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EDUCATION AND ECONOMIC PERFORMANCE IN THE OECD COUNTRIES: AN ELUSIVE RELATIONSHIP?

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"The likelihood of a relationship between education and economic growth is now widely accepted and a number of studies have been made on the subject. There is, however, no general agreement on the precise nature of the relationship and the temptation to add to the dogmatic generalisations already made about it should be avoided. Indeed, the truth is that there is not even agreement among economists as to the most appropriate analytical and classificatory methods that might be used in examining the relationship between education and economic growth" (OECD 1966, p. 369).

1. INTRODUCTION

One of the most common political mantras to-day is that education is the handmaiden of economic growth and prosperity. Politicians like Bill Clinton and Tony Blair constantly trumpet the need to invest in education and training of the work force, and improve the quality of that investment, in order to compete effectively in to-day's increasingly globalised and knowledge-intensive world economy. Population ageing which is set to hit many OECD and non-OECD economies over the next few decades will also increase the pressure on individuals and firms to invest more in upgrading their skills and competences in order to maintain productivity growth and living standards in the future. Thus, investment in education and training, so-called "human capital accumulation", is once again the political flavour of the month.

Faced with this conventional wisdom, it is instructive to remind ourselves that this is not a new issue. In the 1960s and early 1970s, there was intense interest in measuring the contribution of education to economic growth and in developing effective methods of educational planning for economic development. The OECD

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was an active participant in this debate. In 1960, it established a Study Group in the Economics of Education under the chairmanship of Henning Friis, Director of the Danish National Institute of Social Research[1]. The Study Group was extremely active for a number of years, especially in terms of seeking to quantify the contribution of education to economic growth. Much of its work focused around the concept of the so-called "residual factor" à la Edward Denison, and in 1964 it published a major study entitled *The Residual Factor and Economic Growth* – see OECD (1964). However, as the quotation at the beginning of my paper indicates, the consensus view which emerged from all this work on the links between education and economic performance is that it was an elusive relationship.

At the same time, the OECD also launched an Educational Investment and Planning Programme designed to provide a framework of mutual assistance among Member countries as they sought to develop educational planning. The programme was effectively launched in October 1962 by the decision of the Irish Government to appoint a team to prepare the first country report[2]. The report, which was completed in 1965 and published by the OECD in 1966 under the title *Investment in Education: Ireland*, had a major influence on educational policy not only in Ireland but also in many other OECD countries which replicated the Irish example by producing similar reports[3].

But the bubble quickly burst. It soon became apparent that the extravagant claims made on behalf of investment in education in terms of its ability to spur economic growth, reduce poverty and deliver a more equal society, could not deliver the goods. After 1973, when the productivity slowdown in OECD countries became apparent and the simultaneous combination of inflation and rising unemployment dealt a severe blow to the Keynesian consensus, interest waned in the economics of education and in the type of quantitative educational planning exemplified in the *Investment in Education* report.

Ideas in economics, however, go round in a circle: if you standstill long enough, they come round again! So it is with the economics of education and the issue of the contribution of education and training to economic performance. The renewed political and academic interest in these topics owes much to the recent development of so-called "new growth" or "endogenous growth" theories which assign a prominent role to knowledge and investment in education and training, research and development and innovation as key determinants of long-run productivity growth.

The OECD has, not surprisingly, responded actively to this revival of interest in the economics of education. It has invested heavily in an on-going work programme to develop a comprehensive and up-to-date set of indicators of human capital investment and stocks that can validly be compared across countries[4]. It has recently published an initial set of such indicators in OECD (1998a). In addition, it has also undertaken work recently to quantify the impact of education on economic performance in OECD countries over the past few decades.

The purpose of this paper is to summarise some of this recent OECD research. There are four parts to the paper. First, I will present a brief review of productivity trends in the OECD area since 1960, highlighting the degree of convergence in performance that occurred over the period. Second, I will highlight a selection of the OECD education indicators, paying particular attention to how Ireland performs compared with the other countries. Third, I will summarize some recent cross-country research undertaken by colleagues in the OECD Secretariat which seeks to throw light on the links between education and economic performance. Finally, I will outline some considerations for policy in OECD countries.

2. TRENDS IN OECD PRODUCTIVITY PERFORMANCE

Table 1 shows trend growth rates in business-sector total factor productivity (TFP), labour and capital productivity over the period 1960-96[5]. The main trend that emerges from the table is the post-1973 productivity slow-down which is common to almost all countries. There is some evidence of a further deceleration in TFP performance in the 1990s relative to the 1980s. Only a few countries such as Australia, Denmark, Italy, New Zealand, Norway, Portugal and Sweden recorded higher TFP growth rates in the 1990s compared with the 1980s; most including Ireland recorded similar or slower TFP growth rates in the 1990s. However, it is worth noting that Ireland had the highest TFP growth rate in the 1990s among the 22 OECD countries shown in Table 1.

So much for the picture with respect to productivity growth, what about productivity *levels?* Table 2 shows OECD estimates based on purchasing power parities (PPPs) which are more suitable for the purposes of international comparisons of output and productivity levels than data adjusted by nominal exchange rates. These data suggest that, if labour productivity is defined as GDP per worker, the United States was still the productivity leader in 1996 among the OECD countries, but only just: Belgium and Italy were right on its heels and Luxembourg had even surpassed it. Once an adjustment is made for working-time differences, the United States is no longer the productivity leader in the 1990s: it appears to have been joined or surpassed by several European countries, e.g. Germany, France, Italy, the Netherlands and Norway[6].

The data also show a marked catch-up in productivity levels over the past two decades: between 1970 and 1996 output per worker in the other OECD countries rose on average from just under half of the U.S. level to almost 90 per cent of it. It is noticeable that the catch-up has been exceptionally fast in Ireland in recent years: GDP per head (per worker) has risen from 38 (42) per cent of the U.S. level in 1970 to 65 (87) per cent in 1996, with most of the convergence occurring post-1985.

Table 1 **Productivity in the business sector**

Percentage changes at annual rates

	Total factor productivity[a]				Labour productivity[b]				Capital productivity[b]			
	1960-73[c]	1974-79	1980-89	1990-96[d]	1960-73[c]	1974-79	1980-89	1990-96[d]	1960-73[c]	1974-79	1980-89	1990-96[d]
United States	1.9	1.0	1.0	0.5	2.6	1.0	1.3	0.7	0.4	0.4	0.4	0.2
Japan	5.6	2.0	1.7	0.5	8.4	3.5	2.9	1.3	-2.3	-2.3	-1.7	-2.4
Germany[e]	2.6	2.1	1.1	0.4	4.5	3.4	1.8	1.1	-1.4	-0.4	-0.6	-1.2
France	3.7	1.6	1.7	0.8	5.3	2.8	2.6	1.7	0.6	-0.9	-0.1	-1.1
Italy	4.4	1.9	1.2	1.3	6.4	2.7	2.0	2.4	0.5	0.3	-0.2	-1.2
United Kingdom	2.8	1.5	2.1	0.9	4.1	2.3	2.6	1.3	-0.3	-0.6	1.0	-0.1
Canada	1.1	0.1	0.2	-0.4	2.5	1.3	1.4	0.9	-1.9	-2.6	-3.5	-3.2
Total of above countries[f]	3.1	1.4	1.3	0.5	4.5	2.1	1.9	1.1	-0.4	-0.5	0.3	-0.8
Australia	2.2	1.6	0.8	1.6	3.1	2.9	1.3	2.1	0.4	-0.8	-0.1	0.8
Austria	3.2	1.1	1.2	0.4	5.7	3.0	2.5	1.6	-1.8	-2.6	-1.4	-2.1
Belgium	3.8	1.2	1.1	0.4	5.2	2.8	2.0	1.2	0.6	-2.1	-0.9	-1.6
Denmark	1.1	0.8	0.2	1.8	3.1	2.5	1.0	2.9	-2.2	-1.9	-0.8	0.0
Finland	4.0	2.0	2.8	2.8	5.0	3.3	3.6	4.2	1.4	-1.5	0.6	-0.8
Greece	2.7	2.4	0.0	0.1	9.0	5.0	0.9	0.8	-8.8	-2.2	-1.9	-1.0
Ireland	4.6	3.9	3.7	3.7	4.8	4.6	4.4	3.8	3.5	1.9	0.7	3.4
Korea	..	3.0	4.2	2.1	..	6.6	6.7	5.3	..	-3.3	-0.2	-3.7
Netherlands	3.5	1.4	1.1	0.8	4.8	2.3	1.6	1.4	1.0	-0.3	0.3	0.0
New Zealand	1.6	-3.1	1.1	1.3	2.1	-2.8	1.8	0.7	0.6	-3.9	0.1	2.3
Norway[g]	2.2	0.8	-0.4	2.6	3.8	2.2	0.8	3.5	0.1	-1.0	-1.9	1.5
Portugal	4.1	0.4	0.7	1.6	7.5	1.9	1.7	4.4	-2.5	2.7	-1.3	-4.3
Spain	3.3	0.4	1.9	1.3	6.0	2.5	2.8	2.8	-4.1	-5.4	-0.7	-2.7
Sweden	1.9	-0.1	1.0	1.9	3.7	1.3	1.8	3.0	-2.2	-3.3	-0.7	-0.9
Switzerland	1.5	-0.8	-0.3	-0.8	3.3	0.7	0.1	0.1	-1.6	-3.3	-0.9	-2.5
Total of above European Union countries[f]	3.2	1.6	1.4	0.9	5.1	2.8	2.2	1.8	-0.7	-1.1	0.2	-1.1
Total of above OECD countries[f]	3.0	1.4	1.3	0.7	4.6	2.3	2.0	1.4	-0.6	-0.8	-0.3	-0.9

