement to match or go beyond that of males.

Socio-economic equity raises different issues. General cognitive abilities are significantly heritable, and these genetic effects are sustained throughout life (McLearn *et al.*, 1997). To the extent that innate abilities determine the educational attainment and socio-economic level of parents, and are genetically linked to the capacities of their children, success in one generation will be correlated with that of the next. However, the evidence suggests that socio-economic privilege confers many direct benefits, both through a home culture which tends to reinforce the goals of formal education and through the capacity to fund access to education in private schools and post-compulsory education (Dearden, 1998; McPherson and Schapiro, 2000).

Particularly in the post-compulsory phase, systems of educational finance also have an impact on outcomes by virtue of how they distribute the costs of human capital investment between different parties. Overall outcomes for any individual depend not only on the benefits of educational attainment, but also on how much of the cost of that education falls on the individuals who benefit.

New research (OECD, 2001e) has shown that in the compulsory phase of education, the relationship between socio-economic background (measured on a variety of dimensions) and educational achievement is present in all OECD countries but varies in strength, and is independent of average achievement. The message is that national educational policy and practice can ameliorate the influence of social and economic privilege on educational achievement without sacrifice to the overall level of achievement.

Table 5. Educational attainment in 1999
 Percentage of the population that has completed at least upper secondary
 or tertiary phases of education by gender and age group

Age group:	Men						Women					
	At least upper secondary ¹			Tertiary			At least upper secondary ¹			Tertiary		
	25-34	55-64	Total 25-64	25-34	55-64	Total 25-64	25-34	55-64	Total 25-64	25-34	55-64	Total 25-64
Australia	70	54	65	26	19	26	61	33	50	32	15	27
Austria ²	87	70	81	12	9	12	79	48	67	13	4	10
Belgium	70	40	57	30	18	25	76	32	56	38	12	26
Canada	86	64	79	42	28	37	89	60	80	52	27	41
Czech Republic	93	86	91	12	12	13	92	65	81	10	7	9
Denmark	88	75	83	28	21	26	87	58	76	29	17	27
Finland	84	46	70	30	22	28	87	46	73	45	19	34
France ³	76	48	65	29	14	21	77	36	59	33	11	22
Germany	87	83	86	23	28	28	84	63	76	20	11	17
Greece	69	30	52	22	12	20	73	19	48	28	5	16
Hungary	81	32	37	11	14	13	79	29	47	16	9	14
Iceland	64	55	63	25	14	22	65	26	49	30	9	23
Ireland ²	63	30	48	30	14	23	71	32	54	29	9	20
Italy	53	25	44	9	7	10	58	17	41	11	4	9
Japan	91	63	81	44	19	35	95	57	81	46	10	29
Korea	93	43	75	39	15	29	92	13	58	31	2	17
Luxembourg	62	55	61	22	5	22	60	28	51	20	7	15
Mexico	23	11	20	19	9	16	27	8	21	14	3	10
Netherlands	M	M	M	25	23	25	M	M	M	25	11	20
New Zealand	79	65	75	24	20	24	80	55	72	28	26	30
Norway ²	93	72	85	29	22	27	95	64	84	36	15	28
Poland ²	63	43	57	10	11	10	61	32	51	14	9	11
Portugal	27	11	20	9	6	8	34	3	23	15	8	11
Spain	51	18	37	31	12	22	58	9	34	36	5	20
Sweden	87	60	75	29	21	27	88	62	78	34	22	30
Switzerland	92	82	87	36	29	34	86	62	77	16	7	14
Turkey	30	13	25	10	7	9	22	9	18	7	3	6
United Kingdom ³	70	61	69	29	20	26	60	39	53	28	16	24
United States	87	81	86	36	32	37	89	81	87	39	24	35
Country mean	72	51	63	25	17	23	72	39	59	27	11	21

M = Missing data.

1. Excluding ISCED 3C short programmes.

2. Year of reference 1998.

3. Not all ISCED 3 programmes meet minimum requirements for ISCED 3C long programmes. Full details of the ISCED 97 system used to define upper secondary and tertiary in individual countries are given in Annex 3 of OECD (2001d).

Source: OECD (2001d).

highest family income quartile (National Center for Education Statistics, 2000). In the United Kingdom in the late 1990s, young people from households headed by a professional and a managerial worker were twice as likely to remain in full-time education at the age of 18 as those from households headed by an unskilled manual worker (UK Department for Education, 2000b).²⁷

Given that young people from poorer backgrounds are most likely to lack upper-secondary education, the extension of upper-secondary education has targeted benefits at young people from poor backgrounds. Thus, in the United States, for example, between 1970 and 1999 the high-school drop-out rate fell from 28 to 21 per cent among students from the lowest family income quartile, and from 5 to 4 per cent among students from the highest income quartile. Although the proportionate change was similar in the two quartiles, there were roughly seven times more additional participants in the lowest than in the highest family income quartile (National Center for Education Statistics, 2000).

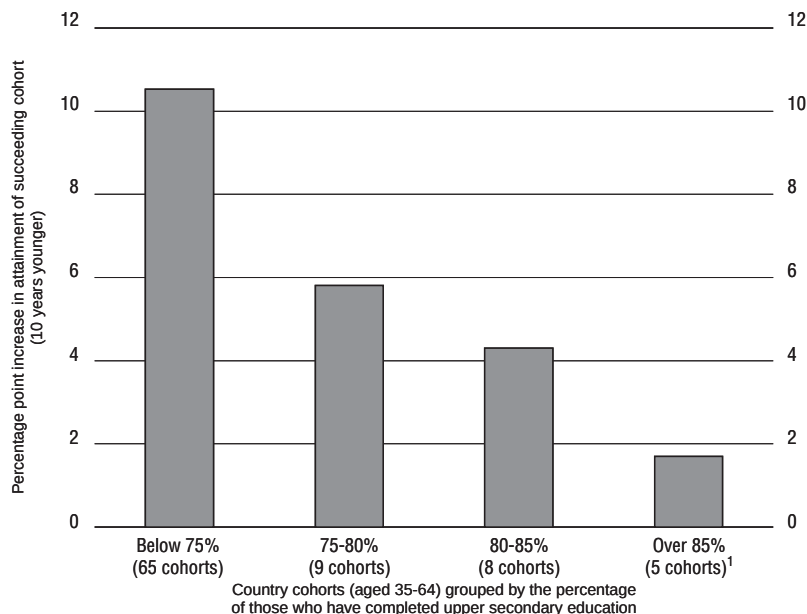
Several countries have set universal participation (at some stage in life) in upper-secondary education as a policy goal, but achievement of this goal remains a challenge in virtually all OECD countries. Indeed, experience shows that as participation rates rise above 75 per cent further increments in participation rates appear to diminish sharply (Figure 8).²⁸ The relatively small group of remaining non-participants often suffers severe problems of disaffection from secondary schools and lack of interest in formal education. Private rates of return for this group may therefore be lower than those reported in Table 3, although broad measures of the social rates of return may be higher (because of the high social costs imposed by factors like crime).

Tertiary education

The participation of young people in tertiary education is highly correlated with the educational attainment of their parents (Figure 9). In many countries, those whose parents have completed some tertiary education are about twice as likely to participate in tertiary education as those whose parents lack upper-secondary education qualifications. This correlation between the educational attainment of successive generations within families acts to limit inter-generational income mobility.²⁹

Increased tertiary participation has improved the *absolute* prospects of those from less advantaged backgrounds, but there is a concern over whether it has also improved their *relative* prospects and therefore equalised opportunities. In Figure 10 two generations of adults are compared to see if the influence of parental background has changed over time. A cohort of secondary school students in the late 1980s was compared with a cohort twenty years older (secondary school students in the late 1960s). The relative influence of parental educational

Figure 8. The challenge of universal upper secondary education



Note: This chart analyses data for three ten-year age cohorts aged 35-64 in 29 countries, splitting these 87 cohorts into four groups according to the 1999 level of upper-secondary attainment in each cohort. The increase in attainment for the succeeding cohort is determined by reference to the cohort ten years younger – for example, showing a 10 percentage points increase when the 35-44 cohort shows a 60 per cent participation rate, and the 25-34 cohort for the same country shows a 70 per cent participation rate.

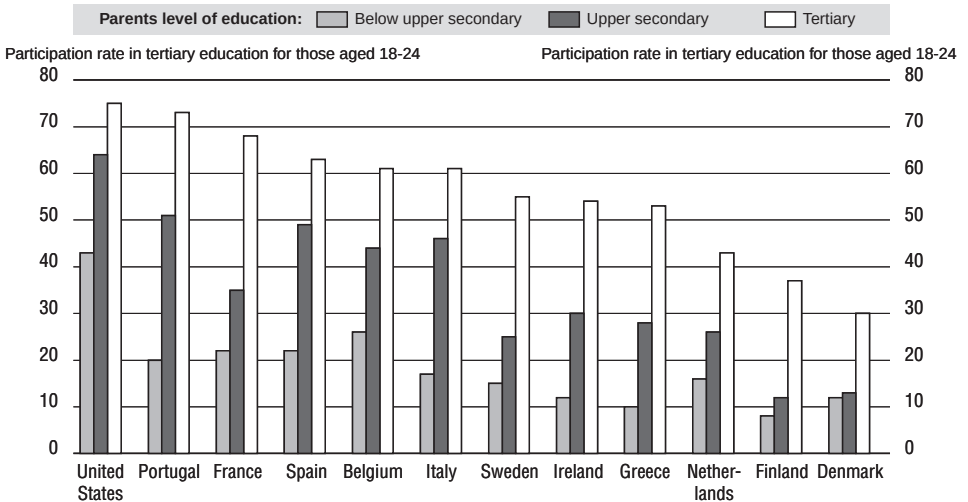
1. Only one of these was over 90 per cent.

Source: Table A.2.2a in OECD (2001c).

background appears to have declined in Belgium (Flanders), Switzerland, the Netherlands and the United States, but increased in Canada, Germany and Australia. Table 6 shows that the average annual increase in the participation rates of young people from low socio-economic groups has in most cases failed to keep up with the increase in total participation rates.

Over the shorter term up to the mid-1990s, for six OECD countries with available data, rates of participation from low income or social class groups have increased. However, young people from better-off backgrounds are also participating more (Table 6). There are many hazards in the interpretation of such data. Other things being equal, one might expect a decline in the proportion of students whose parents have manual jobs, because the base population from which these students are drawn is in decline. Where that percentage holds up (as

Figure 9. The influence of parental education on tertiary participation in 1994-95



Note: Overall participation rates cannot be inferred from this figure since the reported participation rates refer only to those aged 18-24.

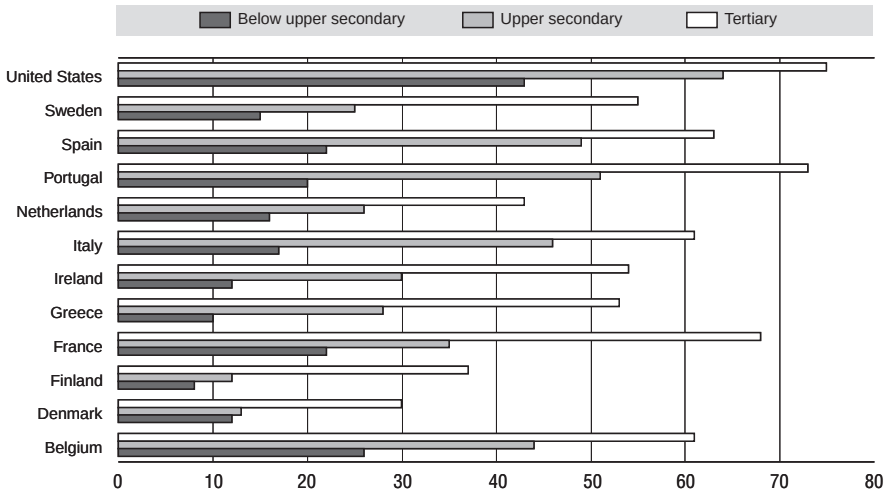
Sources: EURYDICE (1997), Key Data on Education in the European Union 1997 European Communities, Luxembourg; US Bureau of the Census (1995), Social and Economic Characteristics of the Population: School Enrolment, October 1994, Current Population Reports, Series P-20, Table 17. National surveys in Denmark, Finland and Sweden.

in Australia, France and the United Kingdom), it could be argued that this represents a gradual equalisation of opportunities. However, such a conclusion is speculative because of the other factors involved, and any such trend has been extremely weak, particularly when set against the rapidity of the general increase in participation.

Overall, the expansion of tertiary education in OECD countries appears to have had little impact on the *relative* prospects of young people from less-advantaged backgrounds. This demonstrates the importance of other factors in affecting equality of opportunity. Parental and school influences are extremely important determinants of participation at post-compulsory level. In most countries tertiary education requires prior qualifications – generally at upper-secondary level – so that attainment in the compulsory phase of education, as much as anything which occurs subsequently, is a key to tertiary participation.³⁰ Therefore, the expansion of capacity at the tertiary level will not, in itself, have much impact on these factors. The challenge to public policy of delivering equality of opportunity in tertiary education is sizeable, and falls not only on the system for tertiary education itself,

Figure 10. **The influence of parental education on access to tertiary education, 1994-95**

Those aged 18-24: tertiary participation rates by education level of parent



Source: EURYDICE (1997); US Bureau of the Census (1995); and national surveys in Denmark, Finland and Sweden.

but also on support for children and their families, reaching back to pre-schooling and into compulsory and upper-secondary schooling. New research on attainment at age 15 across OECD countries (OECD, 2001e) has shown that countries vary considerably in their capacity to overcome social background obstacles to attainment, suggesting that public policy can achieve a great deal at the compulsory level.

The distribution of the costs and benefits of public post-compulsory education spending

The implication of funding arrangements

Public policy affects the distribution of the costs and benefits of post-compulsory education most directly through the arrangements for public funding of such activity.³¹ The compulsory phase of education accounts for nearly two-thirds of the 15 years of full-time education which young people in OECD countries may expect, on average, to receive. However, since the unit cost of tuition rises with the phase of education, more than half of public expenditure on education is in fact devoted to the post-compulsory phase, split roughly

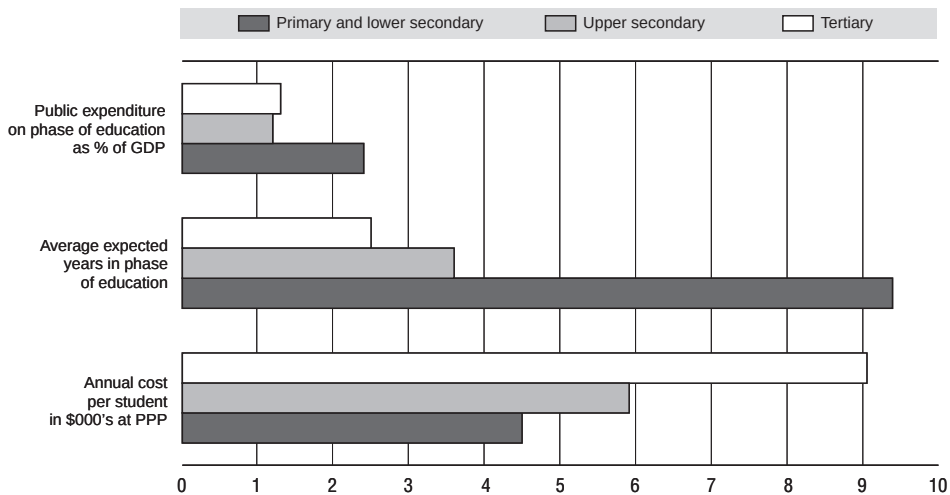
Table 6. **Is increasing participation in tertiary education widening participation?**
A comparison of available international data

	Average annual percentage point increase in participation		Characteristics of the data			Other and latest evidence
	Total	Low socio-economic group	Time period	Low socio-economic group definition	Special features of student data	
Australia						The percentage of tertiary students from a low socio-economic background has changed little, dropping from 15% in 1991 to 14.5% in 1997
Belgium (Flemish community)	1.6	0.7	1985-92	Families whose heads are labourers	Those aged 18-25 in higher education	
France	1.2	0.6	1982-93	Fathers are blue collar workers		Percentage of students whose fathers are blue collar workers remained unchanged at 12% between 1982-83 and 1996-97
Germany						23% of higher education students in the old Länder were from a low socio-economic background in 1982, compared with 14% in 1997
Ireland	1.8	1.5	1986-92	Unskilled workers	Entering full-time students	The gap between participation rates of low and high status groups has changed little since 1980
Japan	1.0	0.6	1990-96	Families in the lowest two income quintiles	Enrolment in day courses at universities as a percentage of 18 to 21 year olds	
United Kingdom	1.8	1.0	1991-97	Unskilled	Home entrants to higher education as a proportion of the average 18 to 19 year old population	Little change in the social class mix of entrants to higher education between 1994 and 1999
United States	0.9	1.2	1990-96	Lowest income quartile	Dependent family members aged 18-24	By 1999 college completion rates for the lowest income quartile returned to a previous peak, but that peak is little higher than the 1970 level

Note: The average annual percentage point increase is calculated as the percentage point change in the participation rate divided by the number of years in the reference period.

Source: For the main table, OECD based primarily on country-provided information for the thematic review of the first years of tertiary education. For left-hand column information, see OECD (2001c); for Ireland, see Clancy and Wall (2001); for the United Kingdom, see UCAS (2000); and for the United States, see Mortenson (2001).

Figure 11. **Expenditure on education in OECD countries 1998**
OECD country averages



Note: Data subject to some OECD estimates. OECD countries devote about 0.5 per cent of GDP in public expenditure to other types of education, mostly pre-primary.

Source: OECD (2001c).

equally between upper-secondary and tertiary levels (Figure 11). On average, annual expenditure per student in OECD countries is about \$4 000 at primary level, \$5 000 at lower-secondary level, \$6 000 at upper-secondary level, and \$9 000 in tertiary education.

In practice, financing education has implications for parents and other family members as well as students. Parents usually contribute towards the costs of human capital investment, and therefore may take part in the initial decision to invest in human capital. Some policy arrangements take explicit account of this, either by assuming that parents will provide some financial support according to their means, or by providing tax breaks for student households where the benefits tend to go directly to the parents rather than to the student. For the sake of simplicity in this paper, the distributional implications of educational finance will be considered primarily from the viewpoint of the individual student over their lifetime rather than from a family perspective. This implies that it is assumed that the costs and benefits of educational finance arrangements for parents, such as tax allowances, are simply handed on to the student.

Among young adults aged 25-34 in OECD countries, about a quarter have tertiary qualifications (Table 5), and will usually have benefited from public funding at both upper-secondary and tertiary levels. It can be estimated that, on average in OECD countries, individuals in this group receive a transfer from public funds of about \$50 000, taking into account the public financing of tuition as well as student grants and loans.³² Individuals in an intermediate group whose highest qualification is upper-secondary – about half the cohort – receives a transfer from public funds of about \$18 000. The worst-off group – those who drop out of school at the compulsory school-leaving age – do not obtain such transfers.³³ However, in the context of a progressive tax system, such regressiveness may merely act to limit the net transfer of resources from the richer to the poorer segments of society that is embedded in the overall tax-transfer system.

Various design features of tertiary funding schemes complicate, but do not fundamentally alter this picture. In countries where public funding of tertiary institutional fees, subsidised loans³⁴ or grants are means-tested, support is more concentrated on those from less affluent backgrounds. Conversely, in other countries, where tax allowances³⁵ are used to support participation in tertiary education, the biggest beneficiaries will tend to be high earners with high marginal tax rates. Although such measures are important in individual countries, their overall impact on income distribution in OECD countries tends to be modest, since 82 per cent of public expenditure on tertiary education is devoted to the direct funding of tertiary institutions.³⁶

Increasing the private cost of tertiary education: evidence of the impact on demand

If public funding for tertiary education were to be cut to reduce the regressive transfer from public funds, there would be a risk that participation in such education might fall. However, the limited direct experience of changes in public funding arrangements suggests that the impact on student numbers is likely to be relatively small:

- In the United Kingdom, the replacement of grants by loans and the introduction of tuition fees in the 1990s had no obvious effect on participation rates (UCAS, 2000).³⁷
- In New Zealand, the replacement of grants by a loan system in 1992 had no marked observable effect on the growth rate of participation in tertiary education (New Zealand Ministry of Education, 1999).
- In Australia, according to one study, the introduction of tuition fees in 1989 reduced applications by school leavers by 14 per cent below what they would otherwise have been, but did not affect application rates by older applicants (Andrews, 1997). However, another study suggested that tuition fees have had no discernible negative effects on student enrolment (Vossensteyn and Canton, 2001).

As for possible adverse effects on particular groups, policy has sought to minimise such negative effects on access by students from disadvantaged backgrounds. In many cases, loan and fee regimes have been introduced with elements of means-testing, and loan arrangements are often structured so that the lifetime repayments are lower for graduates with lower incomes and/or do not begin until graduate incomes exceed a set threshold in the future. Experience to date also suggests limited negative effects on access by disadvantaged groups:

- In the United Kingdom, the replacement of grants by loans and the introduction of tuition fees has left the social class mix of entrants to universities unchanged, and the proportion of ethnic minority entrants and women slightly higher than before (UCAS, 2000). The take-up of student loans has been approximately equal across students from more and less affluent backgrounds. Just as many students from well-off as from poor backgrounds reported worries about getting into debt. The implication is that debt-aversion may mean that some students do not take advantage of subsidised loans, but this does not seem to particularly disadvantage those from less affluent backgrounds. Some ethnic minority students are more reluctant to take out loans but there is no evidence that this translates into under-participation (UK Department for Education and Employment, 2001).
- In New Zealand, despite the introduction of a loan scheme in 1992 and substantial fee increases, Maori and Pacific Island groups increased their participation rates significantly (by 24 per cent and 28 per cent, respectively, between 1994 and 1998) (New Zealand Ministry of Education, 1999).
- In 1974, Australia abolished tuition fees and introduced income support measures for all students in an attempt to widen access. A number of studies have shown that the socio-economic mix of students in Australian universities was little changed as a result (Committee on Higher Education Funding, 1998). Nor did the socio-economic mix of students change following the re-introduction of tuition fees in 1989 based on an income contingent loan, or following the more recent increase and differentiation in fees (Vossensteyn and Canton, 2001).

The limited evidence reviewed above suggests that the simultaneous increase in tuition fees and an expansion of student loan arrangements might advance equity objectives without compromising efficiency goals. An increase in tuition fees would reduce the regressive nature of financial arrangements in post-compulsory education, while the greater availability of student loans would act to offset the impact of increased private costs on enrolment. At the same time, easier access to student loans, even without a subsidy element, may be particularly important for young people from disadvantaged backgrounds, improving opportunities for all individuals to develop to their full potential.

CONCLUSION

This paper has documented the high average private and social internal rates of return to education immediately following compulsory schooling. The high private internal rates of return suggest that there are strong incentives for the average student to engage in education activity. Indeed, the excess of private returns over estimated social returns suggests that policy is set so as to internalise a substantial part of any externalities that may be associated with post-compulsory education. Furthermore, the large gap between these estimated rates and the risk-free interest rate point to super-normal returns to investment in human capital. This could signal temporary excess demand for higher educated workers, with market forces being expected to eventually drive down returns to rates that are similar to those on alternative productive assets – though this transition might take a long time. It could also reflect economic rent related to a scarce resource, namely ability and motivation of individuals, with the internal rates of return for the marginal student being lower than for the average student. For public policy purposes, it is important to establish which of the two possible explanations of high internal rates of return are more relevant. If it is a shortage of higher educated persons *per se*, then policy should aim at expanding capacity in post-compulsory education as this would result in high returns at the margin for both individuals and society. On the other hand, if high average rates of return are due to a shortage of abilities, capacity expansion and stronger private incentives to acquire post-compulsory education may not result in high rates of return at the margin for individuals or for society at large.

The evidence provided in this paper also indicates that the beneficiaries of government spending on post-compulsory education tend to come from relatively well-off families and have high income prospects. There are several possible ways in which these equity outcomes can be altered. One important reason why the expansion of post-compulsory education has not significantly improved equality of opportunity could be that compulsory education has not succeeded in sufficiently reducing the link between basic educational attainment and children's parental background. This would point to the importance of intervention at an early stage when children's cognitive and non-cognitive abilities are being developed so as to equalise their chances of taking advantage of post-compulsory education. The regressivity of the post-compulsory financing system could be reduced by increasing tuition fees. However, this would reduce the financial gains from investing in tertiary education and might have adverse effects on the access of people from disadvantaged backgrounds to higher education. An accompanying expansion of students' access to loans to finance their education could offset such effects, and the experience of countries that have combined an increase in tuition fees and an increase in student loan facilities suggest that there are no significant adverse effects on participation.

NOTES

1. See Bassanini and Scarpetta (2001) and OECD (2001a).
2. These may include better health and, for many people, enjoyment derived from the process of learning and the exercise of learnt skills independently of monetary rewards. See OECD (2001b) for a review of studies on the non-economic benefits of education.
3. Post-compulsory education in this article refers to upper-secondary and tertiary education. In some countries parts of upper-secondary education are compulsory.
4. See the appendix for definitions of upper-secondary and tertiary education.
5. Piece (1997) finds that high-wage jobs in the United States are more likely to have comprehensive benefits (especially employer-provided health insurance, pensions, and paid leave). Moreover, data from the Current Population Survey indicate that changes in the incidence of employer-provided health insurance and pension coverage have exacerbated relative wage changes, with a substantial decline in the relative likelihood of coverage for less-educated workers from 1979 to the mid-1990s.
6. Various hypotheses have been advanced for the shifts in relative demand and supply: skill-biased technical change that has increased the relative demand for highly educated and more skilled workers; international trade that has reduced the demand for the less educated in some manufacturing industries (Wood, 1998, and Borjas and Ramsey, 1995); and, in the United States, the declining size of cohorts entering the labour market and the increased rate of unskilled immigration (Katz and Murphy, 1992; Borjas *et al.*, 1997). Other hypotheses for the increase in wage premiums in recent decades in the United States and the United Kingdom include the decline in unionisation (and, in the case of the United States, the fall in the real value of the minimum wage), and in Sweden and Italy it has been related to the weakening of centralised wage-setting situations.
7. See, for example, Katz and Autor (1999) for an analysis of the changes in the wage structure and earnings of several OECD countries.
8. The age-earnings relationship across birth cohorts is another factor contributing to changes in the wage structure by age, but it has not been taken into account in this study. Moreover, human capital depreciation due to technological change could also influence the wage profile of ageing workers by reducing faster individuals' earning capacity over the life cycle (Ramirez, 2001).
9. This pattern reflects the Japanese seniority pay system and the mandatory age of retirement. This arrangement results from the well-known fact that older workers in Japanese firms leave their "career" employer prior to permanent withdrawal from the labour market, transferring to a related company (subsidiary) where earnings are lower. Because the mandatory retirement age from a career job intervenes before the employee becomes eligible for a public pension, there are strong incentives for older workers to continue work at lower wages.

10. However, in some countries, notably the United States and the United Kingdom, young people often combine participation in education and part-time work. Recent studies have suggested that subsequent student employability may be enhanced by part-time work experience (UK Department of Education and Employment, 2000a).
11. The subsidy rate includes student grants for tuition but excludes those for living costs.
12. In the internal rate-of-return calculations that are reported in the article, the theoretical length of tertiary education is a weighted average of the theoretical lengths of first and advanced degrees (*e.g.* master and professional degrees).
13. With a proportional tax regime, changes in the level of the tax will have no effect on human capital accumulation. Increases in the tax rate reduce earnings by the same proportion as they reduce costs; so the return should not be much affected by the rate. For further discussion of taxes on human capital, see Gordon and Tchilinguirian (1998).
14. In many countries, young people combine study with part-time work. Under such circumstances the opportunity cost of education will consist of a mixture of foregone earnings and foregone leisure. If the foregone leisure time is valued at the same rate as foregone working time, the rate of return is not affected by such arrangements. If, on the other hand, the opportunity cost per unit of leisure is assumed to be less than earnings per unit of working time, the internal rates of return in Table 3 would be understated.
15. Indeed, calculation of the estimated rates of return implicitly assume a replacement ratio for unemployment benefits equal to 0 per cent. Should the unemployment benefits cover 50 per cent of the lost earnings, the estimated impact of the unemployment risk on the rate of return would be cut at least by half. The impact of unemployment benefits on the internal rate depends also strongly on the entitlement conditions for the receipt of such benefits, especially for young people with limited work histories.
16. The existence of non-economic benefits would reinforce this argument as, if quantified, they would raise further the calculated rates of return.
17. For earlier OECD estimates of internal rates of return, see OECD (1997b and 1998). The previous OECD exercise from 1998 involved the collection of information via country representatives through a questionnaire. The current exercise is based directly on data sets for each country available to the OECD.
18. This implies that the impact of the other factors is conditional on the earnings gains and the length of education.
19. The inclusion of unemployment benefits in the rate-of-return calculation would lower the impact of the unemployment risk. As replacement rates move towards 100 per cent, the impact of the unemployment risk would go to zero.
20. It should be noted, however, that wage relativities also reflect other things than market forces.
21. See OECD (2001b) for a review of studies measuring the social benefits of education.
22. The signalling role of education is analysed in Bedard (2001) for the United States and in Harmon and Walker (2001) for the United Kingdom.
23. See *e.g.* OECD (2001b). A recent econometric study linking people's willingness to pay for more expensive houses and the proportion of graduates in the neighbourhood suggests that the externality from tertiary education, in the form of neighbourhood benefits, may be as large as the individual benefits (Gibbons, 2000).
24. This may partly reflect that the calculations ignore the probability of educational failure but even correcting for this, rates of return are likely to remain high.