a) TFP growth is equal to a weighted average of the growth in labour and capital productivity. The sample-period averages for capital and labour shares are used as weights.

b) Labour productivity is output per employed person. Capital productivity is output per unit of capital stock.

c) Or earliest year available, i.e. 1961 for Greece and Ireland; 1962 for Japan and the United Kingdom; 1964 for Spain; 1965 for France and Sweden; 1966 for Australia, Canada and Norway; 1967 for New Zealand; 1969 for the Netherlands; 1970 for Belgium; and 1975 for Korea.

d) Or latest available year, i.e. 1993 for western Germany and Portugal; 1994 for Austria and Norway; 1995 for Australia, Italy, Finland, Ireland, Korea, New Zealand, Spain and Switzerland.

e) Figures refer to western Germany. For Germany, 1991-96, total factor productivity growth was 1.6 percent, labour productivity growth was 2.8 percent and capital productivity growth was -0.9 percent.

f) Aggregates are calculated on the basis of 1992 GDP for the business sector expressed in 1992 purchasing power parities.

g) Mainland business sector i.e. excluding shipping as well as crude petroleum and gas extraction.

Sources: OECD Economics Department and OECD Analytical Database.

Table 2 Productivity levels in OECD countries

	GDP per head [a] (at current prices and current PPPs in US dollars)				GDP per worker [a] (US = 100 in 1993)				GDP per worker-hour (US = 100 in 1993)			
	1970	1980	1990	1996	1970	1980	1990	1996	1970	1980	1990	1996
United States	4 920	11 896	22 224	27 821	24	52	89	111	24	53	89	111
Japan	2 874	8 036	17 824	23 235	11	33	68	87	..	30	65	81
Germany	3 119	8 235	15 991	21 573	..	..	70	95	..	..	86	117
France	3 533	9 281	17 347	20 472	16	44	83	102	16	47	97	121
Italy	2 993	8 268	16 257	20 235	16	43	81	109	16	48	94	116
United Kingdom	3 223	7 875	15 847	19 156	14	34	65	83	14	37	71	93
Canada	3 564	9 815	18 304	21 529	18	42	74	90	19	45	83	101
Australia	3 647	9 082	16 025	20 793	16	40	66	87	..	42	69	91
Austria	2 991	8 593	16 712	21 971	14	41	73	83	..	..	..	..
Belgium	3 213	8 837	16 668	21 989	16	45	84	110	..	..	..	..
Denmark	3 509	8 570	16 552	22 681	14	34	61	87	..	..	..	..
Finland	2 850	7 841	16 193	18 644	12	31	62	86	11	32	69	92
Greece	1 463	4 300	7 375	9 709	8	24	39	51	..	..	..	..
Iceland	2 766	9 311	17 294	23 180	13	38	67	84	..	..	..	..
Ireland	1 849	5 182	11 375	18 139	10	29	68	96	..	..	..	..
Korea	661	2 364	7 928	13 580	..	13	36	57	..	..	..	..
Luxembourg	3 980	9 766	22 809	31 678	19	43	88	115	..	..	..	..
Mexico	1 246	3 529	5 411	7 776	..	22	38	41	..	..	36	44
Netherlands	3 430	8 572	15 962	20 469	18	46	72	87	19	56	98	123
New Zealand	3 360	7 584	13 352	17 473	17	36	58	72	..	..	62	76
Norway	2 948	9 047	17 512	24 531	14	37	70	97	16	48	96	133
Portugal	1 557	4 494	9 372	12 963	7	21	38	55	..	..	45	49
Spain	2 203	5 781	11 856	15 162	11	35	69	91	..	34	73	97
Sweden	3 791	9 061	17 004	19 289	15	34	63	83	18	46	82	104
Switzerland	5 150	11 642	21 242	24 621	20	45	78	88	..	..	88	106
European Union	3 023	7 902	15 390	19 450	..	..	..	..	..	..	..	..
OECD (above countries)	3 331	8 485	16 430	20 938	..	..	..	..	..	..	..	..

a) GDP data are converted to US dollars using purchasing power parities (PPPs) rather than current exchange rates. The 1990 and 1993 PPPs are triennial benchmarks calculated jointly by the OECD and Eurostat. The 1996 PPPs for the European countries except Turkey are annual benchmark results calculated by Eurostat. PPPs for Turkey and the non-European countries are OECD estimates. For Korea and Mexico, the PPPs were obtained by a regression procedure. The 1970 and 1980 PPPs were computed by backdating the 1990 PPPs using each country's rate of inflation relative to that of the United States.

b) For Germany, 1991 data are used since 1990 data are unavailable. For Austria, 1994 data are used since 1996 data are unavailable. For Belgium, Greece, Luxembourg and Mexico, 1995 data are used since 1996 data are unavailable.

c) For Germany, Mexico and Switzerland, 1991 data are used since 1990 data are unavailable. For Portugal, 1992 data are used since 1990 data are unavailable. For Japan, Italy and Portugal, 1994 data are used since 1996 data are unavailable. For Finland, Mexico and Switzerland, 1995 data are used since 1996 data are unavailable. For Italy and the Netherlands, GDP per worker-hour is calculated using hours worked in dependent employment since data for hours worked in total employment are unavailable. There are a number of series breaks in the employment and hours series used; these are documented in *Labour Force Statistics* and in the *Employment Outlook*, published annually by the OECD.

Sources: OECD Annual Hours Database, OECD Annual National Accounts Database and OECD Labour Force Database.

3. SELECTED INDICATORS OF HUMAN CAPITAL IN OECD COUNTRIES

Past attempts to quantify the contribution of education and training to economic performance in OECD countries have been hindered by the lack of reliable comparable data on human capital. As I mentioned above, the OECD has invested heavily in recent years in trying to remedy this data deficiency via its International Indicators of Education Systems (INES) project which is carried out in very close collaboration with networks of experts in Member countries. In this section, I propose to present some selected indicators on human capital investment and stocks as well as some proxy measures of outcomes, paying particular attention to how Ireland compares with other OECD countries.

Before turning to this, two caveats are in order at this point. First, the range of the education indicators collected by OECD is evolving continuously and the degree of comparability of the indicators is less than ideal in some cases. However, we are working actively, in close collaboration with our networks of national experts, to improve comparability and coverage of the indicators. Second, we lack long and consistent time series for almost all of the indicators, a factor which certainly limits the usefulness of our data base for analytical purposes. We hope to remedy this deficiency in the future by collecting some historical data but this is likely to prove a slow task.

One of the few exceptions to a lack of historic data concerns *public expenditure on education as a percent of GDP* (Table 3), though even here there is a major break in series in the early 1990s when the INES project was launched. In 1995, the typical OECD country spent 5.6 per cent of GDP on education, ranging from a low of under 4 per cent in Greece and Japan to a high of 8 per cent in Denmark[7]. Ireland, with an expenditure share of 5.2 per cent, was just below the OECD and EU averages.