25. High private internal rates of return would also be compatible with equilibrium if individuals apply a high discount rate to future gains. Indeed, some studies on time preferences of individuals report very high discount rates, see *e.g.* Alessie and Kapteyn (2001).
26. This picture of increased attainment is common to virtually all OECD countries for which data are available. The sole exceptions are very slight declines in male tertiary participation rates in Poland and Hungary.
27. The links between childhood experiences and educational attainment are analysed in Gregg and Machin (2001) for Britain and in Büchel *et al.* (2001) for Germany.
28. OECD (2001c), pp. 22-23, describes how countries have responded with a variety of policy measures to keep young people in education beyond the school-leaving age, to ensure that young people see what they are taught as being of practical relevance, and to support their future motivation to learn.
29. For evidence on intergenerational income mobility, see *e.g.* Solon (1992), Björklund and Jantti (1997), Couch and Dunn (1997), and Checchi *et al.* (1999).
30. In the United Kingdom, for example, 44 per cent of 18 year olds from better-off backgrounds obtain the upper-secondary qualification of two A levels, compared with only 18 per cent from less-affluent backgrounds. However, for those who do obtain two A levels, social origin appears to have little bearing on the prospects of entering higher education, (UK Department for Education, 2000c).
31. The figures given here are for tuition only. OECD governments also provide a substantial stream of public funding to tertiary institutions for research purposes and, in practice, cross-subsidies between tuition and research funding certainly occur.
32. In OECD countries, the average tuition cost of a tertiary qualification is \$35 000, with over 80 per cent coming from public funds. In addition, student grants and loans represent 17 per cent of total government expenditure on tertiary education. The net result is a transfer from public funds to the graduate of about \$35 000. On the premise that schooling is compulsory up to the 16th birthday, and upper-secondary education typically lasts until age 18, it can be assumed that a tertiary graduate has also benefited from three years of upper-secondary education, with the average transfer of public funds estimated at \$6 000 per year – yielding a separate transfer of about \$18 000. The total subsidy to tertiary graduates is therefore about \$50 000. See OECD (2001d) for more details.
33. The regressive nature of funding arrangements in tertiary education has been recognised for many years. For an early analysis, see Hansen and Weisbrod (1969).
34. There are two main types of government-supported student loan – “mortgage” and “income-contingent” loans. Under mortgage schemes, repayments are typically triggered by debtors achieving a certain income level, at which point they pay off regular amounts of their loan each year until it is fully repaid. Under income-contingent schemes, repayments may again be triggered by the debtor reaching a threshold income level, but the repayment then takes place as a fixed proportion of the debtor's income (or income above the threshold level) until the debt is repaid. Given that the interest rate charged on student loans is typically below the market rate and low earners pay off income-contingent loans more slowly (and therefore at a lesser real cost) than high earners, income-contingent loans are more equitable in their impact than mortgage-style loans.

35. On efficiency grounds, the argument for tax relief for investment in human capital is that it avoids the distortionary double taxation which would arise if income is taxed prior to its use to fund human capital investment and then again at the point where that investment is transformed into an income stream. Tax breaks on physical capital investment are commonly justified on similar grounds.
36. For a general picture of the mix of grants, loans, specific subsidies and tax breaks used by OECD countries, see OECD (2000).
37. The introduction of fees introduced a one-year blip in applicant figures as some students sought to enter higher education one year early to escape paying fees, but this blip was corrected the following year.

APPENDIX

Definitions of upper-secondary and tertiary education

The categorisation of phases of education in this paper follows the internationally agreed “ISCED” convention adopted in 1997 and agreed internationally by Member countries of the OECD, and the United Nations. The system divides education into six levels based on a range of criteria, including years of study, type and level of educational programme, linkage with subsequent ISCED levels, and vocational or non-vocational orientation.

For the purposes of this study the main categories employed are ISCED 3 (upper-secondary), and ISCED 5 and 6 jointly (tertiary). In addition, there is a quantitatively much less important category of ISCED 4 (post-secondary non-tertiary), which mainly covers shorter post-compulsory courses.

A full description of the criteria used to allocate individual country programmes into ISCED levels is given on pages 340-341 of OECD (2001c). The great diversity of national education systems inevitably means that the application of a complex range of overlapping criteria requires some judgement, and, in practice, the assignment of national programmes to ISCED levels is agreed between individual OECD countries and the OECD in the context of preparation of the annual compendium of OECD education statistics – *Education at a Glance*. A summary of the criteria used to distinguish between levels is given below.

Upper-secondary programmes are the final stage of secondary education. They are primarily determined by nationally-defined boundaries between lower and upper-secondary programmes, with completion of the lower-secondary programme normally being a precondition of entry into an upper-secondary programme. There are substantial differences in the typical duration of upper-secondary programmes both within and between countries, ranging from two to five years of schooling.

Upper-secondary programmes can include a mix of compulsory and non-compulsory education, as the year in which compulsory schooling ends is not part of the defining criteria used by ISCED to define upper-secondary education.

Tertiary programmes are divided into first and second stage programmes – the latter leading to an advanced research qualification. Entry to tertiary education normally (but not exclusively) requires completion of upper-secondary education. They normally require at least two years of full-time study (or the part-time equivalent). Second-stage programmes require the submission of a thesis or dissertation of publishable quality (alongside coursework).

Data sources for the calculation of internal rates of return

Earnings data have been obtained from national sources and refer to male and female full-time workers. They are generally available for five-year age intervals, and the most recent

data are from either 1999 or 2000. With the exception of Italy, earnings data are on a pre-tax basis.

- For the *United States*, earnings data are from the CPS Annual Demographic Survey, March 2000. They refer to 1999 annual earnings by educational attainment, by age for men and women 18 years old and over who worked full time year round. The educational categories are defined as “not high school graduate” for lower-secondary, “graduate” for upper-secondary, and “total college” for tertiary education.
- For *Japan*, earnings data are from the Ministry of Health, Labour and Welfare, June 1999. They refer to 1999 gross monthly earnings by educational attainment by age for men and women 18 years old and over who worked full time year round. These earnings data do not include bonuses. However, as bonuses are proportional to the monthly wage, they do not affect the calculation. The educational categories are defined as lower-secondary, upper-secondary and “junior college and university” for tertiary education. This last category was aggregated using the share of people in each educational category as weights.
- For *Germany*, earnings data are derived from an unweighted sample of the German Socio-Economic Panel Study (GSOEP). They refer to 1998 average annual earnings by educational attainment, by age for men and women who worked full time year round. The educational categories are defined as “between ten and 13 years of education” for lower-secondary, “between 13 and 17 years of education” for upper-secondary and “superior or equal to 17 years of education” for tertiary education.
- For *France*, earnings data are from the Enquête-Emploi from INSEE. They refer to 2000 median monthly earnings by educational attainment, by age for men and women who worked full time year round. The educational categories are defined as “enseignement secondaire inférieur” for lower-secondary, “enseignement secondaire supérieur et post-secondaire” for upper-secondary and “enseignement supérieur” for tertiary education.
- For *Italy*, earnings data are derived from the Survey of Italian Households’ income and wealth from Banca d’Italia. They refer to 1998 annual post-tax earnings by educational attainment, by age for men and women who worked full time year round. The educational categories are defined as “middle school” for lower-secondary, “high school” for upper-secondary and “university degree” for tertiary education.
- For *Canada*, earnings data are from the Labour Force Survey, Statistics Canada. They refer to 2000 annual average earnings by educational attainment, by age for men and women who worked full time year round. The educational categories are defined as “études secondaires complétées et études post-secondaires partielles” for lower-secondary, “certificat ou diplôme d’études post-secondaires” for upper-secondary and “grade universitaire, baccalauréat, maîtrise ou doctorat” for tertiary education. These categories were aggregated using the share of people in each educational category as weights.
- For *the United Kingdom*, earnings data are from the Labour Force Survey, Office for National Statistics, United Kingdom. They refer to 2000 average weekly earnings by educational attainment, by age, 16 years old and over for men and women who worked full time. The educational categories are defined as “no qualification, secondary education up to the age of 14” for lower-secondary, “GCSE A to C or equivalent and GCE A level or equivalent” for upper-secondary and “higher education and degree or equivalent” for tertiary education. These categories were aggregated using the share of people in each educational category as weights.

- For *Sweden*, earnings data are from Statistics Sweden. They refer to 1999 annual average earnings by educational attainment, by age for men and women who worked full time. The educational categories are defined as “level 2, nine-year compulsory school” for lower-secondary, “level 3-4, upper-secondary school, two years or shorter and upper-secondary school, three years” for upper-secondary and “level 5, 6 and 7, tertiary education, shorter than three years, tertiary education three years or longer and postgraduate education” for tertiary education. These categories were aggregated using the share of people in each educational category as weights.
- For *the Netherlands*, earnings data are from Statistics Netherlands. They refer to 1997 yearly earnings of full-time employees by gender, age group and education level. The educational categories are defined as “MAVO + VBO” for lower-secondary, “HAVO/VWO + MBO” for upper-secondary and “HBO + WO” for tertiary education. These categories are aggregated using the share of people in each educational category as weights.
- For *Denmark*, earnings data are from Denmark Statistics. They refer to 1999 income from wages and salaries for full-time employees by gender, age and educational level. The educational categories are defined as “basic school including lower-secondary” for lower-secondary, “upper-secondary, vocational secondary and post-secondary not tertiary” for upper-secondary and “medium long tertiary and long tertiary” for tertiary education. These categories were aggregated using the share of people in each educational category as weights.

The unemployment rates by education and age come from *Education at a Glance* and refer to 1999.

The labour productivity growth rate used in the calculation is set equal to the average rate in the OECD Economics Department’s medium-term reference scenario for 2002-06.

The theoretical length of studies is taken from OECD (1999a), *Classifying Educational Programmes, Manual for ISCED-97 Implementation in OECD Countries*. For tertiary studies, the weighted average theoretical length of the different programmes are used (*e.g.* master and professional degrees), the weights being the share of students in the different programmes.

The private cost of tertiary education is computed as the average total cost per full-time student multiplied by the share of private funds in total tertiary education spending. The data on total cost per full-time student and the share of private spending in total spending come from *Education at a Glance* (see OECD, 2001b) and refer to the year 1998 (which is scaled up by the GDP price deflator to get 1999 values).

The data on student loans and grants are derived from details of such systems from national sources. The maximum length of the associated repayment schedule has been used for the calculation.

The income tax rates and the social security contributions paid by employees are derived from national tax models developed by the OECD and refer to 1999.

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TAX SYSTEMS IN EUROPEAN UNION COUNTRIES

Isabelle Joumard

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INTRODUCTION

A review of tax policies of EU countries is useful for several reasons. First, the tax to GDP ratio in the EU area, having risen steadily up to the late 1990s, is very high by international standards (Figure 1). Second, while some caution is needed in measuring the incidence of the tax burden, there is little doubt that average effective tax rates on labour and consumption are much higher in the EU area than in most other OECD countries. Finally, the removal of obstacles to the free movement of goods, people and capital within the EU area, combined with the advent of the single currency, have brought to the fore a number of international taxation issues, related to cross-border investment, saving and shopping, as well as e-commerce. Thus, tax design is an important influence on EU countries' performance and their experience may provide useful insights for other countries and regions where international integration is deepening.

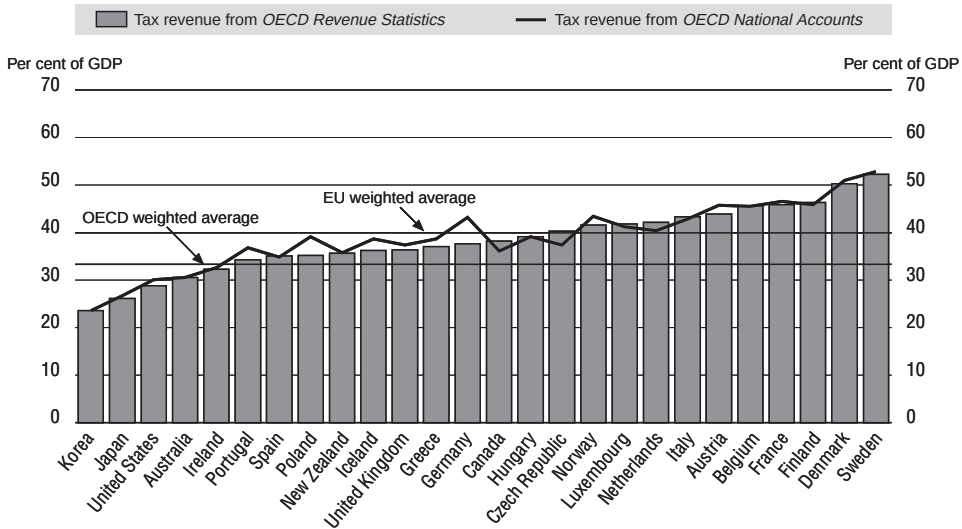
This paper provides an overview of some of the more common broad features of tax systems in the EU and of the main policy issues they raise. The first section presents the main forces shaping tax policy in the EU area, since the early 1970s and in the near future. The second section examines the main features of EU countries' tax systems and how they affect employment, consumption patterns, saving and investment, income redistribution, and tax compliance and collection costs. Finally, the last section proposes some recommendations for future tax reforms.

FORCES SHAPING TAX POLICY IN THE EU AREA

Growth in public spending and fiscal consolidation commitments have implied rising tax burdens

A sustained expansion of public sector commitments to welfare provision – which has gradually become more general and generous – and the rise in unemployment acted as persistent underlying pressures to increase taxes in most EU countries between 1970 and the early 1990s.¹ From a level broadly at par with that of the United States in 1970, the tax-to-GDP ratio for the EU area

Figure 1. Tax to GDP ratio in OECD countries¹
1999

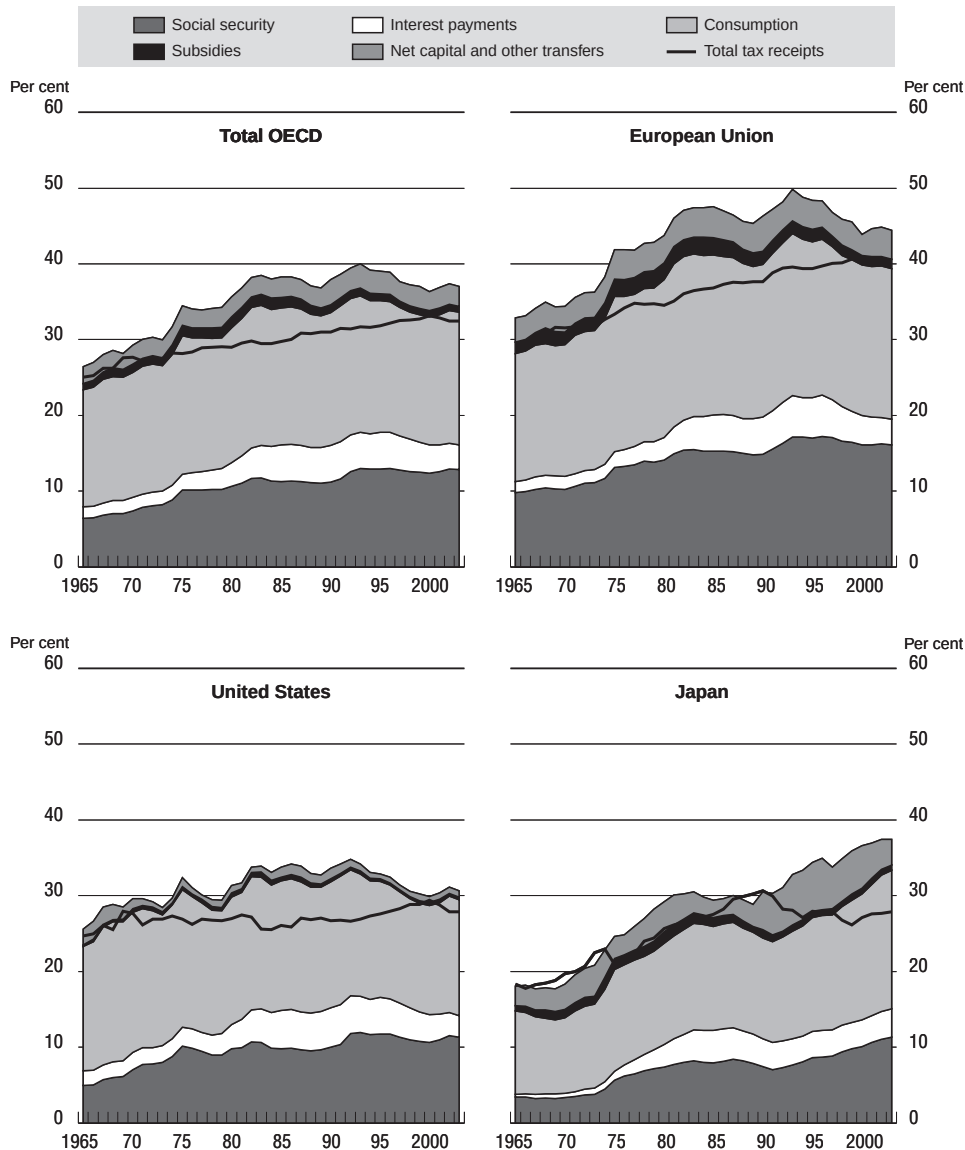


1. Tax revenues from *OECD National Accounts* are not fully comparable with the information found in *OECD Revenue Statistics*. The divergences are due to a variety of general and country specific factors. The most important are the following: i) differences in accounting periods and methods; ii) voluntary social security contributions, which are fairly large for some countries (including Germany), are included as tax revenues in the National Accounts but not in the Revenue Statistics; so are the employer social security contributions for government employees; iii) imputed government contributions are not included in the Revenue Statistics; iv) inheritance and gift taxes are not considered as taxes in the National Accounts while they are included in the Revenue Statistics; v) for EU countries, VAT and customs revenues are shown net of the amounts transferred to the European Commission in the National Accounts while the Revenue Statics show gross data.

Source: *OECD National Accounts*; *OECD Revenue Statistics, 1965-2000*.

increased by 8 percentage points up to 1993, while it remained broadly stable in the United States. The rise in the tax-to-GDP ratio in Japan was broadly similar to the EU area but from a much lower starting point. Reflecting the important role played by wage-based taxes in financing the welfare system in most EU countries (social security contributions and/or personal income tax), this was largely reflected in a pronounced rise in the tax wedge on labour. Since the increase in public expenditure was also financed by an “inflation tax” until the late 1970s, the disinflation policies pursued during the 1980s implied a surge in real interest rates and a debt “snowball effect” reflected in a steep increase in interest payments on public debt as shown in Figure 2 (in particular Belgium, Denmark, Greece, Italy, Portugal and Sweden). The surge in government expenditure also reflected substantial support to public enterprises (Greece, Italy,

Figure 2. Trends in general government tax revenues and outlays
As a percentage of GDP



Note: From 2000 onwards data are based on OECD estimates and projections presented in *OECD Economic Outlook 70*.

Source: *OECD Analytical Data Base* and *OECD Revenue Statistics, 1965-2000*. Weighted average for total OECD and European Union.

Portugal, Spain and Sweden), and/or the implementation of large public infrastructure programmes (in particular for countries benefiting from EU structural funds – Greece, Ireland, Portugal and Spain – which cover only part of the spending on these programmes).

The 1992 Maastricht Treaty and later the Stability and Growth Pacts created a framework in which many EU countries have implemented fiscal consolidation efforts. In many EU countries, scaling back public spending was achieved by curtailing public sector pay, adopting strict rules on the number of civil servants (replacing only a fraction of retiring employees), and cutting or postponing public investment. Meanwhile, the tax-to-GDP ratio continued to rise in most EU countries, with the main exceptions being Ireland and the Netherlands. The bulk of the rise in revenues no longer stemmed from personal income taxes and social security contributions but from corporate income and indirect taxes.

A brighter economic outlook has recently allowed some tax reductions

Since the late 1990s, most EU countries have taken advantage of buoyant revenues to reduce tax rates. Though some of these tax measures have involved cutting indirect taxes with little overall impact on supply-side conditions, many have been designed to have a structural impact: increase employment incentives and opportunities, and boost productivity. Main candidates for cuts have been social security contributions and the personal income tax (*e.g.* in Germany, Finland, France, Ireland, Italy, the Netherlands, Spain, Sweden and the United Kingdom). Overall, this has implied a slight decline in tax wedges on labour, though sometimes with a more pronounced impact on low-wage earners. In addition, several EU countries have also introduced measures to achieve a general reduction in corporate income taxes and improve the functioning of capital markets (*e.g.* Germany, Ireland, Italy).

Upward pressures on public spending will likely increase...

Population ageing will, in the absence of reforms, raise spending on pensions and health care. Fiscal implications will likely be considerable for EU countries, with old-age pension spending projected to increase, as a share of GDP, by over 4 percentage points by 2050 in Denmark, Finland, France, Germany, the Netherlands, and Spain (Table 1 and Dang *et al.*, 2001). While estimates are more uncertain for health care, they could add an additional 3 percentage points to the increase in overall public spending on average across EU countries. This mainly reflects rapidly rising elderly dependency ratios in conjunction with extensive public old-age pension and health and long-term care systems in place in many EU countries. Prospects for enlargement of the EU by admitting 13 new member countries may also imply additional spending,² although this would be less significant. The European Commission budget would have to pay for “pre-accession”

Table 1. **Age-related spending in some OECD countries**

Per cent of GDP, changes in percentage points

	Total age-related spending			of which:					
	Level 2000	Change 2000-peak ¹	Change 2000-50	Old-age pension			Health care and long-term care		
				Level 2000	Change 2000-peak ²	Change 2000-50	Level 2000	Change 2000-peak ⁵	Change 2000-50
Austria	10.4	4.6	2.3	9.5	4.3	2.2	..	..	..
Belgium	22.1	5.4	5.2	8.8	3.7	3.3	6.2	3.0	3.0
Denmark	29.3	7.3	5.7	6.1	3.6	2.7	6.6	2.7	2.7
Finland	19.4	8.5	8.5	8.1	4.8	4.8	8.1	3.8	3.8
France ³	..	..	..	12.1	4.0	3.9	..	..	..
Germany	..	..	..	11.8	5.0	5.0	..	..	..
Italy	..	..	..	14.2	1.7	-0.3	..	..	..
Netherlands	19.1	10.1	9.9	5.2	5.3	4.8	7.2	4.8	4.8
Portugal ⁴	15.6	6.6	4.3	8.0	4.5	4.5	..	..	..
Spain	..	..	..	9.4	8.0	8.0	..	..	..
Sweden	29.0	3.4	3.2	9.2	2.2	1.6	8.1	3.2	3.2
United Kingdom	15.6	0.8	0.2	4.3	0.0	-0.7	5.6	1.8	1.7
<i>Memorandum items:</i>									
Australia	16.7	5.6	5.6	3.0	1.6	1.6	6.8	6.2	6.2
Canada	17.9	8.7	8.7	5.1	5.8	5.8	6.3	4.2	4.2
Japan	13.7	3.0	3.0	7.9	1.0	0.6	5.8	2.4	2.4
United States	11.2	5.5	5.5	4.4	1.8	1.8	2.6	4.4	4.4

1. The peak values are in 2050 except for Denmark (2030), Sweden and the United Kingdom (2035), and Belgium and the Netherlands (2040).

2. The peak values are in 2050 except for Japan (2015), the United Kingdom and Italy (2030), the United States, Finland, Sweden, Austria and France (2035), Denmark, the Netherlands, Norway, Portugal and Belgium (2040) and Spain (2045).

3. For France, the latest available year is 2040.

4. Portugal provided an estimate for total age-related spending but did not provide expenditure for all of the spending components.

5. The peak values are in 2050 except for Denmark (2035) and United Kingdom (2040).

Source: Dang, Antolin and Oxley (2001).

preparations, devote resources to infrastructure developments and regional support in these countries, and extend to them the EU Common Agricultural Policy (CAP).

... while forces working to erode tax bases are of concern

Free capital movements, the elimination of custom controls, the advent of the single currency and the development of information and communication technologies all contribute to increase the mobility of tax bases. On the one hand, enhanced mobility within the EU area may create welfare gains by enabling individuals and companies to choose, as a jurisdiction of residence, the country or

region that provides the fiscal package – in particular the provision of public goods and the associated tax burden – best suited to their needs. The greater exposure to international competition also provides strong incentives for governments to raise public sector efficiency and may yield a double dividend: lower taxation and better public services. On the other hand, free movements of products and factors, in conjunction with differences in EU countries' tax systems and barriers to effective information exchanges, extend the scope for tax avoidance and evasion. This could require lowering the tax burden on highly mobile production factors, and result in a higher tax pressure on the less mobile ones, in particular labour, or erode revenues to the point where public services cannot be delivered as extensively as voters might wish. At the corporate income tax level, there is no clear evidence of a race-to-the-bottom since cuts in statutory rates have often been accompanied by base-broadening measures. Nevertheless, recent trends in capital income taxation and the preferential tax treatment to non-residents by many EU countries may signal that such a pressure to lower taxes on highly mobile factors is at play. While enhanced co-ordination in some areas of tax policy could moderate tax base erosion pressures, there are economic and institutional constraints in this regard. Both the size and the composition of public spending vary significantly across EU countries (Atkinson and Van den Noord, 2001). This is reflected in different financing needs which may in turn warrant significant differences in tax systems. Institutionally, the requirement of unanimity for any decision on tax policy at the EU level makes agreement on how to proceed difficult where countries have diverging interests.

The trend towards globalisation in financial markets and the advent of cheap and rapid electronic links to overseas financial markets make it increasingly difficult to tax capital income effectively. In EU countries, restrictions on capital movements were fully removed in the early 1990s. Reinforcing the attractiveness of cross-border investment is the single currency, which has eliminated exchange risks and costs within the euro area. Meanwhile, the limited information flows between financial intermediaries and tax administrations both within and across EU countries – including bank secrecy laws in some EU countries – makes it easy to evade tax.³

EU countries' consumption and corporate tax bases are also becoming more vulnerable to erosion. Intra-EU cross-border shopping has been given a further boost since the adoption of the single currency, which facilitates cross-country price comparisons, and the emergence of e-commerce transactions. E-commerce is much less advanced in most EU countries than in the United States, though disparity across countries is wide – the Nordic countries being in a leading position. Recent estimates suggest that it accounted for less than 0.5 per cent of consumption in 1999, but its share is growing rapidly (Coppel, 2000). And, the advent of "smart" mobile phones, free Internet access, and cheaper telecom tariffs, are expected to boost private consumer e-commerce transactions. Tax base

erosion pressures may thus intensify in certain fields. In the context of Business-to-Consumer (B2C) transactions, EU countries which have maintained a higher effective tax rate on consumption (*e.g.* Denmark and Finland) will be the most affected since EU online providers of digital products currently apply their own country's VAT rates to intra-EU sales and products delivered from a non-EU online source are tax-free.⁴ New information and communication technologies also make a physical location of management and service activities much less important, thus increasing the mobility of corporate income tax bases.

COMMON FEATURES OF EU TAX SYSTEMS

Overview

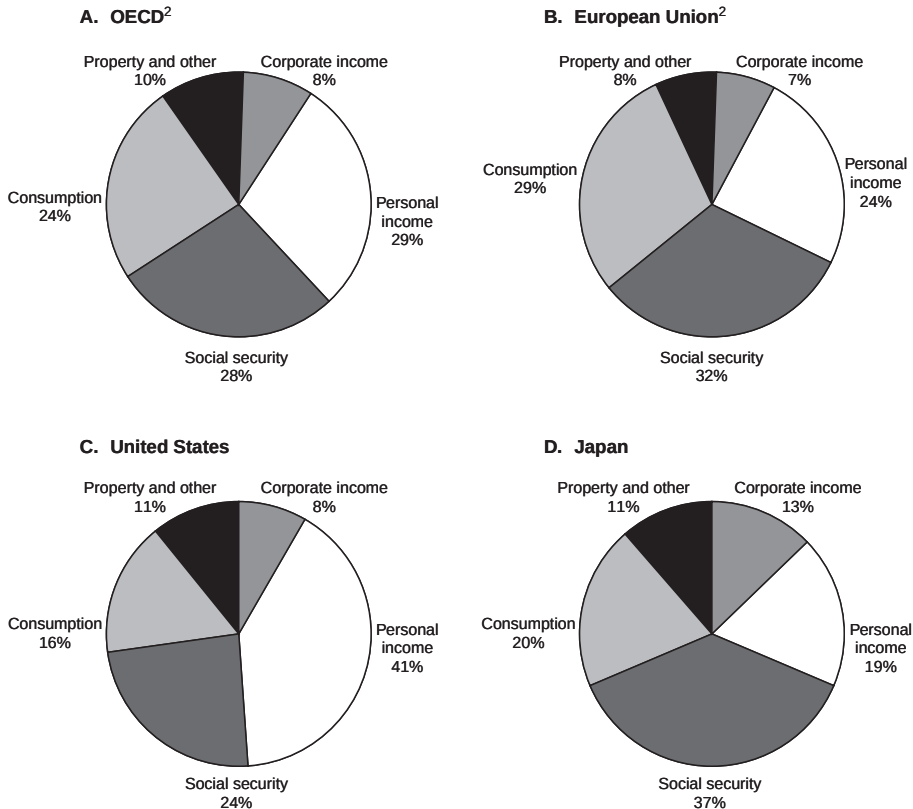
The tax burden in the EU area is much higher than in most other OECD countries. Defined as the tax-to-GDP ratio, it stood at almost 41 per cent in 1999, some 11 and 13 percentage points higher than in the United States and Japan, respectively.⁵ The tax mix is also different. Most EU countries rely heavily on social security contributions, consumption and environmentally-related taxes. On the other hand, corporate income and property taxes account for a much lower share of total tax revenues than in Japan and the United States – the United Kingdom and France being the main exceptions to this EU model (Figure 3). This often reflects a wide range of tax incentives for corporations and a lenient taxation of real estate. As a result of some integration between personal and corporate taxes, the tax system also creates less distortion for corporate financing decisions among domestic resources than in other major OECD economies, though it introduces some discrimination towards foreign investment. Another common distortion is that the personal income tax often grants a favoured tax treatment to specific saving vehicles (housing investment, life insurance and pension schemes). Overall, while income redistribution is often conceived as a key objective of EU countries' tax systems, progressivity embodied in statutory tax rates on personal income is weakened by a large set of tax allowances and tax credits, which mostly benefit higher-income groups. Further lessening the redistributive nature of the tax system is the relatively low taxation of property and capital income and the fact that social security contributions are basically proportional and sometimes regressive (mainly due to ceilings).

High tax wedges on labour

High taxes on labour are partly shifted forward into labour costs...

The average effective tax rate on labour in the EU area appears to be about 15 percentage points higher than in the United States and Japan.⁶ While the calculation of average effective tax rates is fraught with methodological problems

Figure 3. **Tax mix by source**¹
Per cent share of total tax revenue, 1999



1. The breakdown of income tax into personal and corporate tax is not fully comparable across countries.

2. Weighted average.

Source: OECD, *Revenue Statistics 1965-2000*.

and does not take into account any shifting of tax incidence, there is little doubt that taxes in the EU area impinge very heavily on labour markets.⁷ Labour income is most heavily taxed in Austria, Belgium, France, Italy and the Nordic countries while the United Kingdom, Ireland, and Portugal stand out for taxing labour income at an average effective rate broadly equal to that of the United States and Japan. Since the mid-1990s, many EU countries have introduced measures to lower the tax burden on labour, typically by reducing payroll taxes to boost the demand for labour, and foster work incentives (see Box I). However, both the

Box 1. Tax measures to improve labour market performance since the mid-1990s: individual countries' experiences

Many countries have cut payroll taxes since the mid-1990s...

To stimulate the demand for labour, several EU countries have cut social security contributions since the mid-1990s. Some countries (Austria, Belgium, France, Greece, the Netherlands, Spain and the United Kingdom) have targeted the low-paid and/or low-qualified workers, *i.e.* those who have usually suffered the most from high unemployment. Further supporting this approach is evidence suggesting that low-skilled workers face greater wage elasticity of labour demand (OECD, 1994a; Dormond, 1997). In France, the reduction in non-wage labour costs covered about one fourth of wage earners and amounted to about 18 per cent for workers at the minimum wage in 1998.¹ In the Netherlands, the so-called SPAK, introduced in 1996, covers one in six of the workforce and consists of a reduction in social security contributions for wage levels up to 115 per cent of the minimum wage. In Spain, since May 1997 new permanent labour contracts for the young, long-term unemployed, female and older workers, and workers previously with a temporary contract contribute to the social security system at reduced rates (of between 25 and 50 per cent, depending on the targeted group). More than 60 per cent of the new permanent contracts signed over the 1998-2000 period were subject to these reduced contribution rates. In Belgium, a labour cost reduction of about 2 per cent has been achieved and a further cut by 3.4 per cent over six years is programmed (from 1999 to 2004). In the United Kingdom, the National Insurance Contribution system was reformed to reduce the cost of hiring low-paid employees. The starting point at which employers and employees pay their components of National Insurance has been raised, with zero rates for wages below these limits.² Contrasting with these targeted approaches, several countries have cut social security contributions across the board or envisage doing so (Germany, Austria and Finland). In Greece, to promote job creation, a new tax allowance to corporate income tax was introduced in 1999, equal to half of the employers' social security contributions for every new job created.

... rebalanced the tax burden away from labour...

Several countries have recently shifted the tax burden away from labour-intensive activities in order to give a further boost to the demand for labour.

Shifting the tax burden from labour to capital or to a broader tax base. Some EU countries have recently lowered the generous tax allowances granted through the corporate income tax for the depreciation of equipment investment, thus re-balancing the relative cost of labour and capital (*e.g.* Germany and Denmark). Since 1999, the French government is gradually removing the wage component from the base of the local business tax (*taxe professionnelle*), a process which is supposed to be completed in 2003. Furthermore, the tax base to fund contributions for health insurance and family allowances has been progressively extended from labour to capital income (*Contribution sociale généralisée*). In Italy, the 1997-98 tax reform eliminated some employers' compulsory health contributions, bringing the overall employers' contribution rate down to 34.1 from 46.4 per cent. At the same time, a new tax, IRAP, based on expenditure was introduced.

Box 1. Tax measures to improve labour market performance since the mid-1990s: individual countries' experiences (cont.)

... and to polluting activities (the "double dividend approach"). Several countries have introduced or raised energy and other "green" taxes to finance, at least partly, cuts in payroll taxation. In Germany, new taxes on energy consumption implemented in April 1999 have been used to lower pension contribution rates. Italy launched a green tax reform in 1999 which involves a stepwise implementation of excise taxes which are both higher and more closely related to the carbon dioxide emissions produced by each fuel by 2005. The increase in tax revenues is to be recycled through lower taxes on labour. In the United Kingdom, a new climate change levy on companies for the use of gas, coal, and electricity came into effect in April 2001. Part of the receipts is recycled through a 0.3 percentage point cut in employers' social security contributions. In the Netherlands, about one third of the cut in personal income taxes in 2001 was expected to be financed through a VAT hike and green taxes.

Lowering indirect taxes on labour intensive activities. The European Council adopted in 1999 an EC directive granting an option to those EU countries who wish to do so to apply a reduced VAT rate to certain labour intensive services, for the period 2000-02. The objective is to stimulate demand for these services, and thus employment, and to bring part of the informal economy back to the surface. Activities targeted are: i) small repairs to bicycles, footwear, leather articles, clothing and household linens; ii) renovation and repairs to private housing; iii) window washing and cleaning of private homes; iv) home health care; and v) hairdressing. Nine countries have seized this opportunity: Belgium, France, Greece, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom (for the Isle of Man only).

... and enhanced tax incentives to work

EU countries have implemented a large array of tax measures to enhance incentives to enter into employment or to increase work efforts.

Cuts in marginal rates on labour income have been a key device aimed at boosting the supply of labour, across the board (Austria, Germany, Ireland, the Netherlands, Spain, Sweden and the United Kingdom) or targeted on the lower income groups (Denmark, France, Finland, Italy and Portugal).

Tax relief to make work more attractive for targeted groups of the population (spouses and low-paid workers in most cases). An earned income tax credit (EITC) and/or a tax relief for childcare expenses have been introduced or raised in Belgium, Finland, Germany, Italy, the Netherlands and the United Kingdom. To improve second earners' incentives to enter work, Ireland is switching gradually from a joint to an individual assessment of married couple income. France, Germany, Greece, and Spain have also recently raised the general personal income tax allowance, thus exempting the income of most low-qualified workers from taxation. In addition, to

Box 1. Tax measures to improve labour market performance since the mid-1990s: individual countries' experiences (cont.)

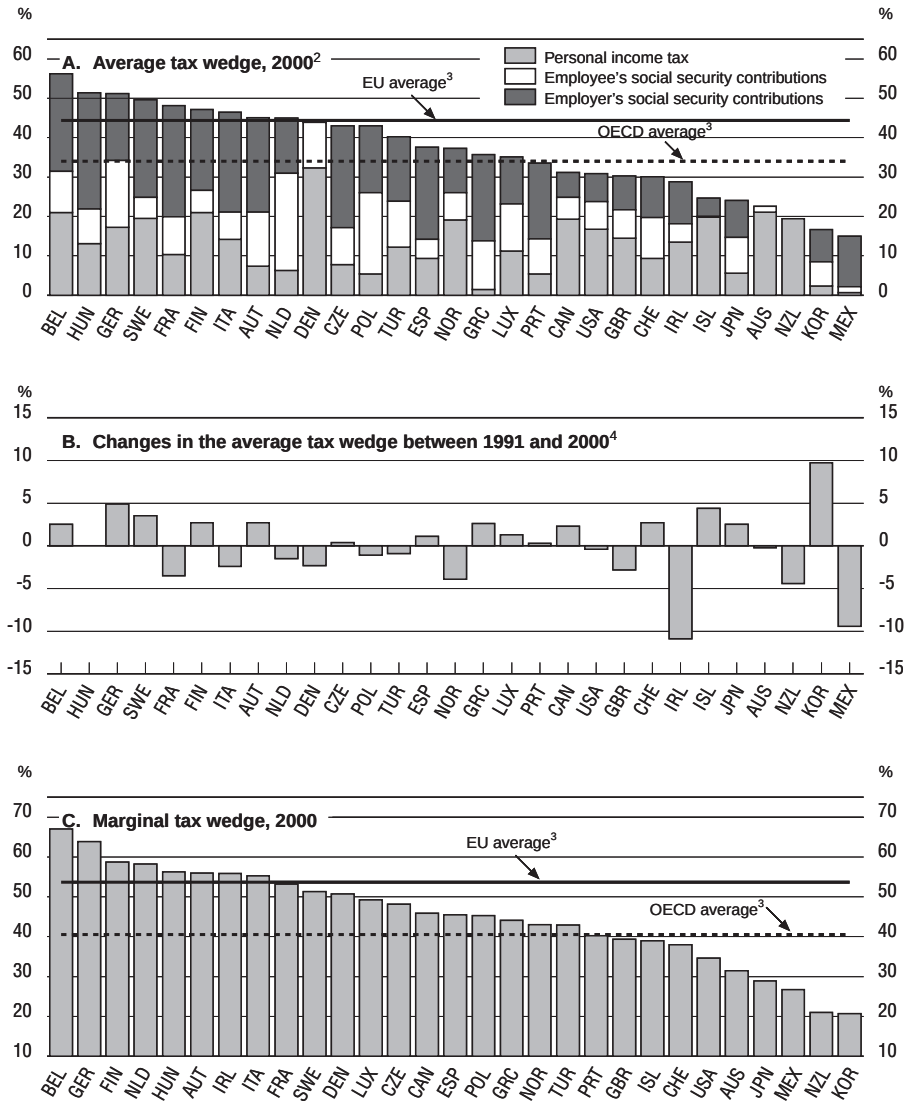
lessen the unemployment trap, a few countries have removed some of the tax privileges granted to out-of-work benefits, or introduced a progressive phase-out scheme for means-tested benefits or tax breaks. Unemployment benefits became taxed in Spain in 1994. In France from 1999, people who qualify for the basic income support (*Revenu Minimum d'Insertion*), are granted a temporary exemption for the tax on rented flats (*taxe d'habitation*) once they find a job. In 2001, an employment bonus (*Prime pour l'emploi*) delivered through the tax system is being introduced and is expected to benefit up to ten million people. As a key element of the United Kingdom's Welfare to Work programme, the qualifying ceiling for several in-work support schemes has been raised and the phase-out rate lowered.

1. In France, a system of graduated rebates of social charges on low wages (*ristourne dégressive*) was instituted in 1993 and later refined and extended in several stages. For more details, see OECD (1999a), Gubian (1999) and Pearson (2000).
2. In the previous system, firms paying wages above the lower limit were required to pay National Insurance on wages below it (as were employees), effectively providing an entrance fee for workers whose wages rose above the threshold.

average and marginal tax wedges on labour remain high. At the wage level of an average production worker (APW), the average effective tax wedge on labour in the EU area approached 40 per cent in year 2000, compared with about 30 and 24 per cent in the United States and Japan respectively (Figure 4, Panel A). For most EU countries, high tax wedges on labour largely reflect the important role played by wage-based contributions in financing the transfer system, as well as its broad coverage and public nature. High tax wedges on labour help to explain the low degree of labour resource utilisation in most EU countries since taxes on labour are in turn partly shifted forward into labour costs (Daveri and Tabellini, 2000).⁸ This largely reflects various rigidities on the labour and product markets, collective bargaining arrangements, and the weak relation between contributions paid and transfers received, all of which reduce firms' ability and/or incentives to resist wage claims.⁹

... and operate to lower work incentives

The marginal tax wedge on labour, which is an important indicator for work incentives, is also significantly higher than in other OECD countries (Figure 4, Panel C). This may result in a low participation rate and/or in lower working hours.

Figure 4. Tax wedges on labour¹

1. For a single individual at the income level of the average production worker. Tax wedges are calculated by expressing the sum of personal income tax, employee plus employer social security contributions together with any payroll taxes as a percentage of labour costs (gross wage plus employers' contributions).
2. Data for 2000 are based on estimated wage levels of the average production worker.
3. Weighted using 1995 GDP and purchasing power parities.
4. The first year refers to 1991 or the earliest year available. To be consistent with the 1991 data, the 2000 data for Austria excludes payroll taxes.

Source: OECD, *Taxing wages 1999-2000*.

If the system contains some elements of family taxation (either because income taxes are levied on households rather than individuals or because there are family-related tax allowances or credits), high marginal tax wedges on labour may discourage a potential second earner from taking on a job. In some countries, in particular the Nordic countries, the distorting effects of the tax system seem to work through short working time amid high participation rates.¹⁰ In some countries, low-paid workers are the most severely affected by high taxes on labour, despite nominally progressive income tax schedules (Figure 5). This largely reflects social security contribution ceilings and/or floors (in place in Austria, Germany, Greece, the Netherlands and Spain) and the fact that high-income earners may benefit from tax relief on certain components of their income, such as compensation in-kind and/or stock options.¹¹

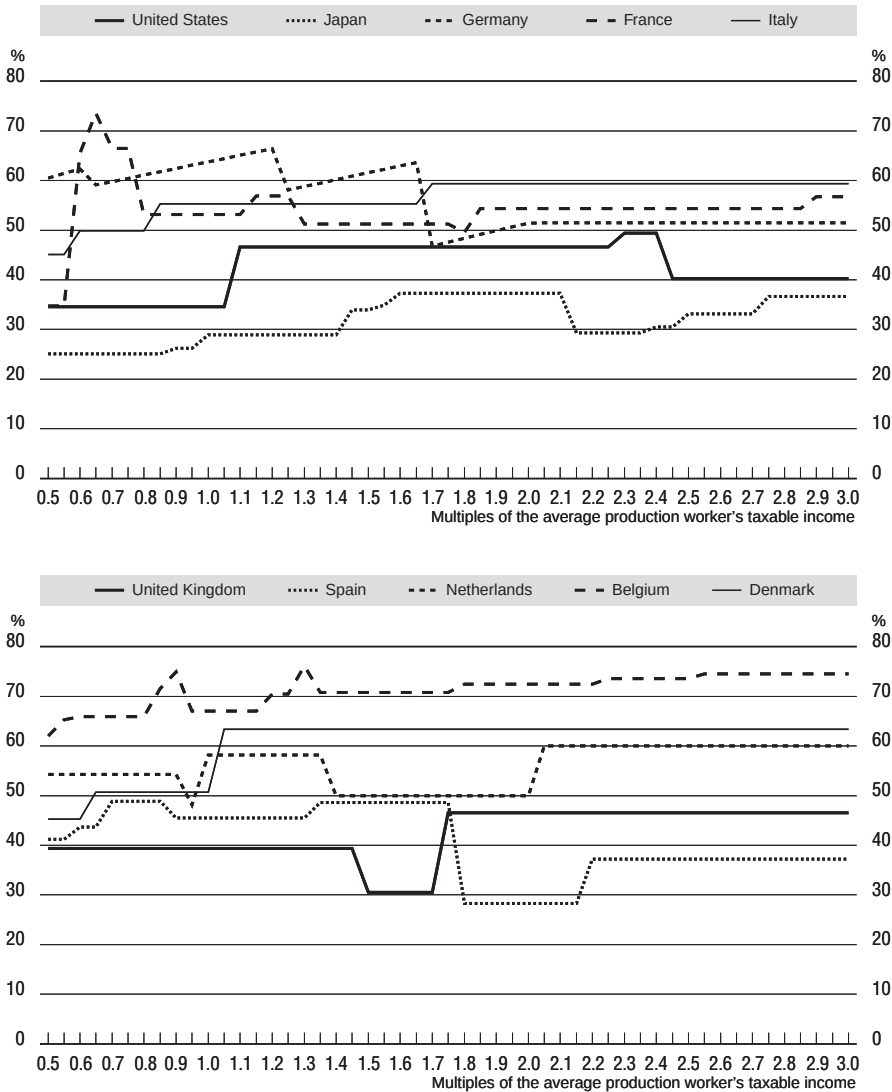
The interaction of the tax and transfer systems further creates incentives to remain outside the labour market for some groups, in particular low-wage and older workers, as well as spouses of low-income earners. First, some EU countries have applied favourable tax rules to pensions, which combined with a front-loaded accumulation pattern of pension rights, provide strong incentives for early retirement (Blöndal and Scarpetta, 1999).¹² This may partly explain the relatively low participation rates for older people. Second, at the family level, net replacement rates are close to, or exceed, 100 per cent in some cases and may thus create unemployment traps (Table 2). This partly reflects a preferential tax treatment granted to transfer payments or the granting of benefits conditional on the family income level. In fact, unemployment benefits are tax free or taxed at a reduced rate in Austria, Belgium, Germany, Greece, and Portugal and social security contributions are often payable by beneficiaries at a reduced rate (OECD, 1999b).¹³ High marginal effective tax rates at the low end of the wage scale could also reflect employment conditional benefits or tax reductions, such as those currently in place in Finland, the Netherlands and the United Kingdom. They are designed to increase the incentive for people without work to take a low-paid job, but on the other hand may encourage those already in work to reduce their working hours or create adverse incentives for individuals in families with more than one potential worker (Dilnot and McCrae, 2000 and Blundell, 2000).¹⁴

Consumption taxes play an important role

Consumption taxes account for a large share of total tax revenues

Effective tax rates on consumption in the EU area are, on average, higher than in most other OECD countries. This not only reflects a higher tax-to-GDP ratio but also a tax mix relying heavily on consumption taxes. In fact, consumption-based taxes accounted for 29 per cent of total tax revenues in the EU area in 1999 – compared with 20 and 16 per cent in Japan and the United States, respectively –

Figure 5. **Marginal tax wedge on labour along the income ladder¹**
For a single person with no children, 2000, per cent



1. Tax wedges, between labour costs to the employer and the corresponding net take-home pay of the employee, are calculated by expressing the sum of personal income tax, employee plus employer social security contributions together with any payroll tax, as a percentage of labour costs.

Source: OECD, *Taxing wages 1999-2000*.

Table 2. **Marginal effective tax rates on additional income for different family types¹**

1997

Principal earner	Full-time employed			Unemployed		Part-time employed
Secondary earner	Full-time employed	Part-time employed	Non-employed	Full-time employed	Part-time employed without benefit entitlements	Non-employed
Austria	30	21	76	32	43	135
Belgium	57	61	68	43	25	109
Denmark	50	48	84	55	61	84
Finland	36	23	88	48	23	117
France	28	38	76	29	30	69
Germany	51	50	80	31	19	115
Greece	30	30	54	66	118	104
Ireland	32	25	68	20	38	83
Italy	33	25	63	37	19	84
Luxembourg	30	14	87	26	12	198
Netherlands	39	37	89	45	52	90
Portugal	21	13	79	14	11	174
Spain	23	19	78	23	19	77
Sweden	37	42	88	43	42	79
United Kingdom	28	20	72	60	55	93
<i>Memorandum items:</i>						
Canada	37	33	75	34	29	105
Japan	12	10	60	10	7	133
United States	19	11	68	20	0	102
OECD average	32	27	74	34	32	107
EU average	35	31	77	38	38	107

1. This table provides estimates on the incentives to increase working hours or to move out from non-employment for the secondary earner of a family with two children, taking into account the labour market position of the principal earner. The marginal effective tax rate (METR) expresses the amount of earnings which are "taxed away", either via income taxes or means-testing procedures and cancellation of benefits. $METR = 1 - (\text{net income in work} - \text{net income out of work}) / \text{change in gross income}$. Part-time employment corresponds to 16 hours or two days each week, and total earnings are 40 per cent of the average production worker level of earnings. Earnings from full-time employment correspond to average production worker earnings.

Source: OECD (1999), *Benefit system and work incentives*.

with VAT playing a dominant role, accounting for about 60 per cent of total tax revenues on goods and services in the EU area. The heavy reliance on consumption taxes, notwithstanding some administrative issues they raise, has several advantages: *i*) consumption taxes are relatively neutral towards saving and investment decisions; *ii*) they do not discriminate between imports and locally-produced goods and do not affect external competitiveness (as long as they are based on the destination principle); and *iii*) they provide a symmetric treatment of

labour, transfer and capital income, thus creating fewer disincentives to work and meeting the criteria for horizontal equity better than income taxes.

But rate differentiation and exemptions contribute to lower efficiency and neutrality of consumption taxes...

However, many EU countries have maintained reduced rates or exemptions for the value added tax which induce revenue losses.¹⁵ In most cases, this tax relief reflects distributional considerations.¹⁶ However, where such use of VAT rate differentiation is extensive, it gives rise to large dead-weight losses as reduced rates benefit also high income groups (*e.g.* those for restaurant and hotel services). Adding to direct revenue losses, rate differentiation also lowers VAT efficiency indirectly by increasing the complexity of the system and making it more difficult to assess the degree of tax compliance. Overall, as of 1998, effective rates were far below standard rates, in particular in Belgium, Italy, Spain, and Sweden (Table 3). To lower compliance costs for small enterprises, turnover thresholds below which firms are not required to register for VAT have been introduced; the tax liability must thus be determined by applying presumptive methods and/or through simplified regimes. This increases the difficulty of monitoring compliance and may induce tax avoidance by splitting companies into smaller units and under-reporting sales. And the recent Italian experience has shown that requiring small (non-incorporated) companies to register for VAT may also prompt better overall compliance with the tax code.

Differentiated rates and exemptions may also distort competition and consumption patterns within EU countries. For example, one long-standing case of distortion has been the privileged tax treatment of catering (which is taxed at a reduced VAT rate in most EU countries) against restaurant services. Other cases have emerged more recently with the introduction of competition in those sectors which were traditionally controlled by the public sector – *e.g.* postal and telecommunications services, radio and television broadcasting services, as well as electricity, gas and water supply. Under current VAT rules, public sector bodies are subject to a special (and rather complex) VAT treatment which potentially distorts competition (Aujean *et al.*, 1999). One key exemption case of public sector bodies applies to the supply of postal services, which have been traditionally operated by monopolistic public agencies and are increasingly operating in competitive markets. In this context, the special VAT treatment granted to public bodies, in place in some countries, may operate to distort competition, as evidenced by the complaints already received from private operators. It may also introduce a bias for public authorities towards self-supply of goods and services *versus* contracting out to the private sector since they may not claim back the VAT paid on their inputs provided by the private sector. However, Denmark, Finland, the Netherlands, Sweden, and the United Kingdom have introduced special refund schemes to allow local authorities a refund of VAT outside the VAT system.¹⁷

Table 3. Value added taxes in EU countries

Panel A. VAT statutory rates					
	Standard VAT rates			Memorandum items:	
				Hotel accommodation	Restaurant
	End of 1980	End of 1993	May 2001	May 2001	May 2001
Austria	18.0	20.0	20.0	10.0	10.0
Belgium	16.0	19.5	21.0	6.0	21.0
Denmark	22.0	25.0	25.0	25.0	25.0
Finland	n.a.	n.a.	22.0	8.0	22.0
France	17.6	18.6	19.6	5.5	19.6
Germany	13.0	15.0	16.0	16.0	16.0
Greece	n.a.	18.0	18.0	8.0	8.0
Ireland	25.0	21.0	20.0	12.5	12.5
Italy	14.0	19.0	20.0	10.0	10.0
Luxembourg	10.0	15.0	15.0	3.0	3.0
Netherlands	18.0	17.5	19.0	6.0	6.0
Portugal	n.a.	16.0	17.0	5.0	12.0
Spain	n.a.	15.0	16.0	7.0	7.0
Sweden	23.5	25.0	25.0	12.0	25.0
United Kingdom	15.0	17.5	17.5	17.5	17.5
<i>Memorandum items:</i>					
Average ¹ (EU 11)	17.5	19.4	19.8	11.2	15.1
Coefficient of variation (EU 11)	0.3	0.2	0.2	0.6	0.5
Average, ¹ full sample	17.5	16.2	19.4	10.1	14.6
Coefficient of variation	0.3	0.2	0.2	0.6	0.5
Maximum range (maximum-minimum)	15.0	10.0	10.0	22.0	22.0

1. Simple average.

... and variations in consumption tax rates and exemptions across countries may distort international competition...

International differences in VAT rates do not seem to affect consumption choices greatly, although they can have a significant impact on cross-border shopping in boundary areas and on a few goods and services. In fact, while harmonisation efforts in the 1980s and early 1990s were reflected in a lower dispersion of VAT rates, the 10 per cent range in standard VAT rates across EU countries has persisted since 1993, suggesting that there is no clear spontaneous trend towards harmonisation (Guichard and Lefebvre, 1997).¹⁸ Furthermore, since the application of reduced or super-reduced rates is not homogeneous across EU countries, bilateral variations for some products are much higher. The tourism industry, where price competition is important, provides an example: VAT rates

Table 3. Value added taxes in EU countries (cont.)

Panel B. Effectiveness of value added taxes, 1998				
	Standard VAT rates, ² per cent	Effective VAT ³ rates, per cent	Effective VAT rates in per cent of standard rates	Memorandum items: Turnover thresholds for VAT exemption (position as of 1 January 2000)
	A	B	B/A	Euro
Austria	20.0	12.2	61.2	21 802
Belgium	21.0	10.3	49.0	5 578
Denmark	25.0	14.6	58.3	2 681
Finland	22.0	12.9	58.5	8 409
France	20.6	10.9	53.0	76 225/26 679 ⁴
Germany	16.0	9.4	59.0	16 617
Greece	18.0	9.5	53.0	7 337
Ireland	21.0	12.2	58.2	50 790/25 395 ⁵
Italy	20.0	8.5	42.7	2 582
Luxembourg	15.0	8.9	59.2	9 916
Netherlands	17.5	10.5	60.1	1 883 ⁶
Portugal	17.0	10.5	61.5	14 964
Spain	16.0	8.0	49.7	.. ⁷
Sweden	25.0	10.0	40.1	..
United Kingdom	17.5	8.8	50.1	82 426
EU average ¹	19.4	10.5	54.2	

1. Simple average.

2. Effective VAT rates are calculated by dividing VAT revenue by its base (i.e. consumption exclusive of consumption taxes).

3. Position as at 1st January 1998.

4. € 76 225 for delivery of goods, restaurants and accommodation; € 26 679 for other services.

5. € 25 395 (excluding VAT) for suppliers of services.

6. When net tax payable lies between € 1 345 and € 1 883 businesses receive a graduated relief.

7. Individual retailers do not register for the VAT.

Sources: OECD, *Revenue Statistics*, 1965-1999; OECD, *Consumption Tax Trends*. European Commission (2001), VAT rates applied in the Member States of the European Community, Doc/2905/2001-EN.

range between 3 and 25 per cent within the EU area. The dispersion of excise duties is even larger and induces not only cross-border shopping but also smuggling.¹⁹ Overall, some EU countries can maintain lower indirect tax rates, thus attracting consumers from neighbouring countries. This serves to raise their tax revenues at the expense of neighbouring countries and contributes to the erosion of aggregate EU tax revenues.²⁰

The emergence and rapid development of e-commerce transactions has given a new, and international, dimension to the potential non-neutralities embodied in the current VAT system. For services delivered on-line, international practices for taxing e-commerce give rise to significant distortions, inducing a discrimination against EU online sellers, and within the EU area against high VAT

countries. This occurs because the VAT rate which applies for electronic deliveries (B2C transactions and to some extent B2B transactions) is the one where the supplier is located (*i.e.* the origin principle). Thus, online sellers established in EU countries with a low VAT rate have a competitive advantage over those in higher VAT countries. In addition, EU online sellers currently suffer a double competitive disadvantage *vis-à-vis* non-EU countries. First, if an EU customer buys and downloads software from an EU online retailer, then VAT is imposed. In contrast, if the retailer is based outside the EU, the transaction is tax-free. Second, services sold to a customer outside the EU area are subject to VAT.

To remove discriminatory factors on services delivered online, the Commission proposed a directive in June 2000 requiring non-EU e-commerce providers to register in at least one EU country when offering services to private consumers and charge the VAT according to the rules of that country on all online sales. To ensure that the compliance burden is eliminated where it would reduce the incentive to carry on business activity and to permit tax administrations to focus resources where the return is likely to be high, the proposed directive introduces thresholds of online sales.²¹ In addition, the Swedish authorities, during their Presidency of the Council of the European Union in 2001, have proposed to require vendors to charge VAT at the rate applicable to the customer's country of residence. This would reduce the competitiveness bias against high VAT countries and the non-neutralities between electronic and traditional commerce. However, despite broad support of most EU countries, there is currently no agreed approach to levy VAT on e-commerce while any decision at the EU level requires unanimity. In any case, in absence of an enhanced international co-operation among tax administrations, fair and effective taxation of e-commerce transactions would rely on voluntary compliance by companies based outside the EU area. Given the complexity of existing VAT rules and the lack of effective enforcement, it may be faster and cheaper for traders to opt for non-compliance. However, private purchasers often prefer to deal with entities that have established a degree of credibility and trust, including compliance with tax rules.

... while "transitional" VAT arrangements are complex, not uniformly applied and prone to tax evasion

The lack of uniformity in the implementation of EC Directives on VAT across EU countries and procedural complications that the cross-country differences in the VAT regime entail in a single market creates further distortions in trade flows. The "transitional" VAT regime for cross-border trade, implemented since the abolition of custom controls between EU countries in 1993 (Appendix 1) embodies a wide variety of rules for determining the place where the transaction is taxed and, consequently, the place where the tax is deducted or refunded.²² The European Commission has argued that, in conjunction with the lack of uniformity

in which the present VAT system is applied, this creates confusion, additional workloads, administrative complication and legal uncertainty for traders (European Commission, 1999a and 1999b). This is reflected in the fact that business surveys consistently point to the complexities of VAT procedures as a major disincentive to cross-border trade.²³ As an illustration, a survey on Dutch firms estimated that compliance costs of the transitional VAT system are equivalent to a 5 per cent border tax on intra-community transactions (Verwaal and Cnossen, 2000).

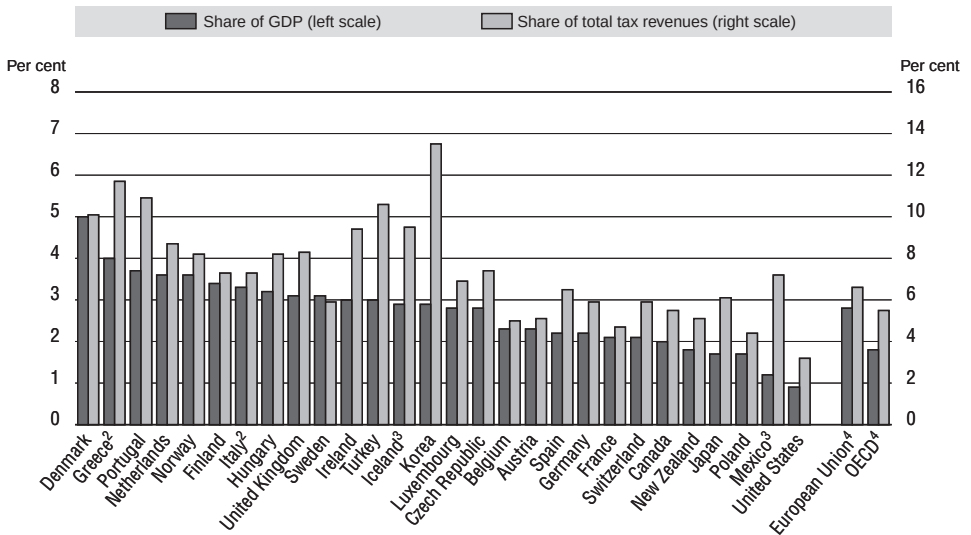
This “transitional” system may be also prone to fraud, as goods travel tax-free across intra-EU frontiers, unless EU countries’ tax authorities fully co-operate with each other. The European Commission (1998b) noted: “Given that, rather than being collected at the moment of importation, VAT is recovered at a later stage, and on the basis of the taxpayers’ periodic declarations, the possibility of fraud has been proportionately increased”.²⁴ And VAT declarations are rarely subject to selective and co-ordinated controls.²⁵ As a result, according to the European Commission (2000e) estimates, VAT fraud amounts to € 8 billion annually, and the European Commission (2000d) noted, “there are indications that the level of serious fraud in intra-Community trade is growing”.