These data suggest that public spending on education as a per cent of GDP has stabilised or declined slightly in most OECD countries since 1970. This trend is also apparent in the data for Ireland. One major factor behind this trend is the so-called "baby-bust": almost all OECD countries recorded declines in the share of young people aged 5 to 14 years in the total population between 1975 and 1995. The drop in the youth population, *ceteris paribus*, should result in declining public spending on education relative to GDP. However, rising enrolment rates among the youth population would tend to offset the "baby-bust" effect on public spending on education.

An alternative indicator of the "effort" devoted by countries to education is *spending per student relative to GDP per capita*. The OECD average for spending per student in 1994 (not shown here) was 26 per cent of per capita GDP, ranging from a low of 13 per cent in Greece to a high of 34 per cent in Austria. Ireland spent a below-average 21 per cent of its GDP to educate the typical student. Looking at spending per student across the different levels of education reveals that the most significant

differentials occur at the tertiary level. On average, OECD countries spent 2.6 times more per student at the tertiary level than at the primary level; the corresponding figure for Ireland was 3.6.

Table 3 Public expenditure on education, including public subsidies to households, 1970 – 1995 (percentage of GDP)

Country	1970	1980	1990	1995
Australia	4.6	5.6	4.6	5.2
Austria	4.6	5.7	5.4	5.6
Canada	10.2	7.7	6.2	6.6
Czech Republic	m	m	4.2	5.1
Denmark	m	7.4	6.3	8.0
Finland	m	5.8	6.0	7.3
France	m	5.1	5.1	5.8
Germany	3.7	4.8	4.1	4.7
Greece	2.8	3.2	m	3.7
Ireland	6.2	6.4	5.0	5.2
Italy	m	4.5	5.2	4.7
Japan	m	m	3.6	3.6
Mexico	2.4	4.6	4.0	4.6
Netherlands	7.5	7.1	5.7	5.3
New Zealand	m	6.7	m	6.2
Norway	m	5.8	m	6.8[a]
Portugal	m	3.7	4.3	5.5
Spain	m	m	4.4	4.9
Sweden	7.9	8.5	m	7.8
Switzerland	3.9	5.2	5.2	5.6
United Kingdom	6.2	5.7	4.9	5.1
United States	6.0	4.9	5.2	5.0 [a]
European Union		5.7	5.2	5.7
OECD Europe		5.6	5.1	5.7
Total OECD		5.7	5.0	5.6

The vertical bar indicates a break in the series because reporting practices changed in 1992.
a. Data on public subsidies to households to cover student living costs are excluded.
m=missing data.
Source: OECD (1997a, Table B1.t; 1998c, Table B1.1a; see also Annex 3).

Educational attainment as a proxy measure of human capital stock

The typical approach used in the literature to develop proxy measures of human capital relies upon input measures such as levels of educational attainment or average years of schooling completed by the population. Measures of educational attainment are computed on the basis of estimated or actual years of schooling

completed by different groups in the population, as classified by the International Standard Classification of Education (ISCED)[8]. These indicators allow for cross-country comparisons of the extent to which the population has either acquired formal educational qualifications or completed certain levels of schooling. They do not take account of skills or competences acquired as a result of on-the-job training or adult education.

Table 4 presents data on the educational attainment of the population aged 25 to 64 over the past two decades. If one focuses on the proportion of the population which has completed upper secondary education or higher levels, more than 60 per cent of the population had achieved this attainment level in 1995 in most countries. In a few countries, e.g. the Czech Republic, Germany, Norway, Switzerland and the United States, this proportion exceeded 80 per cent. In Ireland, the corresponding proportion was below 50 per cent, indicating a large potential for catch-up on this dimension of human capital.

The limited time-series data show that there has been a general upward rise in educational attainment over the past two decades. While we do not have time-series data for Ireland in our data base for the years prior to 1989, it is reasonable to assume that average levels of educational attainment have risen in line with those in other OECD countries over this period.

A related, and widely-used, proxy measure of human capital stock is the *average number of years of schooling* completed by the adult population. This is computed by taking data on the educational attainment of the adult population, as in Table 4, and summing across ISCED levels the product of the proportion of the population that has completed a given ISCED level and the typical number of years needed to complete that level. In this way, this measure accounts for cross-country differences in the average duration of different levels of formal education.

Table 5 shows that, on this measure, average years of schooling across OECD countries ranged from 10 to 13½years in 1995. The United States had the highest average years of formal schooling followed by Germany and Canada while Italy and Portugal had the lowest. Ireland, with an estimated average of 10.8 years, was below the OECD average of just under 12 years.

The limited time-series data suggest that average years of schooling in the adult populations of OECD countries have increased by around 1 year since the beginning of the 1980s. Evidence from a number of different studies which have attempted to compute cross-country estimates back to the 1960s suggests that average years of schooling in OECD countries have typically risen by 2-3 years over the past 3 decades[9]. It is noticeable that all of the studies concur with the data in Table 5 in showing that the adult population in the United States had the highest level of educational attainment among all OECD countries over this period, though the gap

Table 4 Percentage of the population 25 to 64 years of age by the highest completed level of education

	1981				1989				1995			
	Early childhood, primary and lower secondary education	Upper secondary education	Non-university tertiary education	University-level education	Early childhood, primary and lower secondary education	Upper secondary education	Non-university tertiary education	University-level education	Early childhood, primary and lower secondary education	Upper secondary education	Non-university tertiary education	University-level education
Australia	m	m	m	m	45	25	21	10	47	29	10	14
Austria	m	m	m	m	35	59	x	6	31	62	2	6
Belgium	m	m	m	m	63	20	10	7	47	29	14	11
Canada	40	37	12	11	29	41	15	15	25	28	30	17
Czech Republic	m	m	m	m	m	m	m	m	17	73	x	11
Denmark	50	36	4	11	m	m	m	m	38	42	6	14
Finland	m	m	m	m	42	40	8	10	35	45	9	12
France	61	29	3	7	52	34	7	7	32	50	8	11
Germany	m	m	m	m	22	61	7	10	16	61	10	13
Greece	76	16	2	6	m	m	m	m	57	25	6	11
Ireland	m	m	m	m	62	23	7	7	53	27	10	10
Italy	m	m	m	m	74	20	x	6	65	27	x	8
Korea	m	m	m	m	m	m	m	m	40	42	x	18
Luxembourg	m	m	m	m	m	m	m	m	71	18	x	11
Netherlands	m	m	m	m	m	m	m	m	39	39	x	22
New Zealand	67	12	16	5	m	m	m	m	41	34	15	10
Norway	34	51	8	7	23	55	12	11	19	53	11	18
Poland	m	m	m	m	m	m	m	m	26	61	3	10
Portugal	m	m	m	m	92	2	2	4	80	9	4	7
Spain	90	5	x	6	80	10	x	9	72	12	4	12
Sweden	51	33	6	10	33	44	11	13	25	46	14	14
Switzerland	m	m	m	m	21	53	16	10	18	61	12	9
United Kingdom	m	m	m	m	37	48	7	9	24	54	9	12
United States	20	45	14	22	18	46	12	23	14	53	8	25
European Union									**46**	**36**	**8**	**12**
OECD Europe									**40**	**42**	**8**	**12**
Total OECD									**39**	**41**	**10**	**13**

m = missing data; x = included in another category.

Source: OECD (1997a, Table A2.1; see also Annex 3), OECD database.

has narrowed sharply over the past two decades with rising enrolment rates in most countries.

Table 5 Average number of years of schooling in the population aged 24 to 64[(a)]

Country	1981	1989	1995
Australia	m	12.0	11.9
Austria	m	11.7	11.9
Belgium	m	11.0	11.7
Canada	12.3	12.7	13.2
Czech Republic	m	m	12.4
Denmark	11.7	m	12.4
Finland	m	11.3	11.6
France	10.1	10.4	11.2
Germany	m	13.0	13.4
Greece	10.0	m	10.9
Ireland	m	10.4	10.8
Italy	m	9.4	10.0
Netherlands	m	m	12.7
New Zealand	10.1	m	11.4
Norway	11.5	12.0	12.4
Portugal	m	9.5	10.0
Spain	10.5	10.9	11.2
Sweden	11.0	11.8	12.1
Switzerland	m	12.7	12.6
United Kingdom	m	11.5	12.1
United States	13.3	13.4	13.5

a. To calculate the average number of years of schooling, OECD Secretariat estimates of the typical cumulative years of schooling at each educational level in Table 4 have been weighted by the number of persons who have attained that level of education. m = missing data.
Source: OECD database.

Proxy output measures of human capital

The data reported in Tables 3 to 5 are all input-based proxies of human capital. They tell us nothing about the *quality* of education in different countries nor how this critical factor has changed over time. Hence, it is desirable to supplement these indicators with output-based measures of human capital. In particular, it would be desirable to make direct assessments of the skills and competences of workforces and populations across countries. A major breakthrough has been achieved recently in this area by the International Adult Literacy Survey (IALS), a unique collaborative effort involving the OECD, national statistical offices and educational testing experts, which is used to test a range of attributes related to human capital.

The definition of "literacy" which underlies IALS refers to a particular skill "namely, the ability to understand and employ printed information in daily activities at home, at work and in the community -- to achieve one's goals and to develop one's knowledge and potential" [OECD, HDRC and Statistics Canada (1997, p.14)]. The survey assessed a representative sample of adults on the basis of three domains of skill: prose, document and quantitative literacy. The scores recorded by the adults on each domain (which ranged from 0 to 500) were then grouped into five proficiency levels (for further information on the definitions, methods, proficiency levels etc., see Box 1). For example, Level 1 indicates individuals with very poor literacy skills, whereas Levels 4-5 describe respondents with the capacity to use higher order reasoning and information-processing skills.

The results for 12 OECD countries are reported in Table 6; an additional dozen OECD countries are currently in the field collecting assessment data which are expected to become available in early 1999. Since IALS is extremely rich in terms of results, I have chosen in the table to focus on the proportions of the adult population who performed at the top and the bottom of the literacy levels. Countries are ranked in the table in terms of their mean population scores on the scale of quantitative literacy.

Table 6. Percentage of the population at specified literacy levels, 1994-95
(Countries are ranked in this table by the mean score for Quantitative Literacy)

Country	Prose scale		Document scale		Quantitative scale		Total mean score (quantitative scale)	
	Levels							
	1/2	4/5	1/2	4/5	1/2	4/5	Mean	SE
Sweden	27.8	32.4	25.1	35.5	25.2	35.8	305.9	1.0
Germany	48.6	13.4	41.7	18.9	33.3	23.5	293.3	1.1
Switzerland (German)	55.0	8.9	47.2	16.1	40.4	19.0	287.9	1.8
Netherlands	40.6	15.3	35.8	20.0	35.8	19.9	287.7	1.0
Belgium (Flanders)	46.6	14.3	39.5	17.2	39.7	22.6	282.0	3.8
Canada	42.2	22.7	42.9	25.1	43.0	22.2	281.0	3.8
Switzerland (French)	51.4	10.0	45.0	16.0	37.4	20.4	280.1	1.7
Australia	44.1	18.9	44.8	17.4	43.3	19.1	275.9	1.0
United States	46.5	21.1	49.6	19.0	46.3	22.5	275.2	1.7
New Zealand	45.7	19.2	50.6	17.6	49.3	17.2	270.7	1.3
United Kingdom	52.1	16.6	50.4	19.1	51.0	18.6	267.2	1.9
Ireland	52.4	13.5	57.0	11.5	53.1	16.2	264.6	3.2
Poland	77.1	3.1	76.1	5.8	69.2	6.8	234.9	1.7

Note: SE denotes standard error. The differences in mean score (Quantitative scale) between pairs of countries may not be statistically significant.
Source: OECD, HRDC and Statistics Canada (1997).

The results show substantial proportions of the adult populations in all 12 countries with low literacy -- defined as those with Literacy levels 1 or 2. For example, in terms of quantitative literacy, the proportion ranged from a low of 25 per cent in Sweden to a high of 69 per cent in Poland; for those with high literacy (Levels 4 and 5), the equivalent proportions ranged from a low of 7 per cent in Poland to a high of 36 per cent in Sweden.

These cross-country differences cannot be explained completely by differences in educational attainment. While it is the case that, *within* each country, the average literacy score increases as the level of educational attainment increases, there are still marked differences between countries at given attainment levels[10] (Chart 1). For example, it is noticeable that the United States which recorded the highest levels of educational attainment in the OECD area -- in terms either of participation rates or average years of schooling -- no longer dominates the country rankings in terms of literacy. This honour goes to Sweden which consistently tops the rankings on all three domains. But the United States also has higher proportions of the adult population with high literacy on all three domains than many of the other countries with lower proportions of the adult population with low literacy.

The IALS results do not show Ireland in a very favourable position compared with the other countries. Over half of the adult population scores at literacy Levels 1 or 2 on all three domains; the only country which records higher proportions of the adult population with low literacy is Poland. It should be added that the U.K. performance in terms of literacy is not markedly superior to the Irish one.

Of course, the data in Table 6 refer to the adult population aged 16-64 and it might be argued that the relatively poor Irish literacy performance reflects low levels of educational attainment in the past and the ravages of emigration tending to drain away the most literate individuals in each generation. The age-cohort effect can be controlled for by comparing literacy levels for different age groups. For example, the Department of Education (1997) report on the Irish IALS results makes such a cross-country comparison for the age groups 16-25 and 56-65 on the document scale. As one would expect, the proportion of the youngest age group with low literacy is smaller than the proportion of the oldest age group in all countries including Ireland. However, the differences between the youngest and oldest age groups in terms of the proportions with low literacy are large in all countries, and in many of them greater than that recorded in Ireland. Thus, it seems that age-related differences cannot account for the disappointing Irish literacy performance compared with other OECD countries.

Box 1. The International Adult Literacy Survey (IALS)

For the purpose of the IALS, the term "literacy" is used to refer to a particular skill - namely the ability to understand and employ printed information in daily activities at home, at work, in the community - and its usage in order to achieve one's goals, and to develop one's knowledge and potential. This definition provided the basis for the first round of IALS undertaken by seven OECD countries in the autumn of 1994, using a representative sample of the adult population aged 16-65. Five additional countries including Ireland took part in the assessment in 1995-1996, applying the same methodology. The respondents were interviewed for about 20 minutes and then took a 45-minute literacy skill test in their homes in their national languages. The test was developed and administered under the supervision of Statistics Canada and the Educational Testing Service in the United States. In Ireland, a sample of over 2400 people participated in the survey and the response rate was almost 60 per cent -- for details see Department of Education (1997).

The survey assessed literacy proficiency in terms of three domains, each encompassing a common set of skills relevant for diverse tasks:

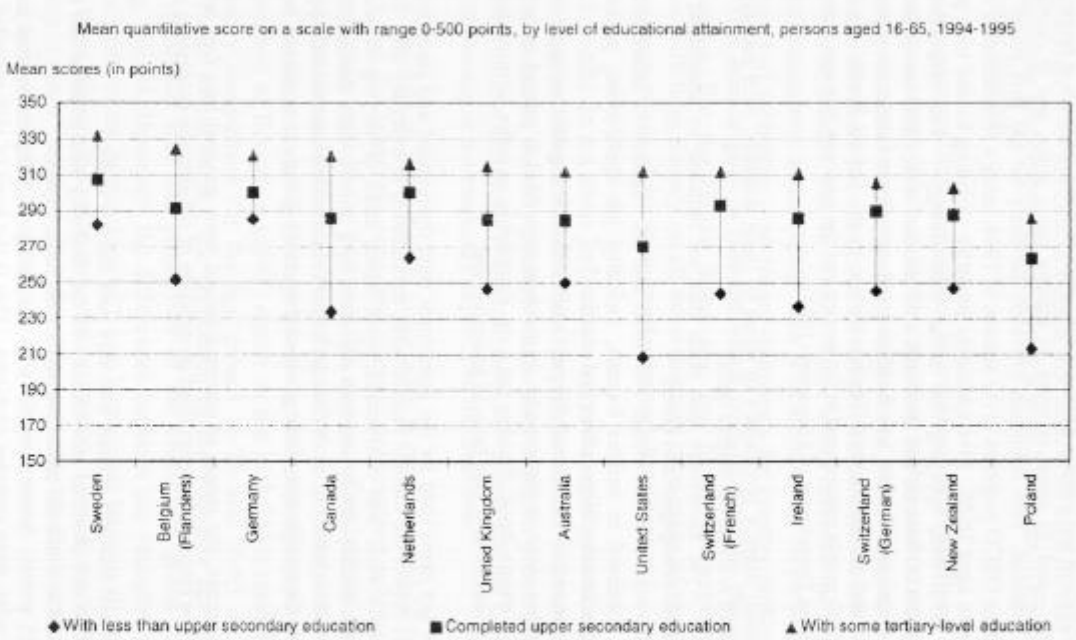
- *Prose literacy* -- the knowledge and skills that are required to understand and use information from newspapers and books.
- *Document literacy* -- the knowledge and skills that are required to locate and use the information contained in various formats, including job applications, payroll forms, transportation schedules, maps, tables and charts.
- *Quantitative literacy* -- the knowledge and skills that are required to apply arithmetic operations, either alone or sequentially, to numbers embedded in printed materials, such as balancing a cheque-book, figuring out a tip, completing an order form or determining the amount of interest on a loan from an advertisement.