One solution to cut compliance costs, which create distortions in the single market, and to reduce scope for tax fraud would be to replace the destination principle by the origin principle (see Appendix I). The taxation of imports and the non-taxation of exports would be abolished and the VAT system would be operated within the EU area in the same way as it would within a single country. Even though the European Commission remains committed to adopting such a system, it could only be introduced with greater harmonisation in value added taxes across EU countries, including tax rates. It would also require the introduction of a revenue-sharing scheme. Acknowledging the significant technical and political challenges associated with such a radical change, the Commission proposed a new approach in June 2000 to improve the current “transitional” system. The “Strategy to improve the operation of the VAT system within the context of the internal market” (European Commission, 2000c) is based on four objectives: simplification of current rules and their modernisation (in particular to reflect recent developments in e-commerce, and some network industries, such as postal services, broadcasting, water and electricity), more uniform application of current rules and a new approach to administrative co-operation.

Environment-related taxes raise substantial revenues

Environmentally-related taxes represent a much higher share of GDP in EU countries than in most other OECD countries (Figure 6). Motor fuel and vehicle taxes account for the bulk of these revenues. However, over past decades, EU

Figure 6. **Revenues from environmentally-related taxes**¹
1998, in per cent of GDP and total tax revenue



1. These data do not reflect environment-related provisions in other taxes, including personal and corporate income-taxes, such as accelerated provisions or tax credits for energy-saving and pollution-reducing equipment.
2. 1997 instead of 1998.
3. 1995 instead of 1998.
4. Weighted average.

Source: Environmentally-related tax database, OECD.

countries have increased the use of economic instruments for pollution control. They have given preferences to taxes, while other countries – in particular the United States – have made greater efforts to rely on pollution permits (OECD, 1999c).²⁶ A number of countries have implemented comprehensive green tax reforms, *e.g.* Denmark, Finland, Germany, the Netherlands and Sweden (OECD, 2001).

However, the tax system does not always provide appropriate incentives to abate pollution. Fuel and vehicle taxes have usually been introduced for fiscal rather than environmental reasons. In addition, the objectives of avoiding competitiveness losses in particular sectors, as well as regional development considerations, have often taken precedence in the design of the tax system over the provision of incentives to abate pollution. This has frequently resulted in a preferential tax treatment granted to heavy polluters, in particular agriculture and energy-intensive manufacturing industries.²⁷ Some countries (Denmark and the United Kingdom, for example) make exemptions for firms conditional on their

agreeing to reduce their emissions substantially. Such an approach is administratively burdensome and it is not clear that the reduction achieved will be much greater than would have occurred anyway (O'Brien and Vourc'h, 2001). Also, existing taxes on electricity are not differentiated by the carbon content of the primary energy used in most EU countries, as efficient efforts to discourage greenhouse gas emissions would warrant. As a result, tax rates in terms of CO₂ emissions vary considerably (estimates for Germany are provided in Kirkpatrick *et al.*, 2001 and for Finland in Vourc'h and Jimenez, 2000). The low taxation of diesel compared to gasoline in the European Union (Figure 7) – diesel releases more CO₂ per litre and other environmental costs associated with diesel are higher – is another illustration of the failure of taxes to reflect the pollution content of products/activities.²⁸

Taxation of capital is relatively low but some distortions remain

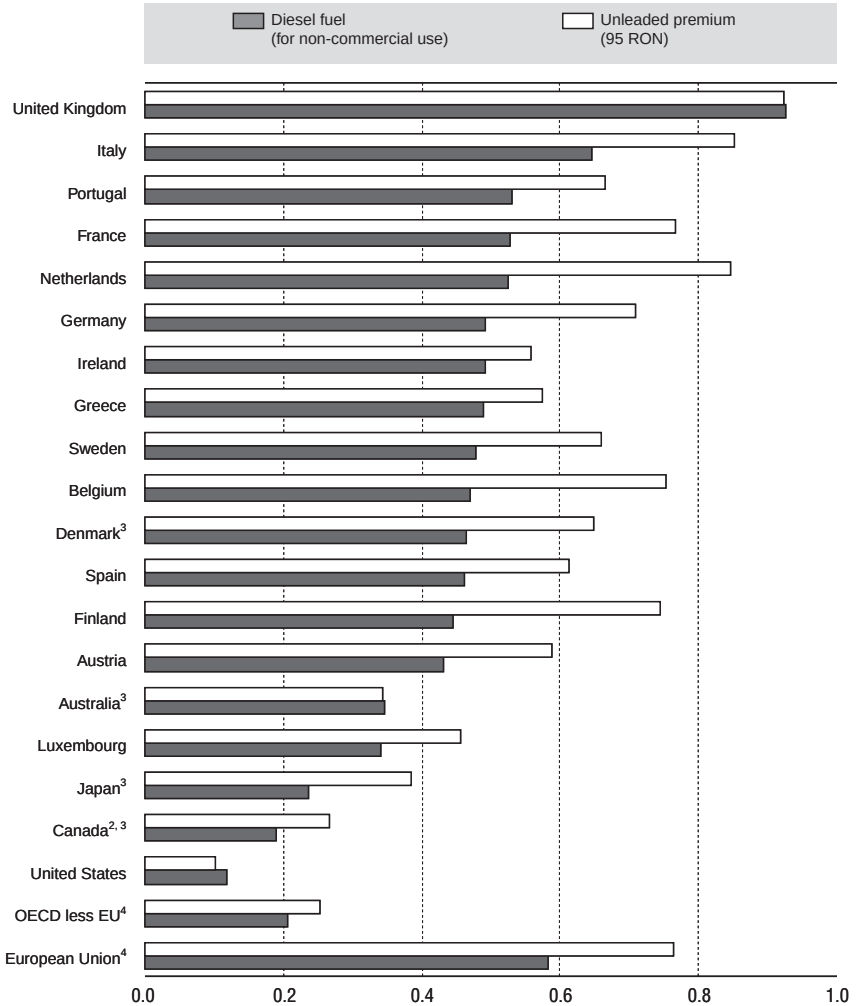
Tax rates on saving vehicles are relatively low and converging

Progress towards greater tax neutrality on capital income accruing from different types of assets has been a hallmark of recent reforms in most EU countries. Precursors are the Nordic countries (Denmark, Finland, Norway and Sweden) which adopted a dual income tax system in the late 1980s-early 1990s (for a description of this model, see Cnossen, 1997). Under such a system, a unique flat rate tax applies to net capital income (interest income, dividends and capital gains) while labour income is subject to an additional and progressive tax. Most other EU countries have not adopted a “pure” dual income tax system but increasingly tax interest income and capital gains at flat rates, usually lower than marginal rates which apply to labour income; and these rates are tending to converge (*e.g.* Austria, France, Germany, Greece, Italy and Spain).²⁹ The Netherlands has also introduced a system which resembles a dual income tax system in 2001 (the so-called “box approach”).³⁰ The move towards a lower and flat tax on capital income has often reflected the need to remain competitive on the international capital market, in particular in the context of free capital movements and the advent of the single currency, and/or the difficulty of securing a proper tax assessment (in particular in countries which have maintained bank secrecy for tax purposes). The potential drawback of the dual income tax model is that it may have adverse effects on income distribution. Also, moving to a dual income tax system may prompt tax planning, in particular for small enterprises and liberal professions for whom the distinction between labour and capital income is not always easy to draw (Strand, 1999 and Van den Noord, 2000).

But the taxation of saving still favours housing investment and retirement schemes...

Most EU countries grant tax-favoured treatment to specific saving instruments. Typically, retirement schemes and housing investment benefit from the

Figure 7. **Petrol taxes in international comparison: unleaded gasoline versus diesel**
Total taxes levied in 2000, US\$ per litre¹



1. Using purchasing power parities.

2. Taxes concern diesel for commercial use.

3. For Australia and Japan taxes concern unleaded 91 RON gasoline, for Canada 97 RON gasoline and for Denmark 98 RON gasoline.

4. Weighted average using weights based on 1995 GDP and PPP.

Source: IEA (2001), *Energy Prices and Taxes, first quarter 2001* and OECD, *Main Economic Indicators*.

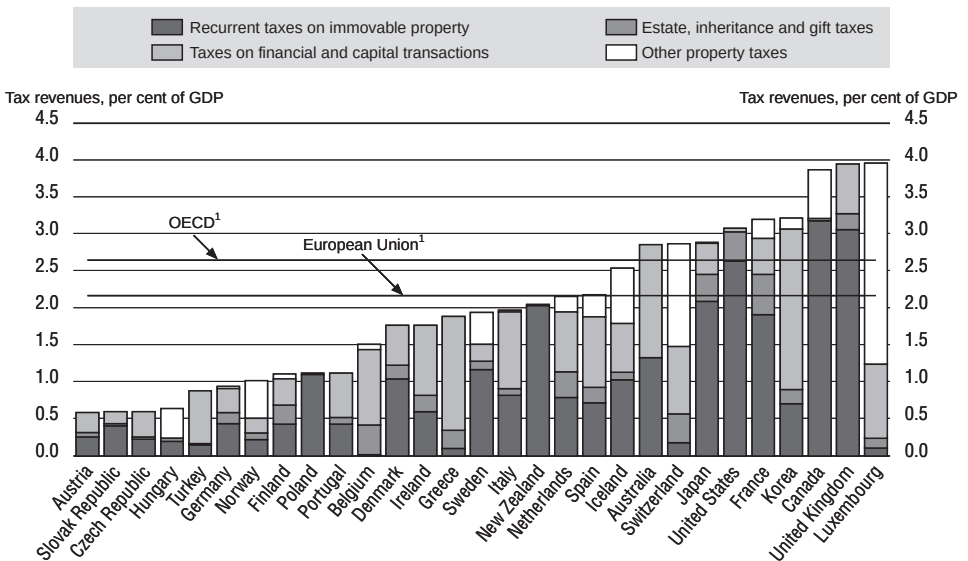
most generous tax breaks. In both cases, these breaks are motivated in part by social or economic objectives: alleviating future pressures on public pension schemes and facilitating population access to proper housing. It is unclear if these measures succeed in achieving these aims. Several empirical studies (OECD, 1994b) have shown that tax incentives are mainly reflected in the composition – and not the level – of saving. In addition, tax privileges to pension vehicles often give some institutions – pension funds and insurance companies in many cases – an undue competitive advantage over other financial intermediaries (Carey *et al.*, 1999). As well, tax privileges for housing investment may largely be capitalised, reflected in higher land and house prices given the low responsiveness of housing supply to demand, or in the financial conditions of mortgage loans if competition in the banking sector is low.

Tax breaks for retirement saving typically include the provision of tax allowances for contributions paid to pension funds or life insurance schemes and the absence of (or reduced) tax on income or capital gains earned by the funds. Many EU countries (*e.g.* Germany, Italy and Spain) have recently increased tax incentives to retirement saving, though from very different starting points. Adema (2002) estimates that tax breaks towards pensions savings amounted to more than 2 per cent of GDP in Ireland and the United Kingdom, but to only 0.1 per cent in Germany in 1997. However, in the absence of co-ordination across the EU area, these tax privileges may act as a barrier to the single market. Specifically, tax incentives for retirement savings could inhibit the participation in another EU country pension scheme, since non-resident citizens and companies usually do not get the same tax privileges (both for contributions and benefits) as nationals when using the services of a pension provider in another member state.³¹

Tax breaks granted to owner-occupied housing are both widespread and extremely diverse. First, interest costs, and in some case principal repayments, are deductible from the tax base or give rights to a tax credit in 12 EU countries.³² To be symmetric with productive investments, tax deductibility of home ownership costs should only apply if housing is consistently treated as an investment good, with service (*e.g.* imputed rents) being taxed. However, the effective taxation of imputed rents, when it exists, is often low since imputed rents are well below market values in many countries. Furthermore, high compliance and administrative costs have also led some countries to abolish the taxation of imputed rents (*e.g.* Spain in 1999). Second, money invested in housing saving accounts gives the right to a tax rebate in some countries. Third, realised capital gains on owner-occupied housing are tax-free in 13 EU countries.

The under-valuation of housing investment for tax purposes is also reflected in the low revenues from property taxes as a share of GDP in the EU area compared to most other OECD countries, the United Kingdom and France being the main exceptions (Figure 8). The general trend, however, has been to reduce

Figure 8. **Taxes on property**
1999



1. Weighted average using 1995 GDP and purchasing power parities.
Source: OECD Revenue Statistics, 1965-2000.

the generosity of some of owner-occupied housing tax privileges. The most decisive move has been made in the United Kingdom which is fully phasing out the mortgage interest relief but Denmark, France, Ireland, the Netherlands and Spain have also reduced these tax privileges recently.

Other features of the taxation of capital income introduce significant non-neutralities. First, some EU countries have fairly large basic allowances against capital income taxation, in particular in Belgium, France, Germany, the Netherlands and the United Kingdom.³³ In some cases, these basic allowances substantially reduce the compliance and administrative burden on taxpayers who make small gains or losses on everyday items. However, these allowances also lower tax revenues, create threshold effects, harm horizontal equity, and worsen income redistribution. Second, some countries grant tax incentives for long holding periods (*e.g.* Austria, Germany, Portugal, Spain and the United Kingdom). They aim to encourage owners to take longer-term investment decisions. However, they may also create a “lock-in effect”, by reducing the liquidity of capital markets and limiting the financing available for newly created and dynamic firms.

... and often grants a favoured regime to non-residents

Some international issues also exist. EU countries still apply different tax provisions on capital income, and often grant a preferential tax treatment to non-residents. While it must be noted that the tax treatment of income, for residents and non-residents, varies substantially between different financial assets, the example of the treatment accorded to interest from government bonds is shown in Table 4. Since some tax administrations do not exchange information on interest income on an automatic basis, or apply a withholding tax on every non-resident's savings income, EU residents may be able unlawfully to escape the tax on this income imposed by their residence country, as well as lawfully earn the interest free of tax in the source country. In 1998, the European Commission proposed a directive on the taxation of cross-border savings of individuals. It was intended to ensure a minimum effective taxation on cross-border interest payments of EU individuals within the EU area but has no direct impact on tax regimes applicable to residents. It envisaged the co-existence of two models: a withholding tax and an automatic exchange of information.³⁴

In 2000, a revised approach was agreed by EU finance ministers which identified the automatic exchange of information system as the preferred regime in the long term. Effective exchange of information is preferred by the EU to a withholding tax system because it represents the only way in which income from savings invested overseas can be taxed on the same basis as domestic savings, thus avoiding distorting saving flows and horizontal equity.³⁵ The agreement provides a seven-year transition period during which Austria, Belgium and Luxembourg may operate a withholding tax system before implementing an exchange of information system. The revised approach also introduced a delay before the directive comes into force to allow negotiation with some non-EU financial centres over adopting similar measures. Luxembourg and Austria have indicated that their eventual approval of the directive – which is due before the end of 2002 and under the rule of unanimity – would be conditional on the Commission reaching an agreement with non-EU financial centres.³⁶

Arrangements to undo double taxation exist but are still imperfect

Some EU countries grant resident individuals some relief for the taxation at the corporate level, by granting them a tax credit corresponding to the tax already paid on corporate profits.³⁷ This contrasts with the system in place in Japan, the United States and some other OECD countries. For a resident investor, this relief results in a lower tax wedge on distributed profits (Figure 9). However, if the typical investor is a resident household, the tax system still gives firms a strong incentive to use debt funding rather than new equity or retained earnings in most EU

Table 4. **Taxation of interest income from government bonds in EU countries in 2000**

	Residents (per cent)	Non- residents	Notes
Austria	25	Exempt	For residents, the withholding tax is final if the taxpayer so decides. Otherwise, interest income is aggregated into the taxable income.
Belgium	15	Exempt	For residents, the withholding tax is final if the taxpayer so decides. Otherwise, interest income is aggregated into the taxable income and taxed at the individual's marginal rate. The first € 1 377 of interest income received per household are tax-free.
Denmark	60.5 ¹	Exempt	Interest income for residents is incorporated into the taxable income and taxed at the individual's marginal rate. Non-residents are in general not subject to tax on interest income, except certain former residents.
Finland	29	Exempt	The withholding tax is final for residents. Non-residents are exempt from taxes on interests derived from Finnish Bonds, debentures and other mass instruments of debt.
France	15	Exempt	For residents, the withholding tax is final if the taxpayer so decides. Otherwise, interest income is included in the taxable income and taxed at the individual's marginal rate. Certain National Savings products are tax exempt and other short-term products are withheld to 15 per cent up to 50 per cent when unnamed.
Germany	53.8 ¹	Exempt	A creditable 31.65 per cent withholding tax is applied for residents. Interest income for residents is incorporated into the taxable income and taxed at the individual's marginal rate. An allowance for income from capital investment is granted up to € 1 534 per year (€ 3 068 for jointly assessed spouses).
Greece	15	7.5%	The withholding tax for non-residents is applied on certain products issued after the EMU joining.
Ireland	46 ¹	Exempt	A creditable 24 per cent withholding tax is applied for residents. Interest income for residents is incorporated into the taxable income and taxed at the individual's marginal rate, except senior citizens and incapacitated persons with no taxable income who are entitled to a refund.
Italy	12.5	Exempt	For residents, the 12.5% withholding tax is final.
Luxembourg	47.15 ¹	Exempt	Net interest income is taxed at the individual's marginal rate. A basic exemption of € 1 487 applies to income from movable capital (of which interest), and if the taxable income is not more than € 8 924, the tax due is reduced to nil.

Table 4. **Taxation of interest income from government bonds in EU countries in 2000** (*cont.*)

	Residents (per cent)	Non- residents	Notes
Netherlands	60 ¹	Exempt	Net interest income is taxed at the individual's marginal rate, with an exemption on the first € 454 (double for married couples).
Portugal	20	20%	For residents, the 20 per cent withholding tax is final unless the recipient elects to treat it as a payment on account.
Spain	48 ¹	Exempt	A creditable 18 per cent withholding tax is applied for residents. Interest income for residents is incorporated into the taxable income and taxed at the individual's marginal rate. Interest received by European Community debt holders from Spain is exonerated.
Sweden	30	Exempt	Taxed as capital income for residents. Interest derived by non-residents is not taxable in Sweden.
United Kingdom	20	Exempt	Interest on certain British Government securities is paid net of tax at 20 per cent but may be received gross in certain circumstances. The latter interest income for residents is then incorporated into taxable income and taxed at the individual's marginal rate. Interest on National Savings Certificates and individual savings accounts (ISA) is tax exempt.

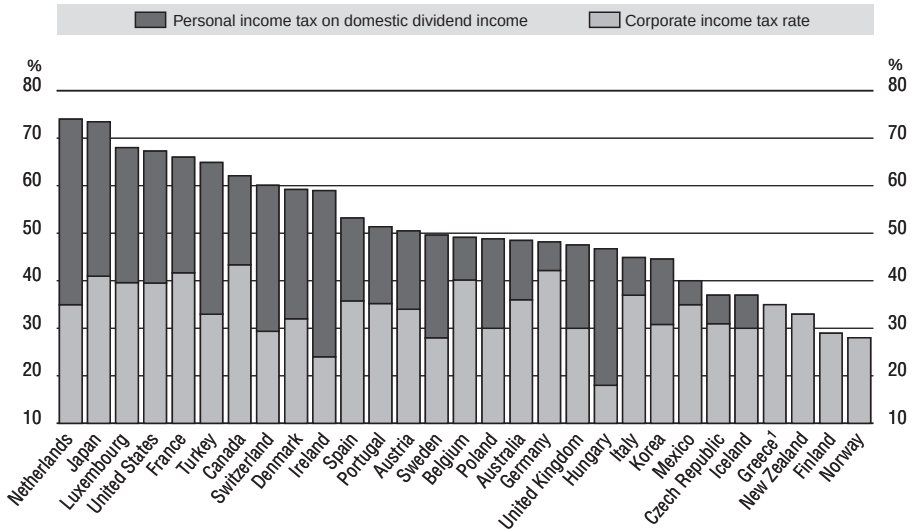
1. The reported rate applies to individuals taxed at the highest marginal tax rate.

Source: OECD Tax Database 2000.

countries. This results from the fact that, as in most other OECD countries, corporate interest payments – as opposed to distributed profits – are deductible from the corporate tax base while at the personal level interest income is often taxed at a rate lower than that which applies to dividends. This may contribute to under-capitalisation, which would make firms more prone to insolvency and, at a macro-level, could exacerbate business cycles. Several countries have recently adopted measures to lower this non-neutrality with respect to the choice of finance, in particular Denmark and Finland, which have applied a combination of imputation credits and a dual income tax system since the early 1990s (see above). Contrasting with approaches to relieve the double taxation at the shareholder level, more recently, two countries have introduced a two-tier system of corporate taxation (Italy in 1997-98 and Austria in 2000) to reduce the relative cost of financing new

Figure 9. **Combined corporate and personal income tax wedge on distributed profits**

1999, resident top earner individuals



1. 1998.

Source: *The OECD Tax database*, 2000.

investment via own-capital (Box 2). Overall, in a purely domestic perspective, the taxation of capital income is both lower and more neutral towards corporate financing decisions in most EU countries than in Canada, Japan and the United States – largely owing to the relief for double taxation of dividends as well as relatively low and converging tax rates on capital income. This is evidenced by international comparisons of the marginal effective tax wedge, and its standard deviation, across financing instruments (Table 5).³⁸

Moving from a purely domestic perspective to an open economy with free capital movements gives a different view on the neutrality of tax relief schemes for corporate taxation on distributed profits at the individual shareholder level, and on their influence on corporate financial structures. If companies are able to finance their investment on international capital markets, the personal tax treatment of investment income at home may not affect much their financing behaviour, in particular for small and open economies. Thus, imputation relief cannot be used to address effectively the under-capitalisation concern. Furthermore, imputation credits, in place in some EU countries to relieve the double

Box 2. **Alternative approaches to lessen the double taxation of equity capital: the Italian, Austrian and Finnish approaches**

With a view to finding ways of relieving the double taxation on equity capital other than by granting imputation credits to the shareholders, some EU countries have tried to reduce the relative cost of financing new investment via own capital by introducing some tax breaks directly at the enterprise level, through the corporate income tax.

The DIT and super DIT model in Italy

In Italy, the ordinary rate of corporate income tax is 37 per cent (to be cut to 35 per cent in 2003). However, the 1997-98 tax reform introduced a two-tier corporate taxation system with the intent of reducing the relative cost of financing new investment via own capital – the dual income tax, or DIT model. Since January 1998 business income is subject to a reduced rate of 19 per cent which applies on the portion of income that is deemed to be derived from the increase in equity capital of the company (qualifying increases are contributions in cash or retained profits). The income taxable at the 19 per cent reduced rate is calculated by applying a certain rate of remuneration (currently set at 7 per cent) to the qualifying increases. The *super* DIT was introduced in 2000 and allows the application of the reduced rate attributable to increases in equity capital to part of the old stock of capital. A “blow-up” factor of 1.4 (raised from 1.2 in 2000) is applied to the increase of the stock of capital in order to extend the tax advantage to part of the income originating from old capital. Remaining profits are taxed at the ordinary 37 per cent rate. However, the effective corporate income tax rate (resulting from the application of the ordinary plus the reduced rate) may not be lower than 27 per cent.

The 2000 corporate income tax reform in Austria

As part of an income tax reform introduced in 2000, the corporate income tax has been changed in Austria to stimulate companies' capitalisation and reduce the relative advantage of debt finance. An opportunity cost on increases of own capital of a company is deductible as an “operating expense” and taxed at a lower rate. In fact, profits are divided in two parts: i) a notional interest on additions to own capital that is deductible as an operating expense from the corporate tax base; ii) the residual taxable profits, *i.e.* taxable profits less the operating expenses. The first component is taxed at a 25 per cent rate (which is equal to the final withholding tax on interest payments and on “speculative” capital gains). Residual taxable profits are taxed at the normal 34 per cent tax rate. To compute the “operating expense”, the taxpayer has to multiply an imputed interest rate, set annually by the government, by the new equity capital invested in the company through capital subscriptions and retained earnings less capital withdrawals.

Box 2. Alternative approaches to lessen the double taxation of equity capital: the Italian, Austrian and Finnish approaches (*cont.*)

The Finnish deduction system up to 1990

Finland applied a dividend deduction system up to 1990 to eliminate the double taxation of dividends. Under this system, a company did not pay corporate tax to the central government on dividends distributed to holders of new shares and the distributing company was entitled to a partial (60 or 40 per cent) deduction for dividends relating to old shares in calculating the corporate income tax. In practice, this system often led to a situation where dividends were tax exempt both at the corporate and at the investor level. In fact, dividends received by a domestic limited company from another domestic limited company were tax exempt. For households, a large part of the dividends they received also remained tax free reflecting the capital income tax allowance. Above the capital income allowance threshold, dividends received by individuals were added to other income components and taxed at the taxpayer's marginal rate. Overall, about 65 per cent of all dividends in Finland were fully tax exempt or subject to low taxation while others were subject to double taxation (Myhrman *et al.*, 1995). To remedy these flaws, an imputation system was introduced to replace the dividend deduction system in 1990.

taxation of distributed profits, discriminate against outward and inward investment. In fact, countries with imputation systems do not give any relief to their residents who are shareholders in companies established in other countries, in respect of corporate income tax already paid in those countries, while they do for resident companies. Likewise, they usually do not extend the imputation credit to non-resident individual shareholders (the United Kingdom and, to a lesser extent, France being notable exceptions owing to bilateral tax treaties with certain countries – both countries grant refundable tax credits to non-residents). This constitutes an inducement for savers to invest in shares at home rather than abroad and for companies to generate profits domestically rather than on an EU-wide (or global) basis, thereby discouraging outward and inward investment.

The failure of the imputation system to redress the distortions in corporate finance decisions, in particular for small and open economies, combined with its bias against foreign investment have led some EU countries to reconsider the taxation of dividends. To avoid discriminating against shareholders in foreign equity, Germany has abolished the imputation system in 2002. At the personal level, shareholders are no longer entitled to an imputation credit but only half of

Table 5. **Marginal effective tax wedges in manufacturing for a resident final investor¹**

Per cent, 1999

	Standard deviation ²	Sources of financing		
		Retained earnings	New equity	Debt
Australia	0.6	2.0	0.8	2.1
Austria	1.1	0.7	2.7	0.1
Belgium	1.3	1.4	2.5	-0.6
Canada	1.5	4.5	5.6	2.0
Denmark	0.3	1.9	2.4	2.5
Finland	0.6	2.2	0.9	0.9
France	2.9	3.6	7.7	0.7
Germany	0.7	0.9	2.5	1.3
Greece	0.7	0.9	0.9	-0.6
Iceland	1.0	1.8	2.3	-0.1
Ireland	1.5	1.5	4.1	0.7
Italy	0.4	1.3	1.3	0.4
Japan	2.3	3.3	5.5	-0.1
Korea	0.5	0.6	1.6	1.6
Luxembourg	0.8	3.6	2.4	1.6
Mexico	0.1	0.8	1.0	1.0
Netherlands	2.0	0.5	5.3	2.5
New Zealand	0.0	1.5	1.5	1.5
Norway	0.0	1.1	1.1	1.1
Portugal	1.1	1.1	2.5	-0.3
Spain	0.6	3.2	2.2	1.6
Sweden	0.8	2.1	2.8	0.8
Switzerland	1.3	0.4	3.5	1.8
United Kingdom	0.5	2.9	2.4	1.6
United States	1.5	1.7	4.8	1.4
EU ³	0.9	2.0	3.2	1.0
OECD ³	1.2	2.0	4.0	1.1

1. These indicators show the degree to which the personal and corporate tax systems scale up (or down) the real pre-tax rate of return that must be earned on an investment, given that the representative investor can earn a 4 per cent real rate of return on a demand deposit. Wealth taxes are excluded. The representative investor is assumed to be a resident person, taxed at the top marginal income tax rate (these calculations ignore the taxation of non-residents and residents investing in foreign assets). Many of the complexities of the tax system that do not affect the marginal investor (*e.g.* regarding reserves and tax allowances) are left aside. See OECD (1991), *Taxing Profits in a Global Economy: Domestic and International Issues*, for discussion of this methodology. Calculations are based on a 2 per cent inflation rate.

2. The standard deviation across financing instruments provides an indicator of the neutrality of the tax system towards corporate financing decisions. The tax system is neutral if a given pre-tax flow of corporate profits produces the same after-tax flow of corporate income for final investors, whether the return takes the form of interest payments, dividends, or capital gains (*i.e.* nil standard deviation).

3. Weighted average across available countries (weights based on 1995 GDP and PPPs).

Source: OECD Secretariat.

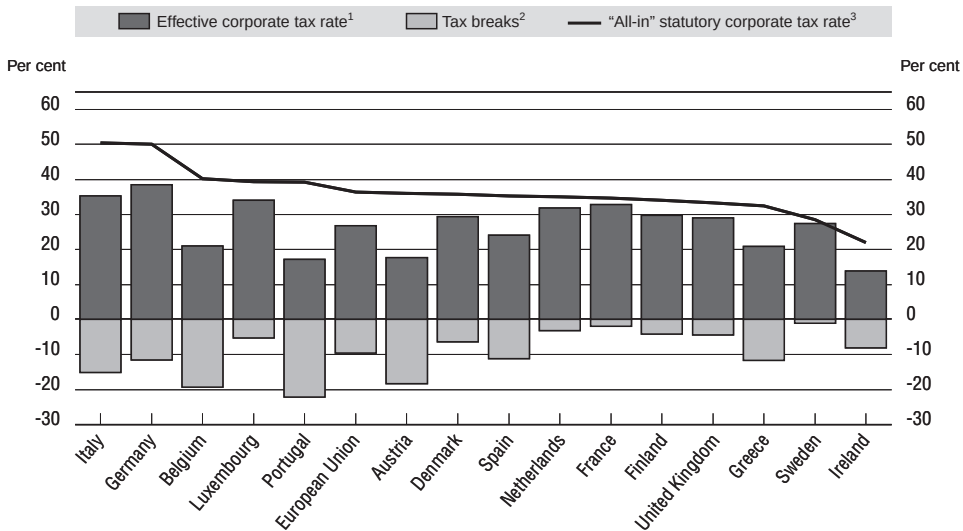
the dividends received from both home and foreign sources enters the shareholder's personal income tax base, and is taxed at his marginal tax rate. To make foreign investment more attractive, the corporate income tax rate has also been lowered to 25 per cent in 2001. In 1997, Italy introduced the choice between imputation credits and a reduced flat tax on dividends. Sweden reintroduced the double taxation in 1995 but cut the corporate tax rate, *de facto* reducing the overall tax wedge on distributed profits, both for domestic and foreign shareholders.