All 101 common test items used for the assessment were open-ended and taken from "real-life" stimuli; they reflect the literacy requirements encountered in everyday life. In each of the three domains a scale was constructed, upon which tasks of varying difficulty were placed. A person's literacy ability was then expressed by a score in each domain, defined as the point on the scale at which he or she had an 80 per cent chance of successfully performing a given task. The data collection, scoring and scaling methodology is explained in detail in Murray *et al*. (1997).

For analytical purposes, the ranges of scores achieved were grouped into five proficiency levels, reflecting the empirically determined progression of information-processing skills and strategies:

Level 1 (0-225 points) indicates persons with very poor literacy skills;
Level 2 (226-275 points) identifies individuals who can deal only with material that is simple, clearly laid out, and in which the tasks involved are not too complex;
Level 3 (276-325 points) denotes people with the ability to integrate several sources of information and solve more complex problems. This is the level of skill regarded by many experts as a suitable minimum for coping with the demands of everyday life and work in a modern society.
Levels 4-5 (326-500 points) describe respondents who demonstrate the capacity to use higher order thinking and information-processing skills. Since the numbers performing at the highest skill level are small (under five per cent in most countries), levels 4 and 5 are combined for the purposes of the data analysis.

Chart 1 Educational attainment and literacy scores among the population aged 16-65, 1994-95[1]



Source: International Adult Literacy Survey, 1994-1995.

1. Countries are ranked by the mean quantitative literacy score of those with some tertiary education.

Rates of return to investment in education

The final set of indicators which I want to present concern rates of return to investment in education. This topic is discussed in Chapter 15 of *Investment in Education: Ireland*, but the authors came to a rather pessimistic conclusion concerning the possibility of quantifying these returns:

"Given the present state of knowledge, it does not appear that sufficiently accurate measurement of "returns" is possible" [OECD (1966, p. 385)].

However, progress has been made since then on the measurement front so this pessimism no longer seems warranted. At the OECD, we have sought recently to compare estimates of the *internal rate of return to investment in different levels of education*, calculated by comparing the expected additional earnings over a working lifetime associated with acquiring higher educational qualifications with the additional cost of completing education at those levels. It must be stressed that these estimates rest on several strong assumptions:

- they focus on the expected earnings gains associated with different levels of educational attainment. No account is taken in the calculations of the fact that higher educational attainment is likely to be associated, *ceteris paribus*, with a lower risk of unemployment;

- they assume that all of the difference between the earnings of educated workers compared with unskilled workers is due to education. Part of it could reflect a "signalling role" of educational qualifications to employers;

- they rest on cross-section profiles of earnings, cross-classified by age and sex and attainment levels, at one point in time. As such, they may be a poor guide to the expected *lifetime* earnings profile of a current cohort which enters the labour market with a given level of education;

- they are *average* rates of return for all individuals with a given level of education which may differ significantly from the marginal returns which should guide individual investment decisions;

- the estimates refer to *private* returns and make no allowance for any social benefits or externalities flowing from investment in education.

In addition, comparisons across countries will be influenced by a range of institutional and non-market influences on the distribution of earnings as well as differences in the levels of educational attainment[11].

Bearing these caveats in mind, Table 7 presents estimates of internal rates of return for 17 OECD countries based on 1995 data. Several patterns stand out in these

estimates. First, rates of return are typically higher for women than for men at all three levels of education. Second, there are relatively high rates of return to upper secondary education: the average return across countries for men and women is 15-16 per cent. Returns are somewhat lower to investment in tertiary education, whether in non-university settings or in university[12]. Third, the data also show quite wide variations in the estimated returns across countries, at all levels of education.

Table 7 Estimated returns to education[(a)] at different levels over a working lifetime -- employed persons only (1995)

	Men			Women		
Country	Upper secondary education	Non-university tertiary	University education	Upper secondary education	Non-university tertiary	University education
Australia	7.5	9.7	10.4	12.5	7.9	6.7
Canada	12.5	23.0	16.5	16.1	28.1	28.5
Czech Rep.	22.0	-	8.7	13.8	-	7.0
Denmark	10.4	5.2	11.0	11.8	5.1	9.2
Finland	10.4	10.5	14.8	8.1	12.2	14.3
France	14.2	17.6	14.1	14.1	20.1	12.7
Germany	5.7	16.6	10.9	5.5	8.7	8.2
Ireland[(b)]	18.6	11.7	14.0	28.8	8.2	17.4
Italy	10.4	-	9.9	9.5	-	4.6
Netherlands	14.1	-	10.8	24.4	-	10.5
New Zealand	12.8	-11.5	11.6	11.2	-0.5	10.3
Norway	11.3	9.4	11.6	17.3	7.8	13.3
Portugal	33.3	-	27.3	32.4	-	28.3
Sweden	10.9	6.5	8.2	9.9	4.2	5.3
Switzerland	19.0	27.1	5.5	22.1	17.7	5.2
UK	14.3	4.8	12.7	19.1	13.7	19.1
United States	26.3	8.9	12.6	22.9	10.5	12.6
Average	14.9	10.7	12.4	16.4	11.1	12.5

Note: - = missing value, or category not applicable.

a) These are the internal rates of return estimated by finding the rate of discount that equates (i) the present value of an estimated future stream of additional gross earnings over a working lifetime (from age 16 to 64) as a result of more education to (ii) the present value of the total cost of graduating at a higher level of education (including forgone earnings). No account is taken of the risk of unemployment over a working lifetime, as the calculation relates to persons in employment only. It is assumed that annual average earnings grow over time at a uniform rate of 1 percent for all individuals regardless of educational attainment level. Formally, this calculation consists of estimating, for educational attainment level i, the rate of interest (r) that equates the present value of a stream of additional earnings (E_i-E_{i-1}) over a working lifetime with the discounted additional costs (C_i-C_{i-1}) of producing a graduate at ISCED level i compared with level i-1: $\sum (E_{i,t}-E_{i-1,t})/(1+r)^t = \sum (C_{i,t}-C_{i-1,t})/(1+r)^t$

The value of t is the time at which each observation of earnings or cost is estimated. On the earnings side, t relates to the working lifetime following exit from schooling. On the cost side, t refers to the duration of a given level of education.

b) Data refer to 1994. Source: OECD (1997a, Indicator E5).

With regard to the estimated rates of return for Ireland, they appear to be greater than the OECD averages, for both men and women. Finally, these estimated rates of return to investment in education compare favourably with estimated rates of return on physical capital. OECD estimates of the rate of return on capital in the business sector in 1995 show an average return across 19 OECD countries of 14.5 per cent. The equivalent estimate for Ireland is 14.4 per cent[13]. If we take these data at face value, they do not suggest that individuals are underinvesting in their human capital as compared with their investments in physical capital.

Chart 2 shows that there is a positive association across countries between the estimated internal rates of return to investment in university education and university graduation rates in 1995; the correlation is statistically more significant for females than it is for males. This suggests that higher rewards to investment in tertiary education encourage more people to acquire university degrees.

4. THE CONTRIBUTION OF HUMAN CAPITAL TO OECD PRODUCTIVITY PERFORMANCE

This section first assesses whether there is any association between the indicators of human capital presented in the previous section and economic performance across OECD countries. This is followed by a review of recent OECD empirical work on the determinants of productivity performance over the past few decades, with a particular focus on the role of education.

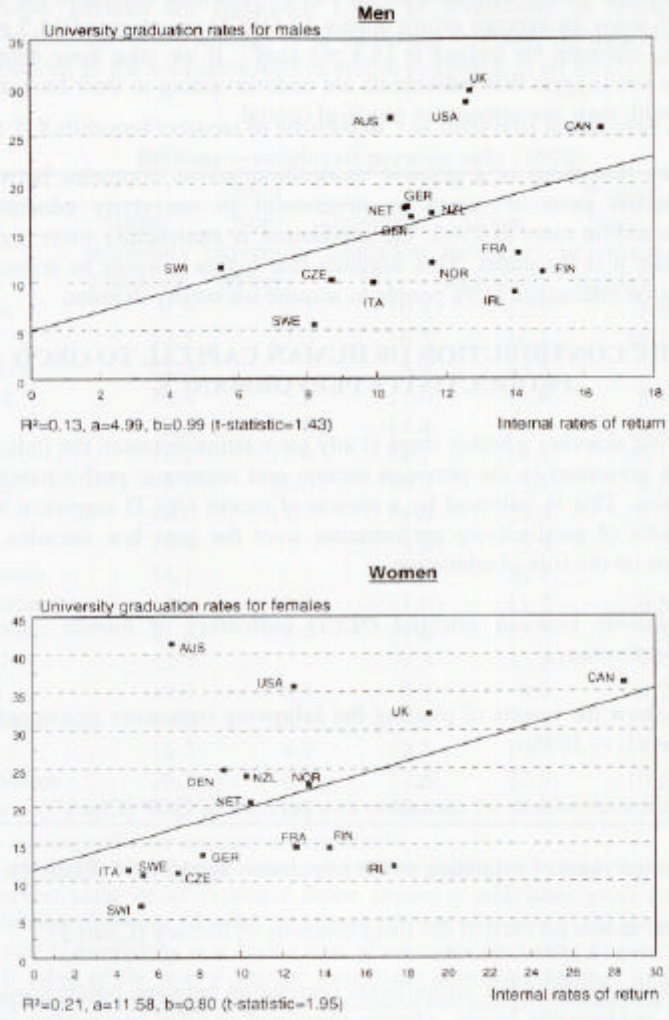
Simple correlations between selected OECD indicators of human capital and productivity performance

Charts 3 to 5 show the results of plotting the following indicators against estimated productivity *levels* in 1996:

- public expenditure on education as a per cent of GDP (Chart 3);
- average years of schooling in the population aged 24-64 (Chart 4);
- mean scores on each of the three domains of literacy (Chart 5).

The results show a positive but insignificant correlation between public spending on education and productivity levels, whether measured as GDP per worker or as per worker-hour. There is a stronger positive and statistically significant association between educational attainment, proxied by average years of schooling, and productivity levels across OECD countries. Finally, there appears to be no association between literacy scores across countries and productivity[14]. The latter result may appear somewhat surprising in view of the significant positive association between educational attainment and productivity levels shown in Chart 4. However, one must bear in mind the very small sample of countries for which the

Chart 2 Internal rates of return to university education and university graduation rates, 1995[a]



a) Data on internal rates of return for Ireland and on graduation rates for France refer to 1994.

Source: OECD (1997a, Tables E5.1 and G2.1).

IALS results are available and the fact that this is a new data set on which relatively little analysis has been undertaken to date.

The results of "new growth" regressions

As noted in section 1, much of the theoretical work on so-called "new (or endogenous) growth models" assigns a key role to education and knowledge. Several different hypotheses have been developed by different writers in this vein. For example, Lucas (1988) highlights the positive externalities associated with human capital. In economies with high levels of human capital, the incidence of learning from others will be higher, and this, in turn, should lead to greater productivity gains from exchanging knowledge in such economies. Romer (1990) emphasises the positive externalities which can flow from research which generates new knowledge and new products. Since research in his model is assumed to depend mainly on human capital, the existence of these externalities implies that investment in human capital will yield increasing returns to scale which, in turn, will result in a higher long-term growth rate[15].

In response to these theoretical models, much recent empirical work tests for possible links between human capital and productivity *growth* over time. One distinguishing feature of this work, as distinct from earlier work in the growth accounting tradition, is that instead of adjusting labour inputs directly to take account of embodied human capital, separate proxies for human capital are used as regressors in multivariate regressions which aim to quantify the determinants of growth across countries. Two of my OECD colleagues, Steve Englander and Andrew Gurney, have recently undertaken such an exercise focusing on the productivity performance of nineteen OECD countries over the period since 1960.

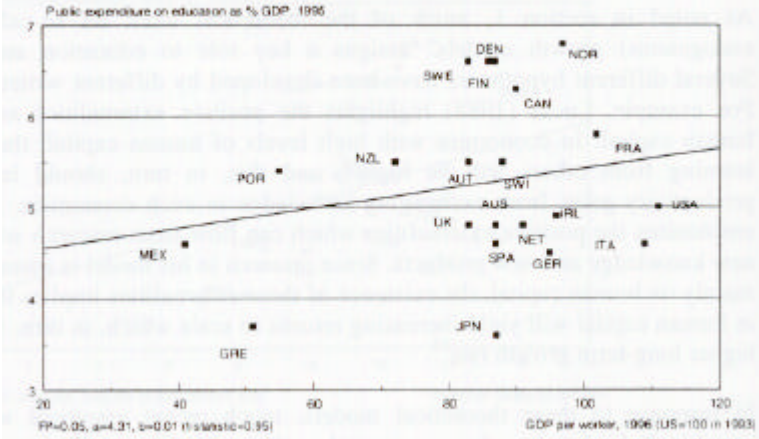
Englander and Gurney (1994b), in their cross-section regressions, were forced to use secondary school enrolment rates as a proxy measure of educational attainment rather than mean years of schooling simply because suitable time-series data on the latter variable are not available for most OECD countries. This was included with a large set of other explanatory variables including investment ratios, inflation rates, measures of infrastructure capital, R & D catch-up, and growth of the labour force.

Their results showed that only two variables were robustly correlated with *both* labour productivity growth and TFP growth. These two variables were labour force growth (with a negative coefficient) and secondary school enrolment rates (with a positive coefficient). For example, the estimated effect of increasing average OECD enrolment rates in secondary education from 70 per cent in 1960 to 95 per cent in 1985 was, *ceteris paribus*, to increase average OECD productivity growth by about 0.6 percentage points per year[16]. Englander and Gurney point out that an effect of this magnitude is in line with estimates derived from microeconomic studies.

Englander and Gurney also assess the relevance to the OECD growth experience of the determinants of growth highlighted in several recent empirical studies. Three of

Chart 3 Public expenditure on education (as a percentage of GDP) and labour productivity

a) labour productivity defined as GDP per worker



b) labour productivity defined as GDP per worker-hour

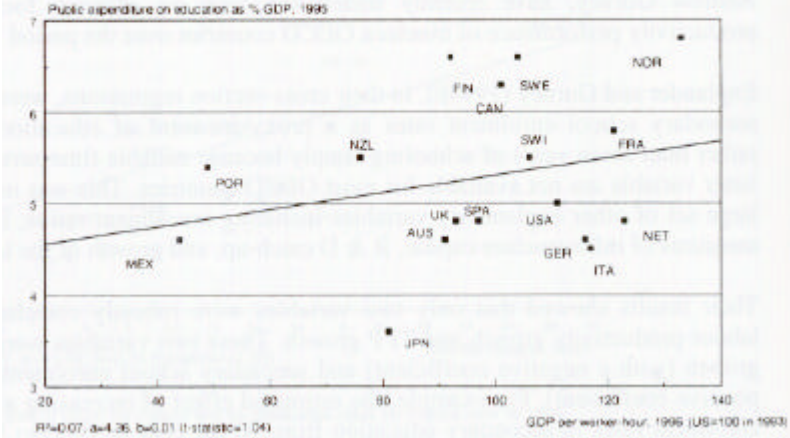
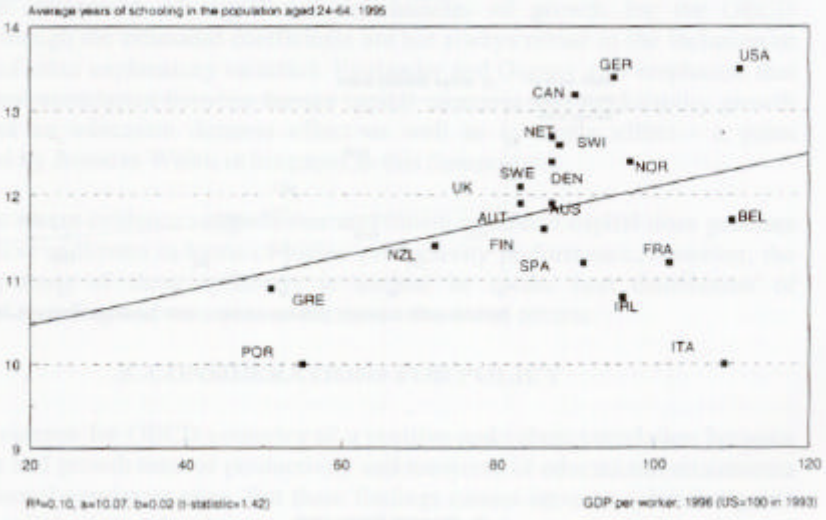