Corporate income tax bases remain narrow, and special regimes are widespread

Corporate income tax revenues in most EU countries are low by international standards, as a share of GDP, despite statutory rates on corporate profits broadly in line with other OECD countries. This relatively low yield, and its large variations across EU countries with similar statutory rates, reflect several factors. Among these are large differences in accountancy rules that firms must comply with, and the percentage of incorporated firms.³⁹ However, the extensive use of tax relief also plays a role, as revealed by a recent business survey of EU firms which provides some estimates of effective tax rates in manufacturing based on firms' financial statements.⁴⁰ The survey suggests that, over 1990-96, the effective corporate tax rate was almost 10 percentage points lower than the statutory rate in the EU area in the manufacturing sector (Figure 10), with large variations across countries in the conditions and generosity of the associated tax allowances.

These rebates often include: investment tax credits, accelerated depreciation allowances for investment in equipment and in intangible assets (such as R&D), tax breaks for employment creation, and tax incentives for deprived areas.⁴¹ Generous investment tax credits in some EU countries, combined with depreciation rates higher than economic depreciation, produce a bias in favour of capital-intensive activities. In addition, many countries have recently introduced or raised tax measures that favour small enterprises, newly created firms and/or information technology companies (*e.g.* France, Netherlands, Portugal, Spain, and the United Kingdom).⁴² These measures are designed to offset the disadvantages of new, or small, enterprises in financing their investment projects and/or the disproportionate costs stemming from administrative complexities, including tax compliance. However, a progressive corporate income tax system may create threshold effects and/or induce the splitting of companies in order to qualify for the reduced taxation scheme. To address this risk, some countries (*e.g.* Spain and the United Kingdom) have introduced legal provisions to guard against disaggregation of larger businesses to exploit the thresholds. Nevertheless, introducing targeted tax relief may result in an inefficient allocation of resources, the creation of tax loopholes, and growing tax planning and lobbying activities.

Figure 10. **Statutory and effective corporate taxation in the EU area**
Average 1990-96



1. These estimates are drawn from the consolidated financial statement data of non-financial EU firms, mainly listed and manufactured companies.

2. Difference between the effective corporate tax rate and the statutory corporate tax rate.

3. Including local government taxes and temporary surcharges.

Source: Buijink, B. *et al.* (1999).

In a number of cases, tax allowances are designed to attract multinational investments. Countries have introduced special regimes to attract foreign direct investment in specific geographical areas or activities (*e.g.* Ireland has applied a reduced corporate income tax rate for manufacturing and certain internationally traded services, off-shore and shipping companies are tax exempt in Greece, and until recently in Spain the Basque country granted large tax privileges for fixed-assets investment above € 15 million). Furthermore, special holding-company schemes and co-ordination centres in some countries allow international investment income to flow through these companies with low taxation (*e.g.* Belgium, Denmark, France, Germany, Greece, Luxembourg, and the Netherlands).⁴³ To eliminate tax measures which could induce harmful competition between EU countries, a Code of Conduct on business taxation was agreed in December 1997 (Appendix 2). Though it contains no legally binding obligations or sanctions, EU countries have committed themselves not to introduce new tax measures which might be considered as harmful and to roll back existing ones by the end of 2002.⁴⁴

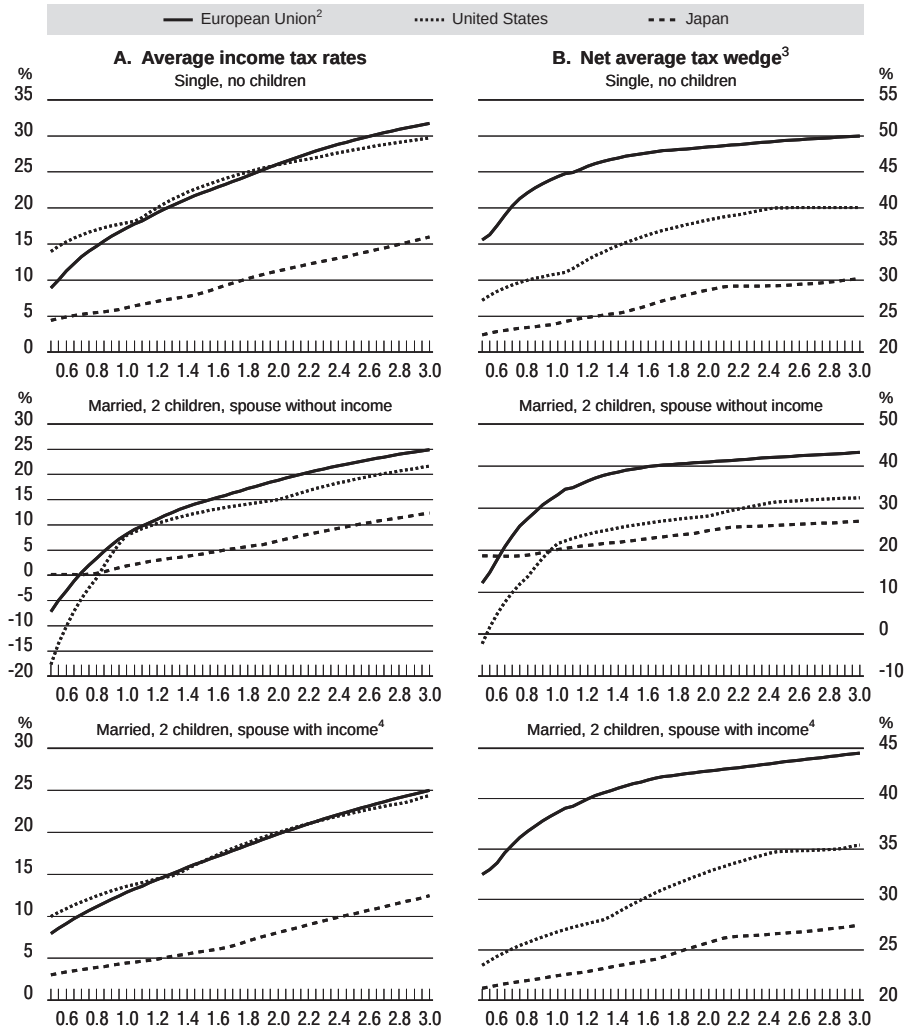
An emphasis on income redistribution?

Income redistribution is often considered to be an important objective of EU countries' tax systems. It is mainly reflected in a highly progressive tax schedule of the personal income tax. However, for low-income working families with children, most EU tax systems are less favourable than the system in place in the United States (Figure 11), where the earned income tax credit conditional on the family situation results in a positive transfer for the most needy. Furthermore, several factors act to weaken the statutory progressivity of EU tax systems.⁴⁵ First, the personal income tax base is very narrow in many countries, in particular in France (Bourguignon, 1998), Greece, and Portugal (Bronchi, 2001; Bronchi and Gomes-Santos, 2001).⁴⁶ Second, capital income is mainly taxed at a flat rate in EU countries, contrasting with its incorporation into the personal income and thus taxed according to a progressive schedule in most other OECD countries. The taxation of property/wealth is also low in most EU countries compared with the OECD average. Third, the personal income tax in most countries embodies extensive tax advantages whose value tends to increase with income, such as tax breaks for health, childcare and education expenses. Likewise, tax breaks for retirement savings and investment in owner-occupied housing may have a regressive impact on the distribution of income since the wealthy tend to save more, in absolute terms and as a share of their income. In addition, ceilings on social security contributions in place in some EU countries are reflected in a slight decline in net tax rates when the income rises (*e.g.* Germany and Spain).⁴⁷ Furthermore, some of the goods and services which are mostly consumed by higher income groups are sometimes taxed at reduced VAT rates (*e.g.* hotel and restaurant services in most EU countries). Overall, the tax system contributes more to income redistribution in EU countries than in most other OECD countries but this largely reflects higher overall tax shares while the relative efficiency of EU countries' tax systems in redistributing income appears to be lower than that of many other OECD countries (Burniaux *et al.*, 1998).⁴⁸ On the other hand, higher tax shares in EU countries are partly used to finance expenditure programmes which are targeted to the most vulnerable groups.

PRIORITIES FOR FUTURE TAX REFORMS

Given the pressures on public spending which will likely emerge in the medium-term – mostly reflecting population ageing – significant cuts in taxes cannot be considered as a sound fiscal option for EU countries. On the other hand, tax base erosion pressures associated with the growing integration within the EU area and with the rest of the world need to be recognised. They could probably be

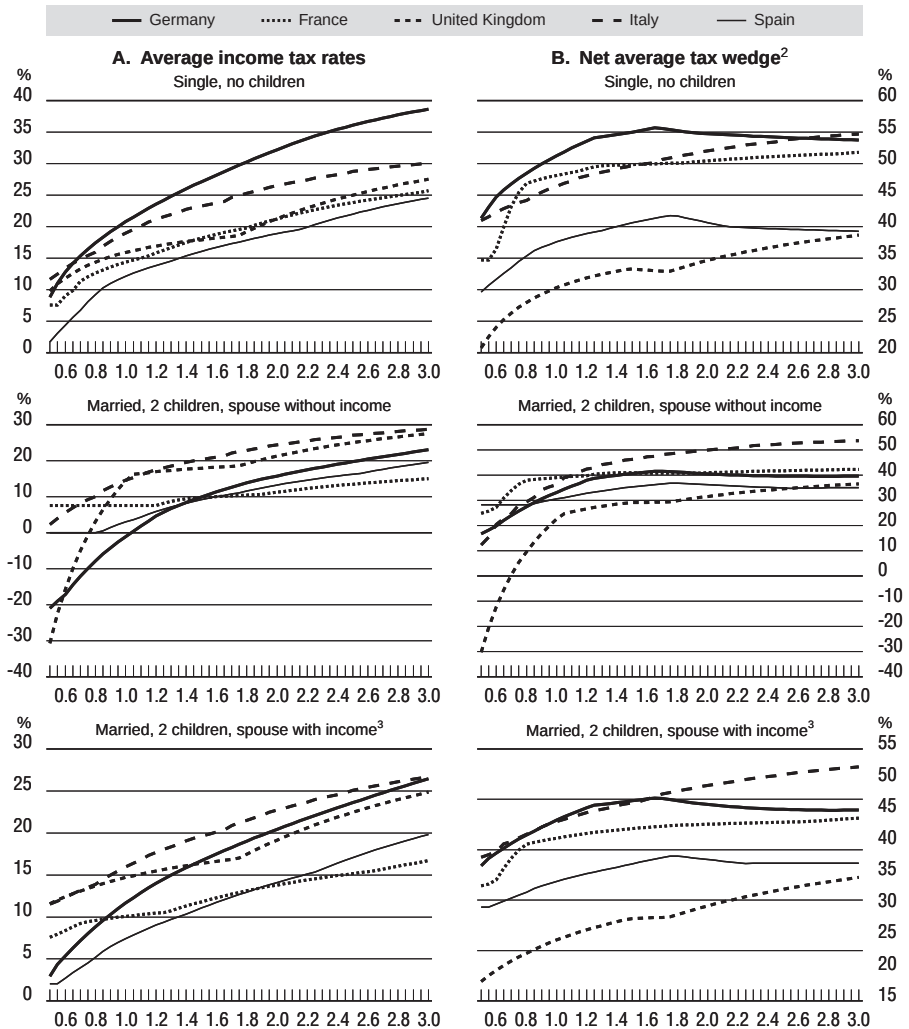
Figure 11. **International comparisons of tax progressivity¹**
Average personal income tax rates and total tax wedges by multiples
of the Average Production Worker's taxable income, 2000



1. The statutory progressivity presented here is based on OECD's tax equations. These equations do not include specific tax allowances and credits such as those related to housing investment or child care expenses.
 2. Weighted average using 1995 GDP and purchasing power parities. For technical reasons the EU average does not include Austria.
 3. Income tax plus employers and employees social security contributions, less cash benefits.
 4. Spouse earning 0.67 per cent of the income of the Average Production Worker.
- Source: OECD, *Taxing Wages 1999-2000*.

Figure 11. **International comparisons of tax progressivity¹ (cont.)**

Average personal income tax rates and total tax wedges by multiples of the Average Production Worker's taxable income, 2000



1. The statutory progressivity presented here is based on OECD's tax equations. These equations do not include specific tax allowances and credits such as those related to housing investment or child care expenses.

2. Income tax plus employers and employees social security contributions, less cash benefits.

3. Spouse earning 0.67 per cent of the income of the Average Production Worker.

Source: OECD, *Taxing Wages 1999-2000*.

lessened by enhanced co-ordination of tax policies and exchanges of information between national tax authorities. For highly mobile factors such as financial capital, it would contribute to avoid that individual countries race to the bottom, into a negative-sum game, but would leave each country the opportunity to decide on tax rules for its residents and apply them consistently. However, tax harmonisation within the EU area is unlikely to be an appropriate option. In fact, both the level and the composition of public spending vary significantly across EU countries, calling for a different level and mix of taxes and making it difficult to define an “optimal” tax system for the EU area. In addition, some differences in taxes, and concomitantly on the level and mix of public services, is also beneficial inasmuch as it increases EU citizens’ menu of choice on where to locate and fosters pressures on governments to raise public sector efficiency. While leaving open the question of what would be an optimal system of taxation for individual EU countries, the following section suggests how tax arrangements might be improved at the margin, drawing on the most blatant inefficiency and equity concerns described previously. In this context, two main revenue-neutral approaches are considered: i) rebalancing the tax system away from labour to less distortive and mobile bases (*e.g.* consumption and real estate); and ii) broadening tax bases, by eliminating exemptions and special regimes, combined with a flattening of the rate structure.

Improve labour market performance

Since the mid-1990s, many EU countries have introduced measures to lower the tax burden on labour, especially at the lower end of the income scale (as mentioned in Box 1). Many of these measures have had promising results, as evidenced by the strong response of employment to output growth and the rise in participation rates in some EU countries since the mid-1990s. However, the tax burden on labour remains high. Lowering further the tax burden on labour while also reducing labour market rigidities could lead to increases in both labour supply and demand, boosting economic growth and increasing employment (OECD, 1994a). In most cases a reduction in the tax burden on labour should preferably be paid for by cuts in primary expenditure (European Commission, 2000e). If this proves to be difficult, an alternative would be to shift more of the burden onto other tax bases.⁴⁹ There are several candidates, in particular taxes on consumption and/or property. This would contribute to lowering the direct cost of labour, and/or improving incentives for work and human capital accumulation especially if transfer income recipients do not receive a full compensation for the rise in effective taxation of consumption or property.⁵⁰ Shifting from wage to a consumption tax would have another advantage: it would broaden the tax base insofar as consumption out of other income would also be taxed, thus partly redressing the low taxation on property and capital income which mitigates the

progressive impact of the tax system. Simulations performed by the European Commission show that a cut in labour taxes by 1 per cent of GDP, coupled with an increase in VAT, would increase employment by almost 0.7 per cent in the long run if transfer recipients were not compensated for their real income loss – though this could induce some undesirable distributional effects. If the loss in purchasing power for transfer recipients were fully compensated, the employment effect would be halved (Table 6).

The impact of a cut in labour taxes on employment prospects would probably be higher if it were targeted on low-skilled workers who are the most vulnerable to the adverse effect of a high tax wedge. One priority would be to reconsider ceilings and floors on social security contributions, especially if social security benefits are not directly related to the amount people have put in. They penalise low-skilled workers, and encourage overtime at the expense of job creation. Reductions in labour taxes may also have to be accompanied by reforms of the labour market and of the benefit system to strengthen the responsiveness of the supply and demand for labour. Cuts in payroll taxes may require reconsidering restrictive employment protection legislation in order to provide employers adequate incentives to hire.⁵¹ Likewise, enhancing the responsiveness of labour

Table 6. **Long-run effects of a tax reform in the EU area: EC estimates¹**
Percentage changes

	GDP	Employment	Investment
Tax cut fully offset by a reduction in government consumption (1 per cent of GDP)			
a) Reduction of labour, corporate and VAT ²	0.54	0.54	1.28
b) Reduction of labour and corporate taxes only ²	0.65	0.57	1.88
c) Reduction of labour taxes only ²	0.81	0.97	1.24
Tax shift from labour to consumption (1 per cent of GDP)			
d) Tax shift from labour to VAT <i>without</i> compensating transfer recipients ³	0.66	0.82	0.73
e) Tax shift from labour to VAT <i>with</i> compensating transfer recipients ⁴	0.37	0.48	0.32

Note: The simulations also reveal that economic growth would lead to a reduction of general government deficit to GDP ratios of about 0.5 percentage point after ten years. Similar tax cuts, without offsetting spending cuts, would entail a deterioration in deficit to GDP ratios of about ¾ percentage point.

1. These simulations have been performed by the European Commission, using the QUEST model.
2. The simulations in rows a) to c) are conducted under the assumption that unemployment benefits are kept constant in real consumption terms, i.e. the reservation wage is assumed to remain constant. In this case, the cut in labour tax is partly shifted onto firms in the form of lower wage costs.
3. The experiment reported in row d) assumes that unemployed workers (and other transfer recipients) are not compensated for the increase in consumer prices, i.e. the reservation wage is assumed to fall by an amount equivalent to the rise in consumer prices.
4. Unemployed workers (and other transfer recipients) are compensated for the increase in consumer prices.

Source: European Commission (2000), "Public Finance in EMU".

supply to tax cuts may call for increased emphasis on in-work benefits while strengthening eligibility conditions for out-of-work transfers. Some tax privileges granted to transfer payments should also be reconsidered, in particular unemployment benefits, severance payments and pensions.

Further reduce non-neutralities in product markets...

Streamlining the VAT structure is a priority to reduce the distortions on the product market stemming from the tax system. This would entail in particular reconsidering reduced VAT rates and exemptions, and to envisage instead more cost-effective direct transfers to households when the effect on income distribution is a concern. Reducing the complexity of the VAT system would in turn cut compliance costs, and thus allow VAT thresholds for small businesses to be lowered. The simplification and modernisation of the current VAT system, combined with a more uniform application across EU countries, should also work to lower compliance costs, and hence encourage firms (especially SMEs) to export, as well as facilitating the detection of fraud.

... and towards saving vehicles

Further progressing towards the dual income tax system in place in most Nordic countries could contribute to improve the neutrality of the tax system with respect to different savings vehicles. This would improve economic efficiency, reduce administrative costs and close some tax loopholes. However, the likely adverse impact on income distribution might require adjustments elsewhere in the tax and/or benefit systems. A less radical change would involve reconsidering privileges granted through the personal income tax to some saving instruments, in particular owner-occupied housing and pension savings. In some cases, relaxing restrictive land-use regulations may be more efficient than tax incentives in facilitating the population's access to better housing. Reducing tax privileges to housing investment could also help to rebalance private investment towards business needs and, in some cases, improve the geographical mobility of workers.⁵² Reconsidering incentives for retirement saving and owner-occupied housing would also lessen equity concerns which arise when relatively well-off taxpayers benefit most from it and/or because the value of tax incentives usually increases with taxpayers' marginal rates (Franco, 1996; Joumard and Varoudakis, 2000).

Another effective non-neutrality embedded in many EU countries' tax systems is the differentiated tax treatment according to the origin and destination of savings. Non-residents are often granted a preferential tax treatment on their interest income. Given the high degree of mobility of the tax base, strengthening international co-ordination for the taxation of income from financial investment is required. The agreement reached in June 2000 between EU governments on the

exchange of information for the taxation of non-residents' saving income is a step in this direction. However, any system, to be truly effective and avoid hurting the competitiveness of EU countries' financial markets, would need to be adopted by a wider group of countries than the European Union.

Increase reliance on the taxation of property

Enhanced taxation of property would contribute to improving the neutrality of the tax system towards various forms of wealth (the main components of which are real estate, financial assets and human capital) and thus serve to rebalance the tax burden away from labour. In a number of countries (including Austria, France, Greece, Portugal and Spain), improving the taxation of property implies updating land registers with an accurate valuation of land and building. Incidentally, enhanced property taxation would also contribute to reducing income inequalities and, if accruing to sub-national governments, close the gap between their spending and revenue-raising powers. This could also improve local governments' fiscal discipline, since property taxes are in general well suited for use by local governments to charge for the benefits of local services, but it obliges them to be more responsive to the concerns of local voters than is the case with other means of financing, *e.g.* central government grants. To this end, greater flexibility in setting property taxes should be given to local governments.

Improve neutrality on the corporate financing side

Improving tax neutrality towards corporate financing by reducing the tax advantage given to debt financing would work to promote sounder financial structures in the business sector. In addition, lessening the tax discrimination against financing through new equity would benefit business start-ups, and innovative and fast-growing companies which may face difficulties in borrowing from banks. On the other hand, the arrangements that undo double taxation of dividends and retained earnings may not fully be effective in reducing the bias towards corporate debt financing, in particular for small and open economies since representative investors are likely to be non-resident. For these reasons, some countries may need to reconsider the relative merits of the imputation credit system and of alternative methods to mitigate the double taxation of profits. In doing so, important variables to be considered include the openness of the economy, tax revenue consideration, but also the administrative costs attached to each system and the transition costs to switch from one system to another.

Streamline special corporate tax regimes and relief

The variety of tax regimes and extensive tax breaks for entrepreneurial activities – according to the size of the company and its activity – should be

reconsidered in favour of the use of structural reforms addressing problems from their roots. In particular, simplifying administrative requirements and tax files may boost small enterprises' growth more efficiently than the introduction of reduced tax rates for small enterprises. Reconsidering local taxes on business inputs (labour, productive equipment, land and/or premises), levied regardless of profitability, would also foster entrepreneurship since these taxes are often a particular burden on small firms and newly-created companies (among countries which apply this type of local taxes are France, Germany, and Italy). Enhanced provisions for carrying forward and backward operational losses may further contribute to improving incentives for risk taking in some countries. In general, granting transparent and universal tax breaks would be less distortive for resource allocation and less inducive to tax avoidance.

At the EU level, streamlined corporate taxation that eliminates special regimes would work to produce a level playing field:

- By ending the practice of offering tax relief to attract new inward investment to a country or a region when these inducements are not available to existing firms in that area. In general the location decision probably owes more to the desire for market proximity, search for agglomeration economies, adaptation to differences in cost levels and availability of infrastructure than to pure tax factors. However, geographical distances within the EU area are short while differences in costs and quality of inputs are narrowing. Since significant irreversibilities associated with productive investment cannot be ruled out, the potential cost of these special incentives may be significant.
- By ensuring that competition for mobile activities, particularly in the financial sector, is fair, *i.e.* transparent, non-discriminatory (does not involve ring-fencing) and accompanied by effective exchange of information.

This argues for the rapid implementation of the EU Code of Conduct and efforts to comply with the OECD harmful tax practices initiative.

Pursue environmental objectives in a cost-effective way⁵³

Despite some improvement in environmental performance in some EU countries over the past decade, there is a need for further progress. Taxes and/or tradable permit schemes have a role to play to improve the cost-effectiveness of environmental policy in EU countries. They will be needed to reduce greenhouse gas emissions at least cost. Economic instruments would also allow the targets on reducing sulphur dioxide and nitrogen oxides emissions that all EU countries have committed to in the Göteborg Protocol to be met in a cost-effective way. In general, there is much room for taxes on different kinds of energy to reflect more accurately the respective environmental externalities associated with their use.

The gap between diesel and petrol taxes that exists in many EU countries is one case in point. Exemption of all commercial aviation fuel is another. Exemptions for particular sectors are frequently introduced to meet competitive concerns, but it is important to avoid them, as they put all the weight on non-exempt sectors and increase the overall costs of meeting a given target. Efforts within the EU to introduce environmental taxes in a co-ordinated way may make it easier to avoid such exemptions and improve their efficiency by limiting opportunities of tax avoidance. The case of aviation kerosene provides a good illustration of how environmental effects would be magnified, and competitiveness concerns would be less acute, if co-ordination were enhanced and extended to non-EU countries (Box 3). However, those efforts have not been very successful in the past. Illustrative is the failure to reach an agreement on a directive on energy taxation proposed in 1997 by the Commission, largely because potential costs for individual countries would

Box 3. Taxing aviation kerosene: the need for international co-ordination

Aviation kerosene is currently exempted from excise duties in the EU area in spite of the EC recommendation to extend excise duties to this product. The EC recently published a study on the impact of the taxation of aircraft fuel on greenhouse gas emissions, EC carriers' international competitiveness and employment (European Commission, 2000f). The study examined five possible tax coverage levels, ranging from taxation of national flights only to taxation of all flights for all carriers to all destination world-wide. Three possible levels of tax were also envisaged. The study showed that environmental effects would be small unless all flights to all destinations were taxed. In a "high taxation scenario" (€ 245/1 000 litres) on all routes for EU carriers only, EU CO₂ emissions would be cut by 0.3 per cent if compared with the baseline scenario. However, the competitive position of EU carriers would suffer and tax avoidance opportunities would increase if non-EU members do not apply a similar tax. In particular, tankering, in which more fuel is taken on board an aircraft than is necessary for a flight, would avoid refuelling in countries where the tax applies. It would also imply that more fuel needs to be burned in order to carry the extra fuel somewhere along the route, thus having additional detrimental effects on the environment. Taxing only intra-EU area flights (at € 245/1 000 litres) would reduce competitive distortions but EU CO₂ emissions would be cut by only 0.06 per cent. Thus, the EC concluded that: "it would not be practicable or desirable for the Community as a whole to introduce taxation of aircraft fuel targeting exclusively intra-Community flights operated by Community air carriers at the present time". It then recommended Member States to intensify their work within the International Civil Aviation Organisation (ICAO) framework for the introduction of taxation on aviation fuel.

likely differ significantly as differences in energy resources and industrial structures among EU countries remain sizeable. As a result, most EU countries have introduced or raised green taxes on a unilateral basis since the early 1990s, but tax breaks for heavily-polluting activities most exposed to international competition continue to flourish.

Abating pollution in a cost-effective way may also require strengthening the design and use of tradable permits. In fact, the European Commission recently launched a discussion on greenhouse gas emissions trading within the European Union (European Commission, 2000g). Enhanced use of tradable permits may also need to be considered for other pollutants since in some cases, tradable permits have several advantages over green taxes. First, they would allow setting a quantity of pollution to be tolerated by issuing a fixed quantity of permits (*e.g.* a maximum amount of greenhouse gas emissions, in line with the EU target). Second, gaining experience with emission trading schemes within EU countries might be useful in the perspective of an introduction of such schemes at an international level. Third, they may allow political hurdles inherent to the subsidiarity principle and the unanimity rule associated with tax decisions at the EU level to be avoided.

NOTES

1. Martinez-Mongay and Fernandez (2000) provide evidence that causality runs from spending to taxation for the EU area. Spending increases are matched by increases in tax receipts one year later.
2. The 13 candidate countries are: Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Romania, Slovakia, Slovenia, Poland and Turkey. Among these, six countries started talks in March 1998 and are at the head of the line for membership: Cyprus, the Czech Republic, Estonia, Hungary, Slovenia and Poland.
3. A potentially aggravating factor is the development of offshore capital investment via the Internet. The so-called e-banking may expose capital-income tax revenues to an increased risk of international evasion if it makes cross-border evasion easier and more accessible to a broader range of population than just the wealthy. Security problems and a relatively low penetration of the Internet in the EU area still limit the expansion of these financial transactions. The Nordic countries are a notable exception: more than one fourth of the entire population of Finland and Sweden do banking online. However, such financial transactions are likely to expand rapidly in the medium run.
4. This anomalous situation is currently the subject of a Commission proposal to correct the place of taxation rule in these circumstances. Those plans for applying VAT to Internet on-line sales from outside the EU area also raise the prospect of pressure for these high tax countries since, if the seller has the option of registering in a single EU country, the tax rate may play an important role in the choice. Nevertheless, it is recognised that this B2C sector of e-commerce currently represents a relatively small proportion of total e-commerce, and that business-to-business transactions will continue to predominate.
5. The tax-to-GDP ratio – showing the share of total tax revenues, including social security contributions, in gross domestic product – is the main aggregate indicator used to measure the overall tax burden. However, this indicator has certain limitations as a comparative measure across countries and over time. Among the factors which can affect the level and trend of the tax-to-GDP ratios are: the extent to which countries provide social or economic assistance via tax expenditures, rather than direct government spending, and whether or not social transfers are subject to tax. Adema (2002) estimated that in 1997 taxes and social security contributions on transfers exceeded 5 per cent of GDP in Denmark, Finland, the Netherlands, and Sweden. They did not exceed 2 per cent of GDP in Belgium, Canada and Germany, and were even lower in Australia, Ireland, Japan, the United Kingdom and the United States.
6. Carey and Rabesona (2002) estimate that the average effective tax rate on labour reached some 37 per cent in 1999, compared with 25 and 23 per cent for the United States and Japan, respectively. Martinez-Mongay (2000) provides broadly similar estimates. The average effective tax rate is the ratio of labour taxes to labour income.

Labour taxes are the sum of the labour's share of the personal income tax, social security charges and payroll taxes. Labour income consists of compensation from dependent employment, including employers' social security contributions.

7. Methodological problems associated with the calculation of effective tax rates are spelled out extensively in Carey and Tchilinguirian (2000). The orders of magnitude provided in this paper should therefore be interpreted as purely indicative.
8. Daveri and Tabellini (2000) show that an increase in labour tax is shifted onto labour costs in continental Europe, but not in the other OECD countries. They estimate that for each percentage point rise in labour taxes, labour costs go up by almost half a percentage point in Europe.
9. Based on panel data for 19 OECD countries, Elmeskov *et al.* (1998) show that different collective bargaining arrangements influence the way in which tax wedges affect unemployment. The impact is stronger in countries with an intermediate degree of centralisation/co-ordination, *i.e.* where sectoral wage bargaining predominates with limited co-ordination (*e.g.* Belgium, Finland, France and Spain). This gives insiders strong bargaining powers to resist employers' attempts to reflect higher payroll taxes in lower wages.
10. Despite a tax wedge on labour which ranks amongst the highest within the OECD area, employment rates in the Nordic countries are high. This partly reflects a strong link between employment history and benefit entitlements, excellent welfare facilities (*e.g.* day care) and flexible job contracts for youngsters.
11. Recently, however, some countries have broadened the personal income tax base to include some of these compensation components. In Germany for instance, reduced taxation on bonuses for employees was eliminated but travel expenses to the working place still give rise to tax relief. Some countries have also introduced a ceiling above which stock options do not benefit from a preferential treatment (*e.g.* France, Spain and the United Kingdom), though differences across countries remain sizeable in this area.
12. Some countries grant pensions a favoured treatment through the personal income tax. For instance, in Belgium, a € 1 510 tax credit was granted for a single taxpayer for pension income and early retirement benefits in 1999. In Austria, pensioners are entitled to an annual tax credit of € 400. In Germany, pension benefits are granted a tax-free allowance of 40 per cent (annual maximum of € 3 068). In Finland, pensions granted through the national pension scheme are exempt up to around € 555 per month.
13. In addition, severance payments are largely tax-free in France, Ireland, Portugal, and Spain. Some information on the taxation of social benefits can be found on the website: http://europa.eu.int/comm/employment_social/soc-prot/missoc99/.
14. In the United Kingdom, the concentration of hours worked by lone parents around the 16 hours point – the cut-off for eligibility for the Family Credit in place up to October 1999 – indicates that the benefit systems impacted significantly on female labour supply.
15. EU countries agreed in 1977 to establish a harmonised VAT system, which had to be adjusted later on to comply with the objective of the single market. The current system has a fair degree of harmonisation, with a harmonised tax base, with two categories of rates, and minimal standard and reduced rates fixed at the EU level. However, exemptions, derogation and special schemes, ruled under the European Community law, allow a certain number of differences to exist across EU countries, depending on their specific economic situation.