Chart 4 Average years of schooling in the population aged 25-64 and labour productivity

a) labour productivity defined as GDP per worker



b) labour productivity defined as GDP per worker-hour

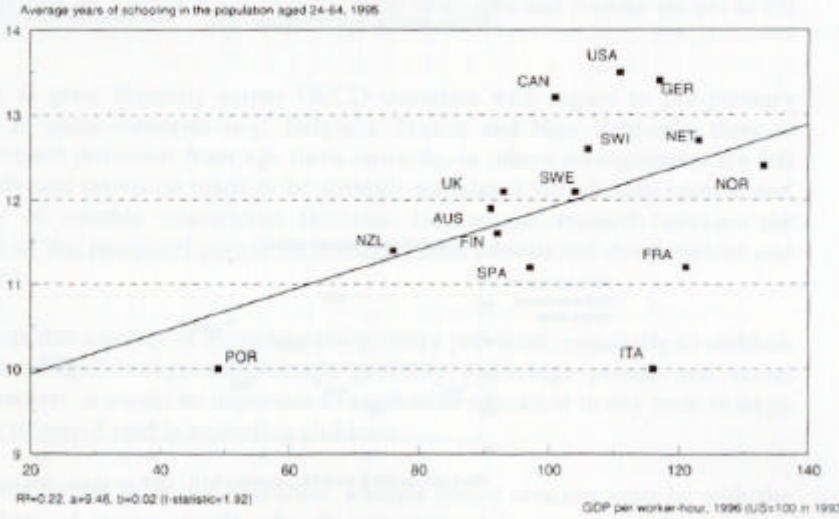
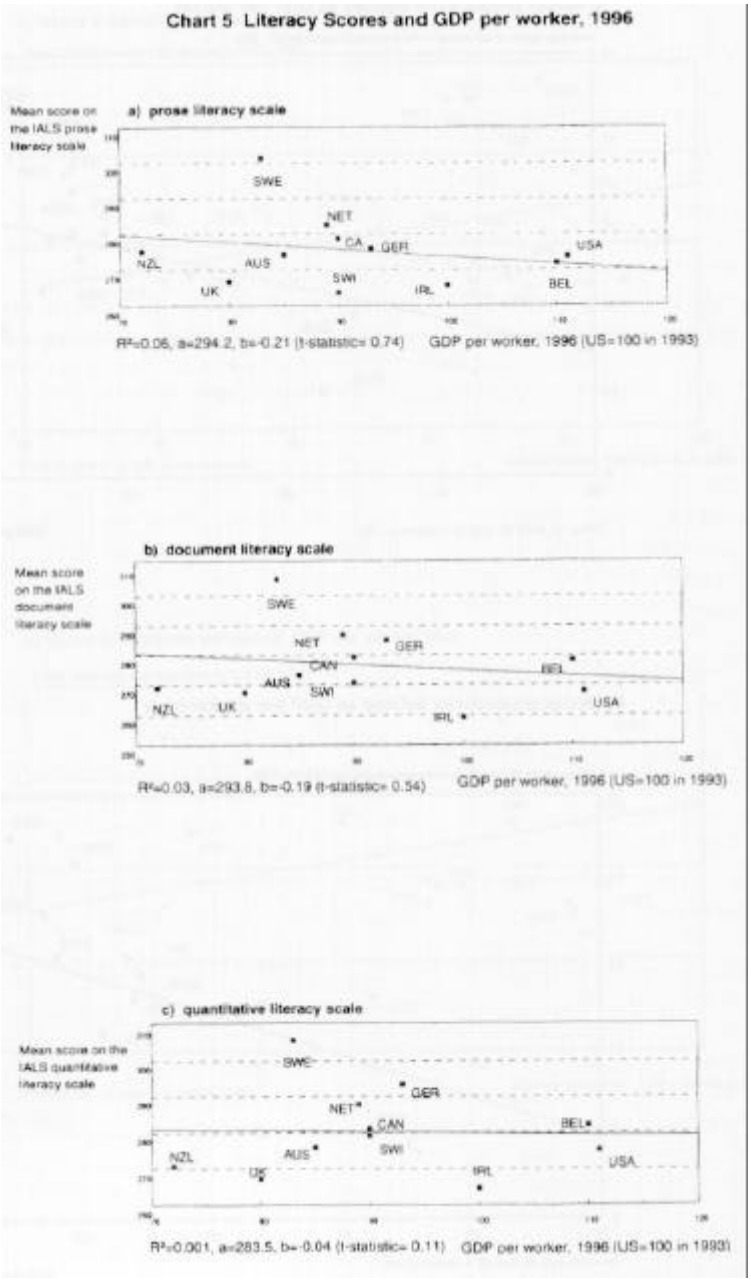


Chart 5 Literacy Scores and GDP per worker, 1996



these studies, Mankiw, Romer and Weil (1992), Barro (1991) and Levine and Renelt (1992), include proxy measures for the stock of human capital, usually various enrolment rates in different levels of education. The re-estimations of these studies reported by Englander and Gurney (1994b) generally show that measures of educational attainment are significant determinants of growth for the OECD countries, though the estimated coefficients are not always robust to the inclusion or exclusion of other explanatory variables. Englander and Gurney also emphasise that the statistical association between human capital measures and productivity growth may reflect an education demand effect as well as a supply effect - a point emphasised by Brendan Walsh in his paper to this Symposium.

In sum, the recent evidence suggests that investment in human capital does generate some positive spillovers in terms of higher productivity performance. However, the exact magnitude of these spillovers is unclear as is the best distribution of educational spending and resources to maximise the social returns.

5. CONSIDERATIONS FOR POLICY

There is evidence for OECD countries of a positive and robust correlation between both levels and growth rates of productivity and measures of educational attainments and educational enrolment rates. But these findings cannot serve as a detailed guide to public policies towards education. For that, we need to analyse education and training systems in OECD countries in much greater detail and trace out their complex interactions with labour and product markets and other policies.

In this regard, I would like to highlight some significant findings from recent OECD research in the field of education and training[17]. This work has influenced both the OECD's diagnosis of the unemployment problem and the menu of policy measures proposed in the OECD *Jobs Study* to help create more jobs and prepare people to fill them[18].

First, there is great diversity across OECD countries with regard to *pre-primary schooling*. In some countries (e.g. Belgium, France and New Zealand), there is almost universal provision from age three onwards, in others arrangements are left to the family and provision tends to be strongly correlated with family income and availability of suitable educational facilities. Educational research stresses the importance of the preschool period for a child's later educational development and performance.

This suggests that a policy of extending pre-primary provision, especially to children from disadvantaged backgrounds, would probably yield high private and social returns. However, it would be important to emphasise *education* in any such strategy as opposed to one of simply extending childcare.

Second, with respect to *initial education*, a major policy concern must be with the large numbers of young people who do not succeed in primary and secondary

education and drop-out or leave school early. For example, in 1995 only ten OECD countries had 90 per cent or more of 17-year olds enrolled in school. For 18-year olds, there is much greater diversity: in many European countries including Ireland, 70-80 per cent of them are still being educated; in others, e.g. the United States, Korea, the United Kingdom and New Zealand, the proportion is between 50 and 60 per cent[19].

The sources of difficulties for school drop-outs and early school leavers are complex and it would be facile to assert that there are obvious or easy solutions to deal with their problems. But it is crucial to improve the access to, and quality of, initial education. Few countries can be complacent on this score. It is worth noting that, on average, the upper secondary graduation rate in OECD countries was 80 per cent in 1995. Ireland performed well on this indicator with a graduation rate of 90 per cent whereas both Canada and the United States recorded below-average graduation rates.

Third, the *transition from school to work* continues to be a policy priority for OECD countries in view of the very high rates of youth unemployment in many of them. There are several different models to choose from among OECD countries. One such example is the Austro-Germano-Swiss model -- the so-called 'dual system'. Several OECD countries, e.g. France and the United Kingdom, have made determined efforts in recent years to copy some of the basic features of the 'dual system', but without any notable success to date. One problem is that it is simply impossible to imitate the 'dual system' in all its main aspects, given the specificities of history, culture and institutions in which it is embedded. Nor should one neglect the fact that the 'dual system' itself is showing signs of being under pressure in present-day Germany.