16. The main consumption items which benefit from reduced VAT rates in most EU countries are: food products, water supplies, pharmaceuticals products, books and newspapers, transport of passengers, hotel accommodation and restaurant services. Other, less frequent, consumption items taxed at reduced rates include: pesticides (Greece, France, Italy, Luxembourg, Netherlands, Portugal and Spain), heating oil (Ireland, Luxembourg, Portugal, United Kingdom), clothing and footwear for children (Ireland, Luxembourg, United Kingdom).
17. In Finland, the special VAT refund scheme which applies to VAT paid on the inputs of municipalities increases neutrality concerning contracting out of taxable services to the private sector. However, for tax-exempt services, including medical and social services, the refund scheme stimulates own production by municipalities since they are compensated for the VAT paid on inputs while private companies are not. In the draft 2002 budget, the government has however proposed to mitigate this bias by introducing a new compensation (OECD, 2002).
18. By 1993, the luxury VAT rates were abolished, the standard rate set to at least 15 per cent and a maximum of two reduced rates were allowed, which must be equal to, or greater than, 5 per cent. In addition, countries were allowed to maintain super-reduced rates and a zero rate on a limited number of products taxed at those rates before 1991. For more details on VAT rates and exemptions, see European Commission (2000b). For excise duties, a system of minimum rates was implemented from 1993.
19. British excise duties on tobacco and alcohol are much higher than in Belgium and France. The British government estimated lost excise duty and VAT from tobacco smuggling to be £1.7 billion in 1998 (Ussher, 2000).
20. As an illustration, gasoline prices are about 25 per cent lower in Luxembourg than in Belgium, Germany and France, largely reflecting lower VAT and excise taxes. It is mirrored in the fact that non-residents' consumption of gasoline accounts for more than 75 per cent of the gasoline sold in Luxembourg.
21. For digital goods delivered online (such as software and music), the Commission proposed in June 2000 a threshold of annual sales of € 100 000 to consumers in the EU area under which non-EU companies will not qualify to pay VAT.
22. For sales to foreign businesses that are registered for VAT, the goods are exported tax free; the receiving business has to declare the import and pay VAT on it. Importing businesses that are not registered for VAT are treated as consumers. For sales to consumers in another EU country, firms have to register for VAT in the destination country and apply its VAT rates. However, for small scale sales (*e.g.* through mail or Internet order), the VAT rate in the supplying country is applied.
23. A recent business survey revealed that in year 2000 26 per cent of firms considered that difficulties related to the VAT system and VAT procedures are an obstacle to the functioning of the EU internal market (*Single Market Scoreboard*, No. 7, November 2000). Verwaal and Cnossen (2000) also argue that: "Due to the transitional VAT and Intrastat system, the legal and procedural requirements imposed in respect of intra-community transactions differ from those imposed on domestic transactions. These requirements bring additional (differential) compliance costs in their train". Compliance costs for intra-community transactions are also shown to vary significantly across firms, largely reflecting economies of scale and variables related to information technologies. The evidence suggests also that the differential compliance costs reduce the intensity of intra-community trade.

24. The European Commission considers that one of the main reasons for the increase in fraud under the current VAT system is the fact that goods circulate without VAT being paid (European Commission, 2000c). It reports two main types of fraud: *a)* the declaration of fictitious intra-Community deliveries: the exempted goods are in fact sold on the internal market and VAT due on final consumption is thus evaded; *b)* failure to declare VAT due on intra-Community purchases, which may then result in VAT fraud on final consumption if the goods are resold through underground trade channels. The right to deduct the tax upstream may also be misused in cases where buyers' VAT declarations request the refund of VAT on purchases for which no VAT was paid.
25. There are some 100 billion VAT declarations submitted per year in the EU area. However, mainly due to lack of resources, they are mostly used as a document stating the tax said to be due while all the other information, which could form the base for control decisions, is not actually used, but is nevertheless collected and stored (European Commission, 2000d).
26. For environmental-related matters, decisions at the EU level require, in general, a qualified majority. There is one main exception relating to decisions covering taxes, which can only be adopted unanimously. Thus, at the EU level, regulations and minimum standards often dominate because the competence of the Commission is more easily exercised (though this does not impede individual countries from introducing taxes on an unilateral basis to comply with EU rules and standards).
27. In fact, tax relief is granted in most countries. In Germany, the energy tax is capped. In Sweden, manufacturing industries are exempt from energy tax while the CO₂ tax rate is one-third of the standard rate. Special, and even more favourable rules, apply to about 60 energy-intensive enterprises. Energy-intensive industries are also largely exempt from the CO₂ tax in Denmark and Finland, as well as from the SO₂ tax in Sweden and Denmark (since 1999, though, Danish electricity utilities pay the SO₂ tax). Agriculture is exempted from tax on wastewater in some EU countries (*e.g.* Denmark) though agriculture is one of the most important contributors to the poor quality of surface water. Likewise in Denmark, the fertiliser tax applies only to non-agricultural uses.
28. However, in some countries, *e.g.* Austria and Finland, registration fees for cars discriminate against diesel-driven passenger vehicles. In Austria, the tax rate also depends on the fuel efficiency of the vehicle. For a petrol-driven and a diesel-driven vehicle using the same amount of fuel per 100 km, the tax rate is higher for the diesel-driven one. However, the tax bases used in annual taxes on vehicles are seldom close proxies to the environmental impacts caused by the vehicles. Lévêque *et al.* (1999) estimate tax concessions to diesel users in France to amount to € 1.2 billion.
29. In some countries, capital gains are taxed at a flat rate (which can be nil), conditional on a minimum holding period (*e.g.* one year in Austria, Germany, Portugal and Spain). Capital gains are tax free in Belgium and the Netherlands. In Germany, dividends and interest income are subject to a withholding tax but should *de jure* also be incorporated into the taxable income, and taxed at the taxpayer's marginal rate. *De facto* however, they are largely unreported (Lang *et al.*, 1997).
30. Since 2001, income in the Netherlands is classified into one of three boxes depending on how it was generated: income from labour (including home ownership); income from a substantial business interest; and imputed income from wealth. The first component is taxed according to a progressive rate schedule while the other two are taxed at a flat, though different, rate (OECD, 2000a).

31. The European Commission as presented in April 2001 a Communication to eliminate obstacles to the cross-border provision of supplementary pensions caused by the tax system. After a detailed examination of EU countries' rules in the field of pension taxation, it envisages a negotiation with individual countries which fail to fulfil an obligation imposed by EC law. Where issues cannot be resolved, the Commission will bring cases before the European Court of Justice.
32. Tax privileges on housing investment are easier to measure in countries which have implemented a dual income tax. For instance in Denmark and Sweden, so extensive are the deductions of interest payments that the net revenues from the taxation of household capital income are actually negative. Acquisition costs are deductible (at least partly) in Austria, Belgium, Portugal. In Spain, mortgage interest payments and acquisition costs give rise to a 15 per cent tax credit, with a maximum € 1 352 credit.
33. In Germany, an allowance for income from capital investment (*e.g.* dividends, interest) was granted up to € 1 534 – double for jointly assessed spouses – in 2000. In France, the first € 1 202 – double for married couples – of dividends received from resident companies were exempt in 2000 and capital gains were tax free below a € 7 625 threshold of sales. The allowance for dividend income has recently been abolished for taxpayers with a net taxable income exceeding € 45 634 – double for married couples. In the Netherlands, the positive balance between interest received and paid (with the exception of mortgage interest for self-occupied housing) is exempt up to € 454 – double for married couples. In the United Kingdom, individuals are entitled to a £6 800 basic annual exemption for capital gains and some saving account instruments (PEPs and ISAs) are tax exempt.
34. In the withholding tax system envisaged by the EC proposed Directive on cross-border savings, the destination country would keep 25 per cent of the tax proceeds and give back the remaining 75 per cent to the country of residence of the investor.
35. The relative merits of information exchange and withholding tax are also influenced by the strength of the incentives to adopt and effectively implement an information exchange system given i) questions about its administrative costs; and ii) the fact that its financial benefits derive from information received from other countries and any resulting reduction in tax evasion.
36. The centres specifically targeted include the United States, Switzerland, Liechtenstein, Andorra, Monaco, San Marino as well as dependent territories of some Member states such as the United Kingdom's Channel Islands and the Isle of Man.
37. Finland, France, Germany (before the 2000 reform), Ireland, Spain, and the United Kingdom apply an imputation system (dividends are taxed according to the personal income tax of the shareholder and corporate and withholding taxes paid on dividends are fully or partly creditable). Austria, Belgium, Denmark and Sweden do not grant relief for taxation at the corporate income level but apply relatively low tax rates at the personal level while Greece has removed double taxation by simply exempting dividends for the personal income tax. Italy and Portugal offer taxpayers the choice between the two systems (imputation credit or a reduced, flat and final withholding tax on dividends). The Netherlands do not provide a relief for the tax paid at the corporate level and apply a flat rate at the personal level, though the tax base is an imputed income and not the effective one.
38. The tax system is neutral towards corporate financing decisions if a given pre-tax flow of corporate profits produces the same after-tax income for final investors, whether the return takes the form of interest payments, dividends, or capital gains (*i.e.* the standard deviation of the rates of return to different sources of finance is nil). This requires that the combined corporate and personal tax burden is equal across financing instruments.

39. In fact, EU countries have failed to agree on various EC proposals for a harmonised accountancy model. The latest initiative dates from June 2000, when the EC unveiled a plan to force companies to offer accounts that conform to a single regional standard by 2005.
40. These estimates are provided by Buijink *et al.* (1999). They are drawn from the consolidated financial statement data of a panel of 2 118 EU manufacturing companies, mainly listed – therefore excluding important sectors such as insurance and financial services.
41. The Baker and McKenzie (1999) survey singled out some of these specific sectoral and geographical tax regimes. They include: high unemployment regions in Belgium; the so-called development zones and shipping in Finland; tax relief granted by France for newly created companies in Corsica, the overseas departments and the so-called “privileged investment zones” (which include Nord-Pas-de-Calais); Eastern Länder in Germany; the less-developed regions, and electric power plants and hotels in Greece; Dublin designated areas, Shannon Airport Industrial Zone, and for manufacturing and financial activities in Ireland; regions with a high unemployment rate in Italy and for certain activities carried out by SMEs; shipping in Luxembourg and the Netherlands; tax breaks granted by Portugal for SMEs and to investment in certain regions, including the International Business Centre of Azores and Madeira for banks, financial and insurance companies; tax breaks granted by Spain for investment in the Canary Islands and for mining and export activities; and Northern Ireland for the United Kingdom.
42. For the United Kingdom, see Freedman and Ward (2000). To help small companies, a 10 per cent starting rate was introduced in April 2000 for companies with taxable profits below £10 000. A 20 per cent rate is also applied for companies with taxable profits between £50 000 and £300 000 (the “normal” corporate income tax rate, *i.e.* paid by companies with profits above £1.5 million, is 30 per cent). In addition, the Budget 2000 introduced an enhanced relief for SMEs for R&D spending. From April 2000, SMEs are entitled to claim 150 per cent of their qualifying expenditure on R&D. In France, full and partial exemptions are granted to companies created between 1995 and 2004 if certain conditions concerning the type and location of the activity are satisfied.
43. Under the holding-company regime, a company based in these countries pays low or no tax on dividends or capital gains from the stakes it holds in other companies. Under the co-ordination centre regime, a company can benefit from substantial tax breaks if it can prove to the government that the branch located in the country co-ordinates the finances for all the company’s European offices.
44. The Report of the Code of Conduct group on business taxation, reported to the ECOFIN council in November 1999, considered 66 tax measures as harmful. It also noted that some of them were being phased out, in particular: Co-ordination Centres in Luxembourg; International Financial Services Centres of Dublin; Luxembourg Finance companies; the Irish 10 per cent manufacturing rate and the Shannon Airport Zones.
45. The statutory progressivity presented in Figure 11 is based on OECD’s tax equations (OECD, *Taxing Wages*). There are several limitations to measuring the progressiveness of the tax system based on these equations. First, take-up rates for tax allowances and credits not included in the tax equations tend to increase with income (*e.g.* those associated to housing investment and childcare expenses). Second, these equations apply to wage income mostly while large groups of taxpayers do not pay social security contributions, or less than wage earners, in many countries (*e.g.* the self-employed, retirees, pensioners, unemployed). In addition, the taxation of the capital income component is not reflected here.

46. In France, about half of the households do not pay personal income tax. In addition, two proportional allowances apply successively on wage income: 10 per cent (with a maximum of € 11 809 in 1999) and 20 per cent on the first remaining € 107 781.
47. Social contributions often finance insurance schemes and thus are not aimed at redistributing income from the rich to the poor. They should rather be considered as redistributing income over the life-cycle of the individual. Contributions for pensions, unemployment, or sickness, largely pertain to this category in many EU countries. However, even in these cases, the insurance component may not be fairly defined on an actuarial basis (*e.g.* for pensions) and/or benefits may increase with the level of income while contributions are subject to a ceiling (*e.g.* health care expenses tend to increase with income). Overall, they may thus benefit more the rich. This has led some countries, including France, to remove most social contribution ceilings.
48. Burniaux *et al.* (1998) present a breakdown of the sources of income inequality. Four components are singled out: labour, capital and self-employment, transfers, and taxes. Using a methodology proposed by Shorrocks, they show that taxes contribute more in EU countries than elsewhere to reduce income inequality. However, controlling for their size, the relative contribution of taxes in reducing inequality was in the mid-1990s lower in all of the seven EU countries considered than in Australia and Japan, and broadly similar to the United States. In other words, for every dollar of income taxes and social security contributions, a larger proportion was taken from the wealthy in Japan and Australia compared with Belgium, Denmark, Finland, Germany, Italy, the Netherlands and Sweden.
49. Econometric simulations for EU countries suggest that cuts in social security contributions offset by an increase in other levies produce a significant positive effect on employment. The most favourable results are observed when the reduction in employers' social security contributions is targeted on categories of workers with a low level of skills and if a tax on CO₂/energy is introduced rather than VAT being increased. For more information on the models and simulations, see European Commission (1993) and Roeger *et al.* (1998). Likewise, using panel data on EU countries over the period 1965-95, Daveri and Tabellini (2000) hardly found any distorting effects of both consumption and capital taxes on employment and growth, in sharp contrast with labour taxation. They thus recommend shifting the burden of taxation away from labour onto consumption or capital. On the other hand, Tyrväinen (1995) showed that while payroll, income and consumption taxes have the same effect on wage-setting behaviour in the long run for most countries, adjustment speeds differ considerably, with wages appearing to adjust more slowly to consumption taxes than to other taxes.
50. Grüner and Heer (2000) develop an endogenous growth model in which a shift from labour to capital and wealth taxation increases growth through higher education.
51. The complementarities between the two measures may largely explain the boom in employment in Spain following the introduction of a new job contract in 1997 with reduced firing costs and social security contributions.
52. In Spain for instance, tax incentives were reduced in 1998 but remain generous. They have been reflected in a very high rate of owner-occupied houses by international standards while the housing rental market is poorly developed. On the labour market, 90 per cent of new job contracts were of a short-term nature in 1999 and only about one fourth of the unemployed indicated that they would accept a job if they had to move.
53. For an in-depth discussion of these issues, see O'Brien and Vourc'h (2001) and OECD (2001).

Appendix 1

REFORMING VAT: MOVING FROM THE DESTINATION
TO ORIGIN PRINCIPLE?

Since the common VAT system was introduced in the 1970s, its declared objective has been to create the conditions necessary for the establishment of an internal market characterised by healthy competition, under which the taxation of imports and the non-taxation of exports in intra-Community trade would be abolished. This commitment underpinned the objective of designing a VAT system which was tailored to the internal market and operated within the EU area in the same way as it would within a single country, *i.e.* to introduce a system of taxation where goods and services would be taxed in the Member State of origin. However, in practice, such a radical change has not secured the necessary support from Member States. Foremost amongst the reasons for this are reservations about the efficiency of the necessary clearing mechanism for the distribution of VAT receipts, and the degree of harmonisation of rates that such a regime would necessitate. Nevertheless, the elimination of custom controls within the EU area in 1993 made it necessary to reform the VAT system operating up to then according to the destination principle. It was thus decided to adopt a “transitional” system which would enable controls at the Community’s internal borders to be abolished whilst allowing tax, in most instances, to continue to be collected in the Member State of destination.

The destination principle. The destination principle implies that consumption taxes are levied where the products are consumed for both final consumers and producers. This system ensures production neutrality, since indirect taxes do not discriminate between foreign and domestic producers, and exports are exempt from domestic taxation. However, this principle requires the monitoring of cross-border trade flows and administrative co-operation since goods and services travel free of tax.

The origin principle. The origin principle implies the taxation of goods and services where produced, regardless of where they are consumed. It has advantages in that it can be applied without border controls, and since exports would no longer travel tax free, the potential for tax fraud would be lower. However, the origin principle introduces the possibility for the tax system to discriminate between domestically-produced goods and imports. The full move from the destination to origin principle would also induce significant changes in the distribution of VAT revenues across countries. EU countries with a trade surplus *vis-à-vis* the rest of the EU area would thus collect extra VAT revenues, compared with the existing regime of export zero-rating, while deficit countries would have to be granted a VAT credit on their intra-community business purchases. To ensure that VAT receipts accrue to the country where consumption takes place, a mechanism to redistribute VAT revenues across countries would thus be required. In 1987, the Commission proposed to set up a “clearing house” which would make the necessary adjustments based on detailed records of individual transactions. This would have required numerous information exchanges and involved high

transaction costs. The Commission thus later proposed a mechanism to reallocate VAT collected, using as a basis aggregate consumption, to ensure that VAT receipts accrue to the EU country where consumption takes place, thus compensating countries for VAT paid on goods that are exported. However, the choice of a method, and statistical sources, to measure aggregate consumption could become a delicate issue, in particular as to the size of the underground economy, each country preferring an estimate of taxable consumption which would maximise its share of the redistribution of overall VAT income (European Commission, 1998b). In addition, such a system would have the drawback of disconnecting tax collected in a particular country from its tax revenues, thus reducing national tax authorities' incentives to improve compliance.*

A "transitional" dual system. Instead, the European Union has kept a dual system since 1993: the destination principle has remained intact for the business sector, but the origin principle now applies to cross-border purchases by individuals. Individuals can now purchase goods anywhere in the EU area, without any further tax liability being incurred when they move the goods from one EU country to another (with the exceptions of new vehicles and mail order transactions). Such a dual system attempts to fulfil the requirements of an internal market without frontiers whilst allowing room for manoeuvre at the national level as regards the establishment of VAT rates and the collection and auditing of the tax (European Commission, 1998b). The transitional regime replaced custom controls by the obligation, for all EU firms exporting to another EU country (B2B and B2C distance selling), to declare their exports to the tax administration, identifying the buyer by a VAT identification number (or giving their own identification number in the country of destination in case of distance selling). A computerised system for automatic exchange of information on the value of intra-EU trade was set up among the national authorities (VAT information exchange system, VIES).

* Keen and Smith (1996) recommend maintaining a close relation between taxes collected and tax revenues for each country to keep the incentive of improving tax collection and compliance for national authorities. They thus proposed to introduce a unique VAT rate on EU cross-border transactions while member states would retain the power to determine the VAT rate on sales by traders to final consumers.

Appendix 2

THE EU CODE OF CONDUCT ON BUSINESS TAXATION

The EU Council adopted a Code of Conduct on business taxation in December 1997, as part of the wider tax package. With the adoption of the EU Code of Conduct, EU countries committed themselves to refraining from introducing new *harmful tax measures*, and to roll back existing ones, *i.e.* those special schemes which may affect in a significant way the location of business activity in the EU area. In March 1998, a group to manage the Code of Conduct on business taxation was created (known as the Code of Conduct group). It produced a report in November 1999 which identified 66 harmful tax measures that unfairly encourage businesses to locate in one EU country at the expense of another. The Code of Conduct is not legally binding, but some of the tax measures covered by the Code fall within the scope of the Maastricht Treaty on state aid, on which the European Commission has some legal powers if it is considered to distort competition.*

According to the Code of Conduct, tax measures are to be regarded as potentially harmful if they provide for a significantly lower effective level of taxation, including zero taxation, than those levels which *generally* apply in the Member State in question. The tax measures covered by the Code include both laws or regulations, and administrative practices. When assessing whether tax measures are harmful, account should be taken of, *inter alia*:

- whether advantages are accorded only to non-residents or in respect of transactions carried out with non-residents; or
- whether advantages are ring-fenced from the domestic market, so they do not affect the national tax base; or
- whether advantages are granted even without any real economic activity and substantial economic presence within the Member State offering such tax advantages; or
- whether the rules for profit determination in respect of activities within a multinational group of companies departs from internationally accepted principles, notably the rules agreed upon within the OECD; or
- whether the tax measure lacks transparency, including where legal provisions are relaxed at an administrative level in a non-transparent way.

* Tax breaks are recognised to have effects equivalent to cash subsidies. The European Commission draws a distinction between state aids and general measures. General measures are deemed not to constitute aid and therefore are not controlled by Article 87(1) of the EC Treaty. Measures are considered general when there is no specificity in terms of sector, region or category; the eligibility for the aid is based on objective criteria, without any discretionary power of the authorities; and the measure is in principle not limited in time or by a predetermined budget.

The EU Code of Conduct and the OECD harmful tax practices initiative

With broadly the same rationale as for the EU Code of conduct, the OECD (1998, 2000b) sets out an approach to dealing with harmful preferential regimes in OECD Member countries and adopted a series of recommendations for combating harmful tax practices. Whilst the EU Code of Conduct and the OECD Guidelines are broadly compatible, the scope of the two differs. The Code of Conduct looks at business activities in general, although with an emphasis on mobile activities. The OECD Guidelines, on the other hand, are clearly limited to financial and other service activities, reflecting a particular concern for the abusive tax practices that preferential regimes of this type can encourage. They are also intended to cover a wider geographical area.

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THE CONTRIBUTION OF INFORMATION AND COMMUNICATION TECHNOLOGIES TO ECONOMIC GROWTH IN NINE OECD COUNTRIES

Alessandra Colecchia and Paul Schreyer

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INTRODUCTION

Recently, OECD (2001a) examined sources of and differences in growth patterns between OECD countries and concluded that one factor that has become increasingly important is information and communication technology (ICT). Some of the effects of ICT, in conjunction with macroeconomic policies are well-documented for the United States which witnessed strong growth over an unusually long expansion, 1992-00. The present work aims at quantifying the contribution of ICTs to output growth in the United States and in several other OECD countries. In particular, it examines the role of ICT as a source of capital services, delivering inputs to the production process. This is different from an output perspective where the primary concern is the role of ICT-producing industries in the economy.

ICT is often embodied in other, non-ICT capital goods – for example semi-conductors are part of assembly lines. Here, ICT plays a role as an intermediate input to capital goods production. While potentially an important source of productivity gains, this contribution to output is not separately identified in the present framework.

This paper is based on Colecchia (2001) which updates and extends an OECD study on the contribution of ICT to output growth in the G7 countries (Schreyer, 2000) in several significant ways. First, the study covers software as an ICT asset. This reflects the recognition of software as an intangible investment good in the System of National Accounts 1993 (SNA93). Second, ICT investment series are as far as possible based on official statistics, while Schreyer (2000) had to rely on private source data. Third, the set of countries has been extended to cover two additional countries, Australia and Finland. In addition, the analysis covers the second half of the 1990s which has been a period of significant interest regarding the role of ICT.

FRAMEWORK

Accounting for the contribution of ICT to output growth

The methodology employed here follows directly the approach by Oliner and Sichel (1994, 2000), Jorgenson and Stiroh (2000) and Schreyer (2000). It represents

an extension to the well-established growth accounting and productivity measurement approach, based on the work by Solow (1957), and Jorgenson and Griliches (1967). A comprehensive discussion of this approach and the ensuing measurement issues can be found in OECD (2001b).

In the decomposition we consider deflated value-added as our output measure and call it Q . Associated with the volume measure of output is a price index for the same period, P . Inputs comprise the primary inputs labour (L) and capital. Capital services are provided by a set R of different types of assets, of which a subset R_1 is ICT and another subset R_2 is non-ICT assets. The present study distinguishes three types of ICT assets: hardware, communication equipment and software but for purposes of theoretical exposition, they are lumped together here as the flow of ICT capital services (K^C) as distinct from the flow of non-ICT capital services (K^N). The well-known growth de-composition is given by:

$$d\ln Q = \varepsilon_L d\ln L + \varepsilon_{KN} d\ln K^N + \varepsilon_{KC} d\ln K^C + d\ln A \quad (1)$$

In (1), ε_L , ε_{KN} and ε_{KC} are the elasticities of production of labour, non-ICT and ICT capital, respectively. For a cost-minimising firm and under competitive conditions on factor markets, ε_L , ε_{KN} and ε_{KC} correspond to cost shares of the different factors of production. Under constant returns of scale, total cost equals total revenue, cost shares equal income shares and sum to unity. Call w the average compensation per hour of labour input, u^C the user cost of a unit of ICT capital services and u^N the user cost of a unit of non-ICT capital services so that wL/PQ is the income share of labour, and $u^C K^C/PQ$ and $u^N K^N/PQ$ are the income shares of ICT and non-ICT capital. In (1), the rate of change of output is presented as a weighted average of the growth rates of factor inputs, and of a multi-factor productivity (MFP) term, $d\ln A$. This rate of MFP change is a Hicks-neutral (input-augmenting) shift of a production possibility function over time. The contribution of an input to output growth is evaluated by its cost or income share multiplied by its rate of volume change. In particular, the contribution of ICT capital to output growth is captured by $[u^C K^C/PQ] d\ln K^C$.

For purposes of empirical implementation, $d\ln K^C$ will be approximated by a logarithmic rate of change of ICT capital services $[\Delta \ln K_t^C = \ln(K_t^C/K_{t-1}^C)]$ and its income share $u^C K^C/PQ$ by a two-period average: $0.5(u_t^C K_t^C/P_t Q_t + u_{t-1}^C K_{t-1}^C/P_{t-1} Q_{t-1})$.

The rate of change of ICT capital input $d\ln K^C$ is a weighted average of the rates of change of its three components: IT equipment, software and communications equipment. A Törnqvist index is used in its empirical implementation with weights $v_t^i \equiv [u_t^i K_t^i / \sum_{i \in R_1} u_t^i K_t^i]$ that stand for the share of ICT asset i in total income of ICT capital at current prices:

$$\Delta \ln K_t^C = \sum_{i \in R_1} 0.5(v_t^i + v_{t-1}^i) \Delta \ln K_t^i \quad (2)$$

Measuring the volume of capital services

Typically, volume changes of ICT and other capital services are not directly observable. The same holds for their user costs that are needed to aggregate flows of capital services. Concerning the flow of capital services, the usual assumption is that, for a particular type of (homogenous) capital good, it is proportional to the productive stock of the same capital good, and that this proportionality factor is constant over time. With this simplification, the rate of change of the productive stock and of the flow of capital services derived from this stock are equal. The productive stock (see OECD 2001b for a fuller discussion) reflects the physical or quantity aspect of a capital good. We construct the productive stock for each asset with the perpetual inventory method that cumulates past investment, corrected for the retirement of assets and corrected for the loss in productive efficiency.

The capital service flow derived from asset i is given by $K_t^i = \lambda S_{t-1}^i$. Here, S_{t-1}^i stands for the productive stock of asset i , at the end of period $t - 1$. λ is a constant parameter that links the productive stock to the flow of capital services. λ can be set to equal unity as its size does not affect the rate of change of the productive stock. Based on volume investment series and assumptions about their service lives, age-efficiency functions and retirement distributions, we compute productive capital stocks for each type of asset. More specifically, letting I_t^i be the flow of constant price investment expenditure during period t , the productive services of capital good i are:

$$K_t^i = S_{t-1}^i = \sum_{\tau=0}^T g_{\tau}^i I_{t-1-\tau}^i \quad i \in R \quad (3)$$

g_{τ}^i is a function that combines the effects of retirement and efficiency loss of an asset. The survival or retirement function indicates how many of the capital goods purchased in a particular period are still at work after τ years. It was chosen as the cumulative function of a normal distribution of retirement with the average service life as its mean and a spread of two standard deviations. In addition, the retirement function was truncated at the maximum service life, determined as $T = 1.5 \times \text{average service life}$. Truncation avoids the situation where some assets of a cohort have an infinite service life.

The age-efficiency function reflects the change in productive efficiency of an asset as it ages, conditional on survival. Call the age-efficiency function for asset i h_{τ}^i . At the beginning of a cohort's life, this coefficient takes the value of one ($h_0^i = 1$), it declines over the service life of an asset and becomes zero when the maximum service life T of the asset is reached ($h_{T+1}^i = 0$). Following the practice at the United States Bureau of Labor Statistics (BLS, 1983), a hyperbolic age-efficiency function was used. Under a hyperbolic function, an asset loses relatively little of its productive efficiency in the early years of service life and relatively much towards the end of its service life.¹

The formulation in (3) implies that investment in period t translates into capital services of the following year. For longer-lived assets such as machinery or non-residential structures, this is a suitable assumption. For short-lived assets such as ICT capital, this may be less plausible. However, in the absence of intra-annual data, it is not possible to introduce a lag structure differentiated by type of asset.

Measuring the price of capital services

The price of capital services is given by the user cost or rental price expression as formulated by Jorgenson (1963). User costs are imputed prices and reflect how much would be charged in a well-functioning market for a one-period rental of a capital good. Ignoring taxes, user costs u_t^i of an asset i are composed of the net rate of return r_t applied to the purchase price of a new asset q_t^i , of the costs of depreciation, captured by the rate of depreciation d_t^i , and of the rate of change of the asset price itself, as expressed by the term ζ_t^i . No distinction was made between realised and expected asset price changes. Thus, ζ_t^i corresponds to the observed rate of change of the investment good deflator of asset i .

$$u_t^i = q_{t-1}^i [r_t + d_t^i - \zeta_t^i (1 - d_t^i)] \quad (4)$$

The expression in brackets represents the gross rate of return on a new capital asset. For ICT assets, the gross rate of return tends to be higher than for other assets. This reflects rapid obsolescence of ICT assets, which enters the user cost term via changes in purchase prices of new capital goods and via depreciation. Generally, falling purchase prices raise the cost of holding a capital good while making it less expensive to buy.

We determine the net rate of return r_t in the user cost expression as the *ex post* rate (Jorgenson and Griliches, 1967) that will just make the user costs exhaust the gross operating surplus of the sector under consideration.² Depreciation rates d_t^i reflect the relative loss of an asset's value due to ageing.³ The rates of depreciation d_t^i for the user cost expression were derived in a consistent manner from age-efficiency profiles and expected asset price changes (see OECD, 2001b for a full statement).

We calculated the net rate of return, r_t , as the *ex post* rate that exhausts all non-labour income in the production account. This was obtained by solving the following relationship for r_t :

$$\text{Non-labour income} = P_t Q_t - w_t L_t = \sum_{i \in R} u_t^i K_t^i = r_t \sum_{i \in R} q_{t-1}^i S_{t-1}^i + \sum_{i \in R} [d_t^i - \zeta_t^i (1 - d_t^i)] q_{t-1}^i S_{t-1}^i \quad (5)$$

DATA

Current-price investment

There are significant differences in the availability and the level of detail at which statistical offices compile and publish data on gross fixed capital formation

by type of asset or by type of investment good. The present study distinguishes seven types of capital goods,⁴ of which three are ICT capital goods (IT hardware, communications equipment and software) and four are non-ICT assets (non-residential buildings, other construction, transport equipment and other non-residential, non-ICT assets). No account was taken of residential assets, land, inventories and intangibles other than software. This remains a high level of aggregation, given that every asset category is implicitly considered as a homogenous type of capital good – an assumption that appears difficult to justify in several cases. At the same time, the bias from using aggregate data is large only when relative prices of the components of an aggregate evolve significantly differently. This is in particular the case for ICT assets and those have been considered separately.

Whereas Schreyer (2000) and Daveri (2000) use a private data source to assess the size of ICT investment at the international level, the present study is based on data that has recently become available in statistical offices' national accounts. Estimates were still necessary, in particular to obtain long time series. Also, certain differences in the coverage of asset classification remain but on the whole, the data set is more consistent than the one used in Schreyer (2000).

Some countries (for example the United States) publish official investment data by detailed type of asset only for private investment. In a number of other countries (for example Germany, Italy or the United Kingdom), the available asset breakdown of investment relates to the entire economy. Estimates had to be made to construct series for both the entire economy and the business sector for all countries under consideration. Table I provides an overview of data availability and coverage.

The System of National Accounts 1993 (SNA93) stipulates that software purchases by firms should be considered investment expenditure, incurred to build up an intangible asset, the stock of software available in the production process. With the implementation of the SNA93 in most OECD countries, the first set of estimates of software expenditure has become available in countries' national accounts. A number of important measurement issues arise in this context. Unlike hardware, whose current price investment can be assessed with reasonable confidence, the measurement of software expenditure at current prices is subject to many uncertainties and estimation methods differ across countries. For example, Lequiller (2001) found significant cross-country differences in the allocation of software expenditure between fixed capital formation and intermediate consumption. This may be as indicative of differences in methodologies as it may reflect truly different investment patterns across OECD countries. In addition, the problem of finding the appropriate price index for software is similar to the one for hardware investment. Consequently, comparisons of software investment across countries have to be treated with considerable care.

Table 1. Availability of current price ICT investment series in official statistics

	Available aggregates	Software	IT equipment	Communications equipment	Time period
Australia	Private, public enterprise and general government	Purchased and own-account software	Computer equipment and peripherals + OECD estimate of office and accounting equipment	OECD estimate based on OECD telecommunication database	1960-2000
Canada	Total economy, business sector and government	Purchased and own-account software	Computers, office and accounting equipment	Communications equipment	1981-2000
Finland	Total economy, business sector and government	Purchased and own-account software	OECD estimate based on production and trade data from the OECD STAN database and investment data from the SNA database	OECD estimate based on production and trade data from the OECD STAN database and investment data from the SNA database	1960-1999
France	Total economy and major institutional sectors	Purchased and own-account software	Computers, office and accounting equipment ("machines de bureau et matériel informatique", GE31)	Communications equipment ("appareils d'émission et de transmission", GE33)	1959-2000
Germany	Total economy OECD estimate for the business sector	Purchased and own-account software	Computers, office and accounting equipment	Communications equipment (including radio and television sets)	1991-2000
Italy	Total economy OECD estimate for the business sector	Purchased and own-account software	Computers, office and accounting equipment	Communications equipment	1982-1999
Japan	Total economy OECD estimate for the business sector	Purchased software	Electric computing equipment and accessory devices	Wired and radio communications equipment	1990-1999
United Kingdom	Total economy OECD estimate for the business sector	Purchased and own-account software: estimates by Oulton (2001) (lower bound estimate used)	Computers, office and accounting equipment (estimate of computers only used by Oulton, 2001)	Communications equipment	1948-1999
United States	Private sector	Purchased and own-account software	Computers, office and accounting equipment	Communications equipment	1948-2000

Note: In this table, *business sector* is used for data classified by institutional sectors or units. In national accounts terminology, this corresponds to the *corporate sector*, i.e. financial and non-financial corporations including quasi-corporations.

Source: OECD STI/STD.

Customised software. Countries estimate customised software purchases either by using information from business surveys or by applying a “commodity-flow method”. The former aims at directly measuring software investment, the latter uses statistical data on the domestic production and imports of packaged software and then proceeds to split this overall supply into a final demand and intermediate consumption component. There is no guarantee that the two methods yield the same result, however, and there are advantages and drawbacks associated with both methods. For example, the commodity-flow method has the advantage of starting from fairly reliable data on overall supply but requires assumptions about the share of final demand in total supply. The company survey method directly inquires about firms’ capital spending but may face other problems; for example firms may understate their software investment because they record software purchases as current expenditure. International comparisons of the split of total supply into a final demand (investment) and an intermediate demand component do reveal significant differences. For an in-depth discussion see Ahmad (2001). Presently, commodity-flow methods are used in Finland, Italy and the United States whereas France, Australia, and the United Kingdom use the company survey method.

Standardised, reproduced software. Separate estimates of reproduced software investment expenditure are difficult to obtain when standardised software is bundled with other commodities in particular computers. Separation of standardised and customised software is also difficult when investment data are based on business surveys as they do not normally distinguish the two types of software.

Own-account software. Estimating own-account software is another difficult issue. In many countries, it suffers from a weak statistical basis and there are considerable cross-country differences in estimation methods. Generally, estimation proceeds by evaluating the compensation for labour input by software engineers involved in the development of own-account software. International differences arise in the definition and measurement of the relevant occupational group (“software developer”); estimates of hours worked in development, and average compensation per hour. There are also conceptual issues such as whether all own-account software should be treated as an investment good or whether some of it (such as own-account software that is subsequently embedded in a product) should be treated as intermediate delivery.

Price indices

Price indices are key in measuring volume investment, capital services and user costs. Accurate price indices should be constant quality deflators that reflect price changes for a given performance of ICT investment goods. Thus, observed

price changes of “computer boxes” have to be quality-adjusted for comparison of different vintages. Wyckoff (1995) was one of the first to point out that the large differences that could be observed between computer price indices in OECD countries were likely much more a reflection of differences in statistical methodology than true differences in price changes. In particular, those countries that employ hedonic methods to construct ICT deflators tend to register a larger drop in ICT prices than countries that do not.

Table 2 identifies countries’ usage of hedonic methods in constructing price indices for software, IT equipment and communications equipment. Several countries employ hedonic techniques to deflate IT equipment expenditure. Presently, only the United States uses a hedonic pricing model for pre-packaged software. Other countries apply either an input-based deflator (such as a wage index for programmers) or use other investment price series (*e.g.* for hardware) as approximations. The input-based deflation method is more likely to overstate the price change of software because it cannot reflect quality improvements. Applying the hardware-related deflator could mean overstating the price change of software: where price indices for hardware and software have been established separately, software price indices fell less rapidly than price indices for hardware. We use the United States’ overall software deflator to construct harmonised price indices for software. This implies an assumption of similar composition (own-account, standard reproduced and customised) of software investment across countries which may not be accurate.⁵

Schreyer (2000) used a set of “harmonised” deflators to control for some of the differences in methodology. “Harmonised” price indices for ICT capital goods were calibrated around the United States ICT price indices. In a first step, the percentage point difference between the price index for IT equipment ($\Delta \ln q_t^{IT,US}$) and the price index for non-ICT equipment was calculated for the United States ($\Delta \ln q_t^{N,US}$). To eliminate short-term fluctuations, the resulting series was regressed against a polynomial trend and predicted values were generated. Call the predicted values from this regression $\lambda_t^{IT} = f(\Delta \ln q_t^{IT,US} - \Delta \ln q_t^{N,US})$. The same procedure was applied to software (SW) and communications equipment (CE) and yielded the series λ_t^{SW} and λ_t^{CE} . To construct the set of harmonised price indices, we applied these factors to non-ICT price indices of other countries: $\Delta \ln q_t^{IT,k} = \Delta \ln q_t^{N,k} + \lambda_t^{IT}$, $\Delta \ln q_t^{SW,k} = \Delta \ln q_t^{N,k} + \lambda_t^{SW}$, $\Delta \ln q_t^{CE,k} = \Delta \ln q_t^{N,k} + \lambda_t^{CE}$, where $k = 1, 2, \dots, 8$ countries other than the United States.

Note a difficulty with using the harmonised deflator. From an accounting perspective, adjusting the price index for investment goods for any country implies an adjustment of the volume index of output. In most cases, such an adjustment would increase the measured rate of volume output change. For practical reasons, these effects had to be ignored in the present analysis.⁶

Table 2. Use of hedonic deflators

	Software	IT equipment	Communications equipment
Australia	No	Hedonic price index linked to US-BEA computer price index, exchange rate-adjusted	No
Canada	Adjusted version of US-BEA price index for pre-packaged software (hedonic) and for customised software (partly hedonic)	Hedonic price index for PCs, portable computers and peripheral equipment	No
Finland	Weighted average (50/50) of average earnings index in computer industry and US-BEA hedonic price index for pre-packaged software	n.a.	n.a.
France	No	Hedonic price index for computers: combined measure of hedonic price index for France and the US-BEA computer price index, exchange rate-adjusted	No
Germany	No	No	No
Italy	No	No	No
Japan	No	Hedonic price index for computers	No
United Kingdom	No	No	No
United States	Hedonic deflator for pre-packaged software; for customised software average of deflators for own-account software (not based on hedonic method) and pre-packaged software	Hedonic deflators for computers and peripheral equipment	Hedonic deflators for telephone switching equipment

Source: OECD.

RESULTS

ICT investment

The economic expansion in the United States in the second half of the 1990s was led by large and sustained growth in business investment, following very low levels at the beginning of the decade. Remarkably, the rate of capital accumulation in the US business sector almost doubled in the second part of the decade, mainly because of strong investment in ICT capital. In 2000, and measured at current prices, ICT investment accounted for nearly a third of overall non-residential investment, and similar high rates are found in Finland, followed by Canada and Australia (Table 3).

When comparing these trends across countries, one has to bear in mind business cycles. For example in the early 1990s, when the United States started its expansion phase, Finland went through a deep economic recession. More recently, when investment in Finland has been surging, Japan has been experiencing an economic downturn. Yet, in spite of different positions in the business cycle, it is apparent from Table 4 that all nine OECD countries under consideration witnessed a rapid increase of constant price ICT investment. The growth rate even

Table 3. **Share of ICT investment in non-residential investment**

Percentages

		Australia	Canada	Finland ¹	France	Germany	Italy ¹	Japan ¹	United Kingdom	United States
IT equipment	1980	2.2	3.9	2.0	2.5	4.6	4.1	3.3	2.9	5.1
	1990	5.5	4.5	3.6	3.5	5.5	4.2	3.8	6.0	7.0
	1995	8.4	5.7	4.0	3.9	4.6	3.5	4.6	8.6	8.7
	2000	7.2	7.9	2.9	4.4	6.1	4.2	5.2	8.4	8.3
Communications equipment	1980	4.0	3.0	3.2	2.9	3.9	4.0	3.4	1.6	7.1
	1990	3.8	3.8	3.9	3.2	4.8	5.7	4.0	2.0	7.5
	1995	4.7	4.0	9.3	3.5	4.2	6.7	5.3	3.6	7.3
	2000	5.6	4.2	15.3	3.9	4.3	7.2	6.9	3.6	8.0
Software	1980	1.1	2.2	2.6	1.3	3.6	1.7	0.4	0.3	3.0
	1990	4.6	4.9	5.2	2.6	3.7	3.8	3.1	2.1	8.0
	1995	6.4	7.1	9.2	3.5	4.5	4.3	4.0	3.5	10.1
	2000	9.7	9.4	9.8	6.1	5.7	4.9	3.8	3.0	13.6
ICT equipment and software	1980	7.3	9.1	7.8	6.8	12.2	9.7	7.0	4.8	15.2
	1990	13.9	13.2	12.7	9.4	13.9	13.7	10.8	10.1	22.5
	1995	19.5	16.8	22.5	10.8	13.3	14.4	13.8	15.6	26.1
	2000	22.5	21.4	28.0	14.4	16.2	16.3	16.0	15.0	29.9

1. 1999 instead of 2000.

Source: Authors' calculations.

Table 4. **Volume investment**
Percentage change at annual rates, business sector

		Australia	Canada	Finland ¹	France	Germany	Italy ¹	Japan ¹	United Kingdom	United States
National price index										
IT equipment	1980-90	31.9	23.2	12.1	18.8	8.5	5.6	13.1	20.7	18.9
	1990-00	22.9	27.2	-7.6	15.4	10.1	4.2	8.1	12.7	27.5
	1990-95	21.3	19.6	-11.3	9.1	4.1	-2.4	5.5	11.9	22.5
	1995-00	24.5	34.8	-2.9	21.7	16.0	12.4	11.3	13.5	32.4
Communications equipment	1980-90	5.5	4.8	8.6	4.6	6.8	8.5	11.8	9.6	3.9
	1990-00	8.1	8.3	10.7	7.3	5.4	5.7	9.4	10.8	11.2
	1990-95	6.4	5.2	4.9	3.3	4.1	5.0	3.4	11.3	6.2
	1995-00	9.8	11.5	17.9	11.2	6.7	6.6	16.8	10.4	16.2
Software	1980-90	28.8	13.6	8.5	11.6	4.2	11.6	7.9	20.6	14.6
	1990-00	17.4	10.9	4.3	9.4	9.5	3.5	-0.3	4.6	14.1
	1990-95	13.8	8.1	1.2	4.7	8.7	1.6	0.2	7.2	11.6
	1995-00	20.9	13.7	8.1	14.0	10.3	5.8	-0.9	2.0	16.6
Harmonised price index										
IT equipment	1980-90	30.2	19.3	25.4	22.5	20.1	18.4	24.8	28.2	18.9
	1990-00	23.0	30.1	15.1	23.5	22.9	20.1	20.1	25.4	27.5
	1990-95	23.9	21.2	9.4	15.4	14.6	11.5	16.6	22.8	22.5
	1995-00	22.0	38.9	22.3	31.6	31.2	30.9	24.4	28.0	32.4
Communications equipment	1980-90	7.1	6.6	8.6	7.3	7.4	8.6	12.0	9.9	3.9
	1990-00	9.7	8.2	18.4	7.9	5.6	8.3	8.1	13.4	11.2
	1990-95	8.7	3.7	12.2	4.3	2.4	5.5	5.5	14.9	6.2
	1995-00	10.7	12.7	26.2	11.4	8.7	11.7	11.3	11.9	16.2
Software	1980-90	24.8	14.8	14.4	15.0	6.9	14.3	32.8	27.3	14.6
	1990-00	11.7	12.1	10.0	12.1	9.7	7.5	3.0	9.9	14.1
	1990-95	9.3	9.6	6.9	5.7	8.6	4.6	4.6	12.7	11.6
	1995-00	14.1	14.6	13.9	18.6	10.9	11.0	1.1	7.1	16.6

1. 1999 instead of 2000.

Source: Authors' calculations.

accelerated in the second part of the 1990s, with the exception of Japan. The rate of growth in IT equipment in the United States in the 1990s doubled with respect to the 1980s and accelerated in the 1995-00 period to reach 34 per cent per year on average. Similar rates of increase were registered in France for all three types of ICT assets. While communications equipment was the most dynamic component in Finland, it was hardware in Japan and software in Australia. Overall, the growth of investment in the 1990s was driven by growth in ICT investment in all nine countries. This is particularly evident in the case of the United States, Australia and Finland where ICT investment accounted for over 50 per cent of non-residential investment growth in the second half of the 1990s.

Volume growth in IT investment has been so significant because of a steady decline in its relative price, giving rise to substitution between different types of capital and between ICT capital and labour. The rapid price decline for computers and office equipment accelerated further in the late 1990s with respect to earlier years. This drop in prices has been much less pronounced for communications equipment and software. Software has nonetheless been a major driver of ICT investment growth in the late 1990, contributing 25-40 per cent of overall investment growth.

One likely reason for rapid software investment is its complementarity with IT capital goods. Consider a general-purpose technology such as the Internet that offers an infrastructure for new forms of business. Their development typically entails investment in communication infrastructure first, followed by investment in applications (software). The development of on-line activities, which often follows, generates demand for new technology infrastructure and applications. For instance, new multimedia applications require continuous improvements in circuit technology and software enabling the use of real-time media data-types such as video, speech, animation and music. Another, more short-lived reason for a steep rise in software investment towards the end of the 1990s was the anticipation of the "Y2K bug" even though it remains difficult to give even approximate indications about the size of this investment effect.

Contribution of ICT capital to output growth

Table 5 shows the contribution of ICT equipment and software to output growth in the business sector of the countries under review. In the first half of the 1990s, and based on the harmonised price index, this contribution ranged between 0.18 percentage point per year and 0.48 percentage point, depending on the country. Over the period 1995-2000, the contribution of IT and software jumped to a range from 0.33 to 0.86 percentage point. In relative terms, ICT capital accounted for between one-third and close to 100 per cent of the overall contribution of capital services to output growth. The contribution of ICT equipment to output growth was highest in the United States (0.86 percentage point on average over the years 1995-99), followed by Australia, Canada and Finland. As the first panel of Table 5 is based on national price indices for ICT, some of the differences in growth contributions may be due to methodological rather than actual discrepancies in price changes. The second panel therefore reproduces the results based on a harmonised price index. A comparison of the tables yields major differences in the ICT contribution to output growth for Finland (up by over 0.4 percentage point in the second half of the 1990s) and a more moderate increase in the measured contributions of Germany, Italy and the United Kingdom. This brings them in line with France and Japan where national IT deflators are based on

Table 5. **Contribution of ICT to output growth**
Percentage points, business sector

		Australia	Canada	Finland ¹	France	Germany	Italy ¹	Japan ¹	United Kingdom	United States
National price index										
<i>% change at annual rate</i>										
Output	1980-85	3.39	2.66	2.80	1.48	1.13	1.54	3.31	2.59	3.35
	1985-90	3.79	2.90	3.42	3.46	3.59	3.04	5.14	3.90	3.31
	1990-95	3.37	1.79	-0.70	0.97	2.22	1.44	1.33	2.12	2.64
	1995-99	4.72	4.09	5.62	2.60	1.73	1.93	1.10	3.48	4.43
	1995-00	4.62	4.20	..	2.81	2.06	..	..	3.55	4.40
<i>Contribution (% points) from:</i>										
IT and communications equipment	1980-85	0.22	0.28	0.14	0.11	0.09	0.11	0.08	0.10	0.36
	1985-90	0.35	0.27	0.18	0.15	0.13	0.13	0.16	0.20	0.32
	1990-95	0.31	0.21	0.00	0.11	0.16	0.10	0.14	0.13	0.29
	1995-99	0.57	0.36	0.11	0.19	0.14	0.12	0.29	0.25	0.61
	1995-00	0.56	0.38	..	0.19	0.15	..	..	0.25	0.62
Software	1980-85	0.05	0.04	0.04	0.03	0.01	0.02	0.00	0.01	0.07
	1985-90	0.16	0.09	0.08	0.05	0.03	0.06	0.02	0.03	0.11
	1990-95	0.16	0.08	0.01	0.02	0.06	0.01	0.00	0.02	0.14
	1995-99	0.21	0.11	0.09	0.08	0.07	0.04	0.00	0.03	0.25
	1995-00	0.23	0.12	..	0.08	0.07	..	..	0.02	0.25
Total ICT	1980-00	0.51	0.37	0.16	0.19	0.17	0.15	0.17	0.19	0.54
	1980-85	0.27	0.32	0.18	0.14	0.10	0.13	0.09	0.12	0.44
	1985-90	0.51	0.36	0.25	0.21	0.16	0.20	0.18	0.23	0.43
	1990-95	0.47	0.28	0.01	0.13	0.22	0.10	0.14	0.15	0.43
	1995-99	0.78	0.47	0.20	0.26	0.21	0.16	0.29	0.28	0.86
	1995-00	0.79	0.51	..	0.27	0.22	..	..	0.27	0.87
Total capital services	1980-85	1.63	1.45	0.68	0.69	0.58	0.72	1.01	0.70	1.25
	1985-90	1.97	1.25	0.83	0.91	0.80	0.86	1.38	1.10	1.10
	1990-95	1.35	0.72	0.03	0.73	0.99	0.62	1.33	0.74	0.97
	1995-99	1.74	1.04	0.15	0.75	0.81	0.82	0.97	1.05	1.69
	1995-00	1.73	1.09	..	0.78	0.83	..	..	1.04	1.71

hedonic models and differ much less from the harmonised set. However, the use of harmonised deflators does not close the apparent gap between ICT contributions in the United States and the large European countries.

In the 1995-2000 period, software capital accumulation accounted for about 20 to 30 per cent of the overall contribution of ICT capital to output growth. It is remarkable that this result holds across all OECD countries in the sample, with the exception of Japan and the United Kingdom. However, software expenditure data for Japan excludes own-account software and this may well explain the discrepancy. For the United Kingdom, Oulton (2001) suggested that the official data under-estimate software expenditure. Also, some researchers (Jorgenson and Stiroh, 2000) have observed that price indices of own-account software may not fully reflect quality improvements and in this sense, the contribution of software to economic growth as computed here may constitute a lower bound. More

Table 5. **Contribution of ICT to output growth** (*cont.*)

Percentage points, business sector

		Australia	Canada	Finland ¹	France	Germany	Italy ¹	Japan ¹	United Kingdom	United States
Harmonised price index										
% change at annual rate										
Output	1980-85	3.39	2.66	2.80	1.48	1.13	1.54	3.31	2.59	3.35
	1985-90	3.79	2.90	3.42	3.46	3.59	3.04	5.14	3.90	3.31
	1990-95	3.37	1.79	-0.70	0.97	2.22	1.44	1.33	2.12	2.64
	1995-99	4.72	4.09	5.62	2.60	1.73	1.93	1.10	3.48	4.43
	1995-00	4.62	4.20	..	2.81	2.06	..	..	3.55	4.40
Contribution (% points) from:										
IT and communications equipment	1980-85	0.24	0.25	0.21	0.13	0.18	0.21	0.16	0.16	0.36
	1985-90	0.34	0.24	0.30	0.17	0.23	0.23	0.23	0.25	0.32
	1990-95	0.37	0.21	0.17	0.16	0.24	0.18	0.25	0.23	0.29
	1995-99	0.53	0.39	0.46	0.23	0.28	0.29	0.36	0.42	0.61
	1995-00	0.53	0.43	..	0.25	0.30	..	..	0.43	0.62
Software	1980-85	0.05	0.04	0.07	0.05	0.03	0.02	0.02	0.02	0.07
	1985-90	0.12	0.09	0.12	0.05	0.04	0.08	0.07	0.04	0.11
	1990-95	0.12	0.09	0.07	0.02	0.06	0.02	0.06	0.04	0.14
	1995-99	0.13	0.12	0.16	0.10	0.07	0.07	0.02	0.05	0.25
	1995-00	0.15	0.13	..	0.10	0.07	..	..	0.04	0.25
Total ICT	1980-00	0.48	0.37	0.39	0.23	0.29	0.28	0.29	0.30	0.54
	1980-85	0.29	0.30	0.28	0.18	0.20	0.23	0.18	0.18	0.44
	1985-90	0.46	0.33	0.42	0.22	0.27	0.31	0.30	0.29	0.43
	1990-95	0.48	0.30	0.24	0.18	0.30	0.21	0.31	0.27	0.43
	1995-99	0.66	0.51	0.62	0.33	0.35	0.36	0.38	0.47	0.86
Total capital services	1995-00	0.68	0.57	..	0.35	0.38	..	..	0.48	0.87
	1980-85	1.66	1.43	0.77	0.72	0.69	0.82	1.10	0.76	1.25
	1985-90	1.93	1.23	1.00	0.92	0.91	0.97	1.50	1.15	1.10
	1990-95	1.37	0.74	0.26	0.78	1.08	0.73	1.49	0.85	0.97
	1995-99	1.63	1.08	0.57	0.82	0.95	1.01	1.07	1.23	1.69
	1995-00	1.63	1.15	..	0.87	0.98	..	..	1.25	1.71

1. 1999 instead of 2000.

Source: Authors' calculations.

generally, however, statistical methodologies to capitalise software are still under development, and a definite statement about upward or downward biases is difficult to make.

Our results are broadly consistent with those of other studies relating to individual countries, in particular Oliner and Sichel (2000), Jorgenson and Stiroh (2000) and Jorgenson (2001) for the United States, Cetto *et al.* (2000) for France, Niininen (1999) for Finland, Oulton (2001) for the United Kingdom, Schreyer (2000) for the G7, Daveri (2000) for 18 countries. Other studies for the United States use a different framework with somewhat different results like in Whelan (2000), or significantly different results as in Kiley (1999).⁷

CONCLUSIONS

This paper examines the contribution of ICT capital to economic growth in nine OECD countries. It does so by looking at investment trends in ICT equipment and software and at the role played by ICT in overall capital accumulation. Contributions to growth are quantified in a growth accounting framework. Because data issues loom heavily in the ICT area and even more so in international comparisons, measurement and statistical points are discussed at some length. Main findings are:

- Despite different positions in the business cycle, all nine countries underwent a marked increase in the rate of investment in ICT capital goods. IT equipment and software have been the most dynamic ICT components, and grew at two-digit real rates in nearly all nine countries. While ICT investment has been growing everywhere, cross-country differences persist. In the year 2000, and measured in nominal terms, ICT investment accounted for about one-third of total non-residential investment in the United States, and somewhat less in Finland, Canada and Australia.
- Concurrent with the rise in demand for IT investment, prices for IT capital goods have fallen in relative and absolute terms. This led to substitution effects towards IT capital goods and away from other factors of production. Software prices fell by less than IT equipment prices but this did not prevent rapid accumulation of software capital. One notable expression of substitution effects between different types of assets is the observed compositional change of capital services, towards capital goods with higher returns per period.
- In the first half of the 1990s, ICT contributed between about 0.2 and 0.5 percentage point per year to economic growth, depending on the country. During the second half of the 1990s, this contribution rose to 0.3 to 0.9 percentage point per year. Thus, the United States has not been alone in benefiting from the positive effects of ICT capital investment on economic growth and it has not been alone in experiencing an acceleration of these effects. However, effects have clearly been largest in the United States, followed only by Australia, Finland and Canada. Of the nine countries considered, Germany, Italy, France and Japan registered the lowest contribution of ICT to economic growth.

NOTES

1. More specifically, the formula employed for the hyperbolic function is $(T - t)/(T - \beta t)$ where T is the maximum service life, t is an index of time passing and the parameter β which shapes the form of the hyperbolic function, has been set to 0.8.
2. This is the most widely-used method based on an assumption of perfect foresight. It fits well with the general equilibrium assumption implied by growth accounting models and has the clear advantage of simplicity. However, it will be subject to measurement errors of gross operating surplus and it is an *ex post* measure that may not reflect the conditions facing producers at the beginning of the period. An alternative method is to choose an exogenous expected rate of return instead of an endogenous realised rate of return. It makes capital measures independent of measures of output and does not have to make the strong assumption that all observed price changes have been fully anticipated by economic actors. Such alternative models were studied by Harper, Berndt and Wood (1989), and more recently by Diewert (2001).
3. In the present study, the age-price profile, which forms the pattern of cross-section depreciation rates, is distinguished from the age-efficiency profile which reflects the productive efficiency of an asset over its service life. See OECD (2001b) for a discussion. Based on current practice in OECD countries, we chose the following average service lives: software (three years), IT equipment (seven years), communications equipment (15 years), transport equipment (15 years), other equipment (15 years), non-residential buildings (60 years) and other structures (20 years).
4. Data sources for current and constant-price investment are OECD *Annual National Accounts* for broad asset categories and national sources or specific communications from statistical offices for a more detailed breakdown, in particular regarding ICT assets. Own estimates were added, in particular for early years.
5. United States deflators for the three types of software fall at different rates because the deflator for own-account software is based on an input-price index. Jorgenson and Stiroh (2000) made adjustments for this discrepancy. No adjustments were made in the study at hand.
6. However, for many countries, the effects of such an adjustment are likely to be small (Schreyer, 2001; Lequiller, 2001).
7. Whelan (2000) analyses the growth contribution within a vintage model of production. Kiley (1999) uses an adjustment cost model and thereby obtains a negative short-term contribution of computers to growth. These results are extensively compared in Oliner and Sichel (2000).

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ESTIMATION OF THE CYCLICAL BEHAVIOUR OF MARK-UPS: A TECHNICAL NOTE

Joaquim Oliveira Martins and Stefano Scarpetta

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INTRODUCTION

The microeconomic literature provides several possible explanations for the existence of pure profits as a long-run equilibrium configuration. Differences in market power across manufacturing sectors must be due in part to differences in entry conditions into each industry. Traditionally, entry conditions and the resulting market structures have been related to technological conditions, such as economies of scale and scope. Another avenue is the existence of product differentiation. For example, under Chamberlinian monopolistic competition, limited market power can arise from the combination of returns to scale and horizontal product differentiation. More recent research has focused on so-called “vertical” product differentiation where firms are able to influence the perceived quality of their products. In industries where firms engage in such product differentiation, product strategies may be able to influence entry conditions in the market; this influence could generate endogenous sunk costs, *e.g.* large advertising or R&D expenditures (Sutton, 1991). These industries would simply not exist under a perfect competition regime.