Nonetheless, analysis of its successes compared with the weaknesses in the school-to-work transition processes in other countries highlights some appropriate directions for policy:

- the importance of maintaining a balanced mix of school-based learning and on-the-job training.

- the promotion of industry-education partnerships, especially at the local level, in order to ensure that the education provided is relevant to labour market needs.

- the creation of frameworks for assessment, recognition and certification of the training, within which the active involvement of employers, trade unions or worker representatives appears to be critical.

- sufficiently low training wages or allowances relative to the average wage in the occupation or sector so as to induce firms to supply a sufficient volume of

training places. In countries with statutory minimum wages, this means there is a good case for establishing a sub-minimum for young workers[20].

Finally, one of the greatest challenges facing OECD countries is how to step up *on-the-job training for adults.* While comparable data on adult training rates across countries are very limited, the International Adult Literacy Survey (IALS) has made a major step forward here by collecting information on the incidence, duration and nature of continuing adult education and training. Chart 6 presents IALS data showing the percentage of the adult employed who participated in job-related training in the 12 months prior to the survey. The average for the 10 countries was 34 per cent. Ireland recorded a below-average training rate of 23.4 per cent. However, it should also be pointed out that Ireland recorded the highest average duration (in hours) per person trained among the countries reporting IALS data.

In principle, firms and their workers both profit from investing in skills. In practice, however, there are forces which discourage individual firms from investing in their workforce: short-term investment horizons and profit maximization objectives; the possibility -- for firms individually, though not collectively -- of dismissing workers with obsolete skills and hiring others with the requisite skills; and the risk of having skilled workers 'poached' by other (non-training) firms. The key question therefore is: how can firms be induced to change their training behaviour and thereby to act in their own (collective) longer-term interest?

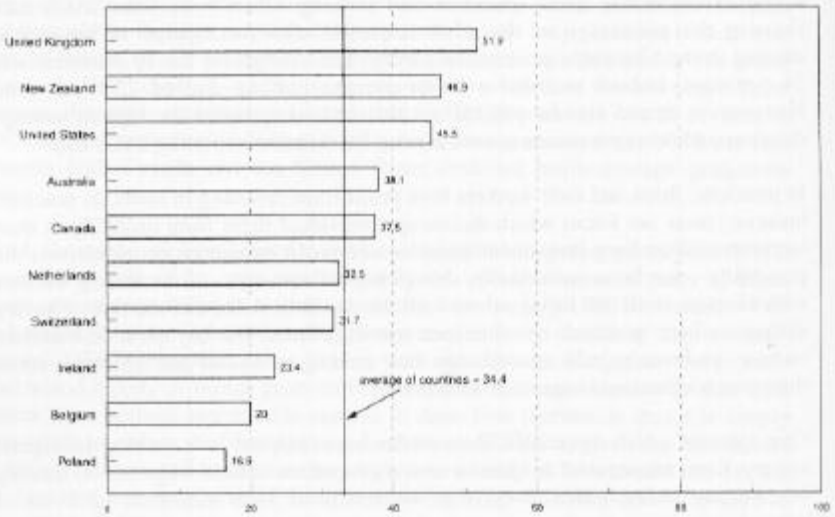
One solution which some OECD countries have adopted is a training levy/grant system: firms are required to spend a certain proportion of their wage bill on training or else pay an equivalent levy. But the results of such measures, in terms of expanding training provision, have tended to be quite disappointing. More radical solutions may have to be envisaged which attempt to promote longer-lasting marriages between workers and their firms[21].

6. CONCLUDING REMARKS

The revival of interest in the economics of education is a very timely one. I hope that the review of recent work by the OECD Secretariat and academics on the links between education and productivity performance demonstrates that there is a positive and significant relationship. There are positive spillovers from investment in education in terms of higher growth rates.

What is much less clear, however, is the appropriate level and composition of investment in education required to maximise these social benefits. Answering these questions must receive a very high priority on the research agenda. It will also require, as the *Investment in Education: Ireland* report stressed, co-operative research on the part of educationalists, sociologists and economists in order to provide convincing answers. This is no mean venture!

Chart 6 Participation of employed adults (aged 25-64) in job-related training[1], 1994-95



1. Percentage of persons aged 25-64 who were in employment and who received job-related training in the previous 12 months. Job-related training refers to all courses undertaken for career or job-related purposes as distinct from personal or other interests.
Source: International Adult Literacy Survey (special tabulations).

Footnotes

1. Other members of the Study Group included Seymour Harris, John Vaizey, Selma Mushkin and Jan Tinbergen. See Papadopoulos (1994) for a review of the work of the Study Group.
2. The team was headed by Paddy Lynch. The other members were Bill Hyland, Martin O'Donoghue and Pádraig O'Nualláin.
3. See Papadopoulos (1994, pp. 47-50) for details.
4. The results of this work are published annually in *Education at a Glance - OECD Indicators*. The latest edition contains over 40 indicators which are grouped under the following seven headings: demographic, social and economic context of education; financial and human resources invested in education; access to education, participation and progression; the learning environment and the organisation of schools; social and labour market outcomes of education; student achievement; and graduate output of educational institutions. For further details, see OECD (1998c). The indicators publication is a companion volume to a second OECD publication, *Education Policy Analysis*, which uses the indicators to address analytical issues in the educational policy field. See OECD (1997b).
5. The business sector is defined as the sector whose primary function is the production and sale of goods and services. It therefore includes public enterprises. Business-sector output at market prices is therefore measured by GDP less the output of general government and capital consumption in the government sector. Labour productivity is defined as either business-sector output per person employed or per hour worked; total factor productivity growth is defined here as that portion of real business-sector output growth which is not accounted for by increases of labour and capital inputs.
6. Data reported in Maddison (1995) suggest that the level of labour productivity, defined as GDP per hour worked, in the United States in 1992 was only exceeded by that of Germany. His calculations show Belgium and the Netherlands as having similar levels to the United States.
7. The data in Table 3 cover public expenditures on education including public subsidies to households. Data on *private* spending on education exists for most countries only for recent years. When this is accounted for, it adds about 1¼ per cent to the GDP share for the typical OECD country in 1994; the corresponding figure for Ireland is ½per cent of GDP.
8. The existing ISCED classification has deficiencies in terms of international comparability. It is currently being revised.
9. See Englander and Gurney (1994a, Table 3).
10. OECD (1997b) points out that roughly one in three people tested in IALS revealed skills that were at least one literacy level above or

below the level that would have been predicted on the basis of their educational attainment.

11. OECD (1997c, Chapter 3) shows that there is a robust correlation between cross-country differences in earnings inequality and collective bargaining structures: more centralised/co-ordinated economies have significantly less earnings inequality compared with more decentralised/unco-ordinated economies.
12. These findings are borne out by a review of the empirical literature on returns to education -- see Psacharopoulos (1994). His review also suggested a tendency for rates of return to decline across OECD countries over time.
13. See OECD (1998b, Annex Table 25).
14. Instead of mean scores, I also plotted the proportions of the population aged 16 to 65 with low literacy scores (Levels 1/2) and high literacy scores (Levels 4/5) against productivity levels. In both cases, there was no relationship across the sample of 12 countries.
15. It is interesting to note that many of the channels emphasised in "new growth" theories through which education might raise the long-term growth rate are discussed in Chapter 15 of *Investment in Education: Ireland*.
16. It is probable that the secondary-school enrolment rate proxies a broad set of education-related effects on productivity growth including rising enrolment rates in tertiary education.
17. See OECD (1995) for a detailed review of education and training in Ireland and proposals for how to deal with what it identifies as the two principal challenges facing the Irish education system: (i) how to improve the prospects for pupils at the lower end of the ability scale; and (ii) how to increase the output of the system in order to strengthen economic growth in the face of a fall in the birth rate.
18. For details, see OECD (1994; 1997d).
19. These data are from OECD (1997a, Table C3.1).
20. This issue is discussed in the OECD's submission to the Irish National Minimum Wage Commission -- see OECD (1997e).
21. OECD (1993a) shows that countries with relatively long average job tenure (between 10-11 years in 1991) such as France, Germany and Japan had more widespread enterprise training rates than the United States, a relatively low job-tenure country (average job tenure of 6.7 years in 1991).

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