Drawing from these microeconomic considerations and following the seminal paper by Bob Hall (1986), there has been a growing interest in the macroeconomic literature on the identification of imperfect competition at the sectoral level by estimating the mark-ups of prices over marginal costs (Hall, 1988; Bils, 1987; Shapiro, 1987; Domowitz, Hubbard and Petersen, 1988; Caballero and Lyons, 1990; Domowitz, 1992; Haskel, Martin and Small, 1995; Roeger, 1995; Beccarelli, 1996; Basu and Fernald, 1995 and 1997; Basu, 1995 and 1999).

Together with the estimation of the levels of mark-ups, some of these studies also focus on the behaviour of price-cost margins over the business cycle. However, the theoretical literature does not offer a clear-cut answer as to whether price margins should be pro- or counter-cyclical. This is likely to depend on the specific product market conditions under which each firm operates. For instance, under a regime of monopolistic competition, firms may find it efficient to set counter-cyclical mark-ups. Profit maximisation conditions imply that the mark-up is an inverse function of the elasticity of demand. The latter is likely to be pro-cyclical if, for example, product variety is also pro-cyclical (Weitzman, 1982). Likewise, if entry is possible, increases in demand would induce an increase in the number of firms, thereby raising the degree of competition in the market and lowering price margins (Chatterjee,

Cooper and Ravikumar, 1993). A similar outcome would also emerge if firms find it optimal to develop their customer base in periods of up-turns, as suggested by Bills (1987) and by Phelps in his “customer market” model (Phelps, 1994). Certain collusion models also hint at counter-cyclical mark-ups. For example, if firms defecting from a cartel are able to expand their market shares in booms, then the gains from defection may outpace the long-term losses from retaliation by other firms (Rotemberg and Saloner, 1986; Chevalier and Scharfstein, 1996). In contrast, if firms operate in oligopolistic markets with homogeneous goods, the behaviour of each firm depends upon the conjectured responses of all other competitors.¹ Under these conditions, the cyclicity of mark-ups depends on specific market characteristics, such as the existence of capacity constraints. If firms operate under full capacity and, thus, are not able to raise their output in response to a competitor (*i.e.* Cournot competition), then mark-ups are likely to be pro-cyclical because capacity constraints are also pro-cyclical.

Assessing whether the mark-up is pro- or counter-cyclical has important implications for different theories of the business cycle. For example, a counter-cyclical mark-up offers an appealing explanation for the observed pro-cyclicality of real wages (see Rotemberg and Woodford, 1991; Chatterjee *et al.*, 1993; Chevalier and Scharfstein, 1996). In addition, to the extent to which the impact of macroeconomic policies on output and prices depends on the level and cyclicity of mark-ups, identifying mark-up behaviour is important for the design of macroeconomic policies (see for example Silvestre, 1993; Aziz and Leruth, 1997).

Along these lines, in this paper we estimate the cyclical behaviour of mark-up pricing over the business cycle for 36 manufacturing industries in the G5 countries, following an extended version of the Rotemberg and Woodford (1991) approach. The paper relies on OECD estimates (Oliveira Martins, Scarpetta and Pilat, 1996a)² of the steady-state mark-up that, in comparison with previous studies, are more in line with microeconomic evidence. Indeed, the estimates based on Hall (1986)'s methodology often lead to an upward bias in price margins and are also likely to lead to a biased and/or inconclusive test as regards cyclicity. For example, firms may react differently to changes in demand when their margins are very high than when they are positive but small.³ Because the level of the mark-up plays a role for its cyclical behaviour, we believe that our benchmark estimates offer a more solid ground to assess pricing behaviour of firms over the business cycle. In any event, we also assess the sensitivity of the cyclicity of mark-ups to different assumptions concerning the degree of downward rigidity and the elasticity of substitution between factors of production.

The plan of the paper is as follows. In the next section an expression for the cyclical mark-up is derived, which is then used to estimate the fluctuations of cost-price margins across countries and sectors. We then discuss the empirical results and their sensitivity to different parameters' values. The fourth section assesses

the impact of the cyclical behaviour of mark-ups on the cyclicity of real wages. The final section provides some concluding remarks.

THE ESTIMATION OF THE TIME-VARYING MARK-UP

In this paper we follow the approach put forward by Rotemberg and Woodford (1991) to estimate the cyclicity of the mark-up.⁴ The starting point is the specification of the production function. In order to be coherent with the estimates of the benchmark steady-state mark-up (provided in Oliveira Martins *et al.*, 1996b), we had to use a slightly more complicated specification than in Rotemberg and Woodford (1991). More precisely, we define a production function with three production factors (labour, capital and intermediate inputs) and Hicks-neutral technical progress.⁵ In order to keep this specification under a tractable form, without imposing strong separability across production inputs, we assume a two-level production function: capital and labour are nested in a value-added function (G), which is then combined with intermediate inputs using a Leontief specification.⁶ Under these assumptions the production function can be written as follows:

$$Q = \Theta \cdot F[G(K, L - \bar{L}), M] \quad (1)$$

where Q, L, K and M are real output, labour, capital and intermediate inputs; Θ is the state of technology at time t . We also assume the possibility of downward rigidities in the adjustment of labour inputs that are captured by the amount of fixed labour input, $\bar{L}$. For a profit-maximising firm under imperfect competition, the mark-up of prices over marginal costs (μ) is equal to:

$$\mu_t = \frac{\Theta_t \cdot F_L[G(K_t, L_t - \bar{L}), M]}{W_t/P_t} \quad (2)$$

where P and W are the output price and wages, respectively. F_L is the partial derivative of F with respect to L (or the marginal productivity of labour). By taking a log-linear approximation of equation (2) around a steady-state growth path and doing some algebraic transformations, a relation for the time-varying mark-up can be derived as follows (details are given in the annex):

$$\begin{aligned} \Delta \log \mu = & (\Delta q + \Delta p) - \Delta w - [(\Delta p_G + \Delta g) - (\Delta p_M + \Delta m)] \cdot \bar{\mu} \cdot s_M + \\ & + \left(\frac{1}{\sigma_G} \cdot \frac{s_K}{s_L + s_K} - \mu \cdot s_K \right) \cdot \Delta k + \left(\frac{1}{\sigma_G} \cdot \frac{s_K}{s_L + s_K} \cdot \frac{L}{L - \bar{L}} + \bar{\mu} \cdot s_L \right) \cdot \Delta l - \bar{\mu} \cdot s_M \cdot \Delta m \end{aligned} \quad (3)$$

where time indices are omitted and lower case letters denote natural logs and Δ stands for first-differences; p_G and p_M are the prices of value-added and

intermediate inputs, respectively; $\bar{\mu}$ is the steady-state mark-up. The coefficients s_L , s_K and s_M are the shares of labour, capital and intermediate inputs in gross output, and σ_G is the elasticity of substitution between capital and labour in the value-added function. The ratio $L/(L - \bar{L})$ in equation (3) can be interpreted as an indicator of the degree of downward rigidities in labour adjustment. It varies from one (no rigidity) to infinity (complete rigidity). Despite its apparent complexity, equation (3) is actually not very demanding in terms of data. Notably, it does not require a price deflator for gross output as the latter only appears in nominal terms. Moreover, under the Leontief specification, the growth rate of the volume of intermediate inputs can be proxied by the growth rate of value added at constant prices. The input shares are directly observable, except the share of capital in gross output s_K , which can be easily derived, consistently with our assumptions, from the Euler equation:

$$\bar{\mu} \cdot s_L \cdot \frac{L - \bar{L}}{\bar{L}} + \bar{\mu} \cdot s_K + \bar{\mu} \cdot s_M = 1 \quad (4)$$

In our baseline case, we assume the absence of downward rigidities (i.e., $\bar{L} = 0$) and a Cobb-Douglas function combining capital and labour (i.e. $\sigma_G = 1$). A sensitivity analysis, provided below, tests for the robustness of the results to changes in these baseline assumptions.

EMPIRICAL RESULTS

The results are presented in Table 1.⁷ For each country, the first column displays the level of the mark-up by sector (derived from previous OECD estimates). The second column shows the correlation between the logarithmic deviation of the mark-up from its steady-state value and a sectoral cyclical variable. The empirical literature has used different proxies for capturing the cyclical variation of product demand at either the aggregate or the sectoral level. For example, Haskel *et al.* (1995) used aggregate unemployment and capacity utilisation, while Bils (1987) used sectoral employment. In this paper we use deviations of industry output from its long-term trend. The trend output was obtained through a smoothing of the observed output, based on the Hodrick-Prescott filter.⁸

A first observation is that most of the statistically significant correlations imply a counter-cyclical behaviour of mark-ups. This is in line with evidence from other papers (*e.g.* Rotemberg and Woodford, 1991; Bils, 1987; Galeotti and Schiantarelli, 1998; Linnemann, 1999). As an aside, the cross-country comparison of the sectoral mark-ups supports the view that persistent profit margins exist in many manufacturing sectors. This may be due to the presence of entry barriers,

Table 1. Mark-ups in the G5 countries: levels and correlation with the cycle, 1970-92

ISIC sectors	France		Germany		Japan		United Kingdom		United States	
	μ^1	Cycl. ²	μ^1	Cycl. ²	μ^1	Cycl. ²	μ^1	Cycl. ²	μ^1	Cycl. ²
Food products	1.11		1.12	-0.56	1.32		1.20	-0.38	1.05	
Textiles	1.10		1.15	-0.44	1.19	-0.44	1.03		1.08	
Wearing apparel	1.15		1.11	-0.58	..	..	1.03		1.10	-0.51
Leather products	1.11		1.18	-0.54	..	..	1.06		1.08	-0.43
Footwear	1.13		..	..	..	..	1.04		1.08	
Wood products	1.15		1.20		..	..	1.18		1.22	0.54
Furniture	1.21		1.15	-0.38	1.25		1.19		1.06	-0.54
Printing and publishing	1.24	-0.48	1.09	-0.48	1.10		1.09	-0.43	1.19	-0.53
Plastic products	..	..	..	..	1.15	-0.49	..	..	1.07	-0.55
Non-metal products	1.24		1.26		1.26		1.15		1.18	
Metal products	1.18	0.40	1.20	-0.64	1.11	0.41	1.03		1.09	-0.41
Chemical products	1.19		1.24		1.26	-0.79	1.08	-0.59	1.26	-0.71
Machinery and equipment	1.12		1.06	-0.59	1.09		..	..	1.06	..
Motorcycles and bicycles	..		..	..	..	..	..	..	1.13	-0.41
Professional goods	..		1.67	-0.42	1.22		1.16		1.09	-0.51
Other manufacturing	..		1.30	-0.49	1.38		..	..	1.08	-0.44
Beverages	1.68		1.33		1.26		1.54	-0.48	..	..
Tobacco	3.12		1.52	-0.51	..	..	1.56	-0.45	1.56	-0.58
Paper and pulp	1.13		1.29		1.20		1.05		1.13	
Petroleum refineries	1.19	-0.43	..	..	1.04	-0.52	1.07	-0.51	1.03	-0.64
Petroleum and coal products	..	..	1.09		1.10	-0.49	1.06	-0.54	1.11	-0.45
Rubber products	1.20	-0.53	..	..	1.15	-0.53	..	..	..	..
Pottery and China	1.29	-0.41	..	..	1.22	-0.42	..	..	1.09	-0.36
Glass	1.22		1.23	-0.52	1.41		1.06		1.17	-0.66
Iron and steel	1.16	-0.43	1.14		1.19		..	..	1.10	
Non-ferrous metals	1.26	-0.51	..	..	1.26		1.05		1.14	
Shipbuilding and repair	..	..	..	..	1.27		..	..	..	..
Other transport equipment	..	..	..	..	..		..	..	..	..
Industrial chemicals	1.21	-0.45	..	..	1.23	-0.60	1.06	-0.51	1.18	
Drugs and medicines	1.04	-0.52	1.45		1.54	-0.77	1.16	-0.54	1.44	-0.65
Office and computing machinery	1.17		1.58	-0.59	1.24		1.47	-0.47	1.54	-0.41
Radio and TV	1.11	-0.54	1.34	-0.67	1.13		1.25	-0.60	1.40	
Electrical apparatus	1.25	-0.48	..	..	1.05		..	..	..	..
Railroad equipment	1.69		..	..	..	..	..	..	..	..
Motor vehicles	1.13	-0.45	1.15		1.17	-0.45	..	..	1.09	-0.42
Aircraft	1.21		..	..	..	..	..	..	..	..

1. The steady-state mark-ups are based on gross output and derived from Oliveira Martins *et al.* (1996b).

2. The correlation between the time-varying mark-up (equation 3 in the text) and the business cycle is estimated under the assumption of no downward labour rigidity and a Cobb-Douglas value added ($\sigma_G = 1$, see text). Only statistically significant mark-ups and correlation coefficients are reported.

Source: OECD-STAN database and authors' calculations.

probably due to sunk costs, that are not eroded by competitive pressures even in the long run.

Another interesting observation emerges from the cross-country comparison of results. While mark-ups are overwhelmingly negatively correlated with the sectoral business cycle, their correlation tends to be stronger in the United States than in the other G5 countries. This fact, taken together with the generally lower level of mark-ups in the US manufacturing sector, lends support to one of the possible interpretation for counter-cyclical mark-ups: the higher degree of competition in the market, driven by *e.g.* higher entry rates, put downward pressure on price margins of incumbent firms.

We test the results obtained in our baseline case against alternative assumptions concerning the elasticity of substitution and the degree of downward rigidities in labour adjustment. In order to simplify the presentation, we only report the estimates for US manufacturing industries but the results for other countries are available upon request. We consider the alternative values of 0.5 and 2 for the elasticity of substitution between capital and labour and the results show that the observed counter-cyclical of the mark-up is robust with respect to the value of the elasticity of substitution (Table 2). Concerning the degree of downward rigidities, we test for the cases where the fixed amount of labour represents respectively 20 and 40 per cent of total labour input. In line with intuition, more downward rigidity of labour generally increases the negative correlation between mark-up variations and the indicator of the cycle.

IMPLICATIONS OF THE RESULTS FOR THE CYCLICALITY OF REAL WAGES

As pointed out in the introduction, the existence of counter-cyclical mark-ups can provide an appealing interpretation for the observed pro-cyclical of real wages at the sectoral level. To assess the existence of this link, we compute real product wages for US manufacturing industries using two different price deflators: the observed output price index in a given industry and the output price net of the effects related to the varying mark-up. The variation in the latter deflator (*i.e.* $\Delta p - \Delta \text{Log} \mu$), by definition, should be equal to the variation in marginal costs. We then compute two different series for sectoral real wages in the US economy and calculate the correlation between real wages and the business cycle in each case (Table 3). If the cyclical of real wages is mainly due to variations in mark-ups, then controlling for the effect of the mark-up should, in principle, remove most of the cyclical component in real wages.

As expected, real wages calculated with the usual price deflator are generally pro-cyclical (Table 3). Only in one sector (wood products) is there a significant negative correlation between real wages and the cycle. But, when real wages net of

Table 2. Cyclicity of the mark-up: sensitivity analysis for the US manufacturing industries¹

ISIC sectors	Elasticity of substitution (K, L) $\sigma = 1$			Elasticity of substitution (K, L) $\sigma = 0.5$			Elasticity of substitution (K, L) $\sigma = 2$		
	Share of fixed labour			Share of fixed labour			Share of fixed labour		
	No rigidity	20%	40%	No rigidity	20%	40%	No rigidity	20%	40%
Food products	-0.31	-0.31	-0.30	-0.32	-0.30	-0.29	-0.30	-0.30	-0.30
Textiles	-0.29	-0.38*	-0.43**	-0.34	-0.41*	-0.41**	-0.43**	-0.32	-0.39*
Wearing apparel	-0.51***	-0.56***	-0.60***	-0.54***	-0.58***	-0.60***	-0.60***	-0.53***	-0.57***
Leather products	-0.43**	-0.52***	-0.61***	-0.47**	-0.61***	-0.66***	-0.61***	-0.46**	-0.51***
Footwear	-0.32	-0.37*	-0.41*	-0.33	-0.36*	-0.35	-0.41*	-0.36*	-0.41*
Wood products	0.54***	0.44**	0.20	0.42**	0.07	-0.35	0.20	0.54***	0.48**
Furniture	-0.54***	-0.59***	-0.59***	-0.57***	-0.56***	-0.52***	-0.59***	-0.57***	-0.61***
Printing and publishing	-0.53***	-0.56***	-0.60***	-0.54***	-0.57***	-0.57***	-0.60***	-0.55***	-0.58***
Plastic products	-0.55***	-0.63***	-0.67***	-0.58***	-0.63***	-0.56***	-0.67***	-0.58***	-0.64***
Non-metal products	-0.28	-0.43**	-0.59***	-0.30	-0.53***	-0.65***	-0.59***	-0.35*	-0.46**
Metal products	-0.41**	-0.48**	-0.51***	-0.46**	-0.50**	-0.50***	-0.51***	-0.43**	-0.48**
Chemical products	-0.71***	-0.69***	-0.65***	-0.65***	-0.60***	-0.52***	-0.65***	-0.72***	-0.71***
Machinery and equipment	-0.20	-0.33	-0.46**	-0.26	-0.44**	-0.56***	-0.46**	-0.25	-0.34
Motorcycles and bicycles	-0.41*	-0.47**	-0.55***	-0.43**	-0.54***	-0.64***	-0.55***	-0.43**	-0.47**
Professional goods	-0.51***	-0.55***	-0.59***	-0.53***	-0.58***	-0.59***	-0.59***	-0.52***	-0.56***
Other manufacturing	-0.44**	-0.50***	-0.57***	-0.51***	-0.57***	-0.63***	-0.57***	-0.44**	-0.49**
Beverages	..	..	..	..	..	..	..	..	..
Tobacco	-0.58***	-0.59***	-0.59***	-0.54***	-0.53***	-0.52***	-0.59***	-0.61***	-0.61***
Paper and pulp	0.06	-0.03	-0.16	-0.04	-0.20	-0.34	-0.16	0.07	0.00
Petroleum refineries	-0.64***	-0.64***	-0.63***	-0.63***	-0.61***	-0.55***	-0.63***	-0.64***	-0.64***
Petroleum and coal products	-0.45**	-0.48**	-0.51***	-0.49**	-0.52***	-0.51**	-0.51***	-0.43**	-0.46**
Rubber products	..	..	..	..	..	..	..	..	..
Pottery and China	-0.36*	-0.53***	-0.64***	-0.30	-0.58***	-0.62***	-0.64***	-0.48**	-0.57***
Glass	-0.66***	-0.70***	-0.72***	-0.66***	-0.72***	-0.69***	-0.72***	-0.68***	-0.70***
Iron and steel	0.19	0.03	-0.18	0.15	-0.16	-0.48**	-0.18	0.13	0.02
Non-ferrous metals	0.12	0.04	-0.09	0.00	-0.17	-0.40*	-0.09	0.13	0.08
Shipbuilding and repair	..	..	..	..	..	..	..	..	..
Other transport equipment	..	..	..	..	..	..	..	..	..
Industrial chemicals	-0.04	-0.09	-0.16	-0.11	-0.20	-0.32	-0.16	-0.03	-0.07
Drugs and medicines	-0.65***	-0.64***	-0.63***	-0.60***	-0.57***	-0.53***	-0.63***	-0.68***	-0.67***
Office and computing machinery	-0.41*	-0.48**	-0.56***	-0.46**	-0.56***	-0.61***	-0.56***	-0.41**	-0.47**

Table 2. **Cyclicalities of the mark-up: sensitivity analysis for the US manufacturing industries¹ (cont.)**

ISIC sectors	Elasticity of substitution (K, L) $\sigma = 1$			Elasticity of substitution (K, L) $\sigma = 0.5$			Elasticity of substitution (K, L) $\sigma = 2$		
	Share of fixed labour			Share of fixed labour			Share of fixed labour		
	No rigidity	20%	40%	No rigidity	20%	40%	No rigidity	20%	40%
Radio and TV	-0.20	-0.10	0.07	0.09	0.23	0.26	0.07	-0.28	-0.22
Electrical apparatus	..	..	..	..	..	..	..	..	..
Railroad equipment	..	..	..	..	..	..	..	..	..
Motor vehicles	-0.42**	-0.53***	-0.62***	-0.44**	-0.59***	-0.63***	-0.62***	-0.46**	-0.53***
Aircraft	..	..	..	..	..	..	..	..	..

1. For the period 1970-92. The variable mark-ups are based on equation 3 in the text. The columns display the correlation between the variable mark-up and the cycle. Correlation coefficients were calculated only for those sectors for which the estimates of the steady-state mark-ups were available.

* Statistically significant at the 10 per cent level.

** At the 5 per cent level.

*** At the 1 per cent level.

Source: Authors' calculations.

Table 3. **Mark-ups and the pro-cyclicality of real wages, US manufacturing industries¹**

ISIC sectors	Correlation between real product wages and the cycle ¹	
	Wages deflated by sectoral output prices	Wages deflated by sectoral output prices adjusted for mark-ups
Food products	0.29	-0.01
Textiles	0.19	-0.04
Wearing apparel	0.50**	0.09
Leather products	0.44**	0.27
Footwear	0.37*	0.27
Wood products	-0.59***	-0.47**
Furniture	0.43**	-0.18
Printing and publishing	0.53***	0.13
Plastic products	0.43**	0.05
Non-metal products	0.28	0.05
Metal products	0.27	-0.05
Chemical products	0.62***	-0.06
Machinery and equipment	0.06	-0.45**
Motorcycles and bicycles	0.34	-0.05
Professional goods	0.49**	0.22
Other manufacturing	0.46**	0.24
Beverages	..	..
Tobacco	0.49**	-0.07
Paper and pulp	-0.19	-0.38*
Petroleum refineries	0.64***	0.31
Petroleum and coal products	0.32	-0.19
Rubber products	..	..
Pottery and China	0.31	0.17
Glass	0.59***	-0.23
Iron and steel	-0.08	0.26
Non-ferrous metals	-0.07	0.11
Shipbuilding and repair	..	..
Other transport equipment	..	..
Industrial chemicals	0.08	0.10
Drugs and medicines	0.63***	0.03
Office and computing machinery	0.33	-0.03
Radio and TV	0.53***	0.57***
Electrical apparatus	..	..
Railroad equipment	..	..
Motor vehicles	0.43**	0.04
Aircraft	..	..

1. For the period 1970-92.

* Statistically significant at the 10 per cent level.

** At the 5 per cent level.

*** At the 1 per cent level.

Source: Authors' calculations.

the effect of mark-up variations are computed, most of the pro-cyclical behaviour of real wages vanishes, except in one sector (radio and TV). This suggests that the main cause for pro-cyclical real product wages could indeed be the presence of counter-cyclical mark-ups. With the usual caveats related to the imperfection of data and estimating assumptions, our results add to an already large body of literature offering an interesting explanation for a long-standing puzzle of business cycles.

CONCLUSIONS

In this paper, we provide estimates of the cyclical behaviour of price margins across manufacturing industries. The results strongly support the hypothesis of counter-cyclical variations in price margins in most manufacturing industries in the United States and, to a lesser extent, in other G5 countries. This is consistent with a growing body of literature showing that economic booms tend to increase competition or decrease the incentives for collusion, thereby creating downward pressures on price margins. We also show that the assumption concerning the degree of downward rigidities in labour adjustment tend to reinforce the estimated counter-cyclicalities of the mark-up. The finding of counter-cyclical mark-ups by sector offers an appealing and plausible explanation for the observed pro-cyclicalities of real wages. Indeed, the latter seems to vanish once the price deflator used to compute real wages is corrected for cyclical variations in price margins. Overall, further research is needed in order to better understand the relationship between industry price behaviour and market characteristics; a research that calls for a higher level of integration between macroeconomic and industrial organisation theories.

NOTES

1. It can be demonstrated that, in this case, the profit-maximising mark-up level of a firm is a function of the degree of concentration in the market and the firm's conjecture of the output responses of other firms to a change in its output.
2. See Oliveira Martins, Scarpetta and Pilat (1996b) for a detailed presentation and results of the estimation of the mark-up ratio for 36 manufacturing industries and 14 OECD countries. This Working Paper can be downloaded from www.oecd.org/eco
3. See for example, the comments of Valérie Ramey on the analysis of the cyclical behaviour of mark-ups presented in Rotemberg and Woodford (1991).
4. This approach provides a second-order approximation of the production function and therefore seems more reliable than the usual methods that rely on a first-order Taylor approximation. Indeed, since the time variation of the mark-up is a second-order effect it also requires a full second-order approximation of the production function (see also Morrison, 1992).
5. Rotemberg and Woodford (1991) defined a production function with capital, labour only and a labour-augmenting technology.
6. This assumption is usual in the literature and does not seem overly stringent. Using a generalisation of the Rotemberg and Woodford's approach, Linnemann (1999) provided numerical simulations suggesting that the type of cyclical behaviour of the mark-up is relatively robust to different values of the elasticity of substitution between value added and intermediate inputs.
7. The version of the OECD STAN data base used in this study (OECD, 1996) covers 21 OECD Member countries and 36 manufacturing sectors (at the 3-4 ISIC digit-level) for the period 1970-1994. STAN provides data on the following variables: production, value added in current and constant prices, gross fixed capital formation, employment (number of persons engaged), labour compensation, exports and imports. Capital stocks were estimated by the OECD Directorate for Science, Industry and Technology and are available upon request.
8. Since we use annual data, the weighting factor for the filter is set at 100.

Annex

MATHEMATICAL DERIVATIONS

The derivation of the mark-up variations proceeds as follows. Recalling that under imperfect competition the mark-up of prices over marginal costs is:

$$\mu_t = \frac{\Theta_t \cdot F_L [G(K_t, L_t - \bar{L}), M]}{W_t/P_t} = \frac{\Theta_t \cdot F_G \cdot G_L}{W_t/P_t} \quad (A1)$$

assuming that W_t and Θ_t have the same trend growth rates, taking the total differential, dividing by $(\mu \cdot W/P)$ and simplifying (time indices are omitted):

$$\Delta \log \mu = \theta - (\Delta w - \Delta p) + \frac{1}{F_G} \cdot (F_{GG} dG + F_{GM} dM) + \frac{1}{F_G} (G_{LL} dL + G_{LK} dK) \quad (A2)$$

where lower case letters denote natural logs and Δ stands for the first-difference; θ is the rate of Hicks-neutral technical progress (*i.e.* $\theta_t = \Delta \log \Theta_t$).

By using the following relations:

- At the first-level the elasticity of substitution between capital and labour can be written as $\sigma_G = G_L \cdot G_K / G_{KL} \cdot G$; and the elasticity between value-added and intermediate inputs as $\sigma = F_G \cdot F_M / F_{GM} \cdot F$.
- Using the separability properties and by differentiating the Euler equation of F and G , with respect to G and L , respectively, yields: $F_{GG} = -F_{GM} \cdot M/G$ and $G_{LL} = -G_{LK} \cdot K/(L - \bar{L})$.
- From the first-order conditions: $\frac{F_M \cdot M}{F} = \bar{\mu} \cdot s_M$ and $\frac{G_K \cdot K}{G} = \frac{s_K}{s_L + s_K}$.

The above equation (A2) can be transformed into the following expression:

$$\begin{aligned} \Delta \log \mu = \theta - (\Delta w - \Delta p) - \frac{1}{\sigma} \cdot \bar{\mu} \cdot s_M \cdot \Delta g + \frac{1}{\sigma} \cdot \bar{\mu} \cdot s_M \cdot \Delta m \\ - \frac{1}{\sigma_G} \cdot \frac{s_K}{s_L + s_K} \cdot \frac{L}{L - \bar{L}} \cdot \Delta l + \frac{1}{\sigma_G} \cdot \frac{s_K}{s_L + s_K} \cdot \Delta k \end{aligned} \quad (A3)$$

Finally, the unobservable productivity term θ can be derived by totally differentiating the production function (equation 1 in the text) and recalling that $\frac{F_K \cdot K}{Q} = \frac{\bar{\mu} \cdot s_K}{\theta}$; $\frac{F_L \cdot L}{Q} = \frac{\bar{\mu} \cdot s_L}{\theta}$; and $\frac{F_M \cdot M}{Q} = \frac{\bar{\mu} \cdot s_M}{\theta}$ which yields:

$$\Delta q = \theta + \bar{\mu} \cdot s_K \cdot \Delta \hat{k} + \bar{\mu} \cdot s_L \cdot \Delta l + \bar{\mu} \cdot s_M \cdot \Delta m \quad (A4)$$

By subtracting (A4) from (A3) and re-arranging one gets:

$$\begin{aligned} \Delta \log \mu = (\Delta q + \Delta p) - \Delta w - \frac{1}{\sigma} \cdot \bar{\mu} \cdot s_M \cdot (\Delta m - \Delta g) + \left(\frac{1}{\sigma_G} \cdot \frac{s_K}{s_L + s_K} - \mu \cdot s_K \right) \cdot \Delta \hat{k} \\ + \left(\frac{1}{\sigma_G} \cdot \frac{s_K}{s_L + s_K} \cdot \frac{L}{L - \bar{L}} + \bar{\mu} \cdot s_L \right) \cdot \Delta l - \bar{\mu} \cdot s_M \cdot \Delta m \end{aligned} \quad (A5)$$

It is noteworthy that the above equation does not require the volume of gross output, but only its growth rate in nominal terms. This advantage overcomes the lack output prices for a number of sectors/countries. However, the equation still requires the volume for both value added and intermediate inputs. While the former is usually provided in industrial statistics, the latter was not available in the database used in this study. In order to solve this data constraint, an additional assumption was required. We considered here the special case of a Leontief function between value added and intermediate inputs. In that case, under cost minimisation, the volume of intermediate inputs can be identified with the volume of value added, *i.e.* $\Delta m = \Delta g$. This simplifying assumption does not seem an excessively stringent one. Nonetheless, an additional problem arises. By inspecting equation (A5), it can be readily seen that if $\sigma = 0$ (the Leontief specification), the term:

$$\frac{1}{\sigma} \cdot \bar{\mu} \cdot s_M \cdot (\Delta m - \Delta g) \approx \frac{0}{0} \quad (A6)$$

is not determined. In order to solve this problem, let us consider the definition of the two-factor elasticity of substitution $\sigma = (\Delta g - \Delta m) / (\Delta p_M - \Delta p_G)$. By replacing this expression into (A6) and noting that under the Leontief assumption $\Delta p_G - \Delta p_M = (\Delta p_G + \Delta g) - (\Delta p_M + \Delta m)$, the undetermined term above can be identified as:

$$\frac{1}{\sigma} \cdot \bar{\mu} \cdot s_M \cdot (\Delta m - \Delta g) = [(\Delta p_G + \Delta g) - (\Delta p_M + \Delta m)] \cdot \bar{\mu} \cdot s_M \quad (A7)$$

Using this result and substituting it into equation (A5), one finally obtains equation (3) in the main text.

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