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SYMPOSIUM ON THE ECONOMIC RETURNS TO EDUCATION

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"The expence of the institutions of education and religious instruction is likewise, no doubt, beneficial to the whole society, and may, therefore, without injustice be defrayed by the general contributions of the whole society. This expence, however, might perhaps with equal propriety, and even with some advantage, be defrayed altogether by those who receive the immediate benefit of such education and instruction. . ."

Adam Smith, *The Wealth of Nations*, (1776), Book V, Chapter 1.

"We may then conclude that the wisdom of expending public and private funds on education is not to be measured by its direct fruits alone. It will be profitable as a mere investment, to give the masses of the people much greater opportunities than they can generally avail themselves of . . . And the economic value of one great industrial genius is sufficient to cover the expenses of the education of a whole town; for one new idea, such as Bessemer's chief invention, adds as much to England's productive power as the labour of a thousand men."

Alfred Marshall, *Principles of Economics: An Introductory Volume*, eighth edition, 1992, p. 216.

"Education – investment in human capital – is at least as important as investment in physical capital for a country's long-run success . . . Thus, one way in which government policy can enhance the standard of living is to provide good schools and encourage the population to take advantage of them."

N. Gregory Mankiw, *Principles of Economics*, 1998, p. 528.

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1. INTRODUCTION

In my contribution to this Symposium I wish to explore two main themes. The first deals with the contribution of education to economic growth at the macro level. In this part I shall discuss the evidence of the importance of education – or human capital formation – as a determinant of the cross-country differences in living standards and rates of economic growth. The second topic I wish to develop is the measurement of the return to education at the level of the individual. In my review of both themes I shall refer to the policy implications and show how Ireland relates to the international experience.

2. THE LINK BETWEEN EDUCATION AND ECONOMIC GROWTH

Investment in education and growth

The determinants of growth have long preoccupied economists. Adam Smith called his book, which stands as the source of modern economics, *An Inquiry into the Origins and Causes of the Wealth of Nations*. While economists have not always given this theme the priority it deserves, it was a concern of the great economists from Smith through Marx and Mill to Marshall and Keynes. Robert Solow's seminal article (Solow 1956) systematised the key ideas in this area and made growth theory a booming area. Much of the literature spawned by this boom was purely theoretical, however, and became an increasingly self-contained and esoteric specialisation. The availability of large data sets, designed to provide comparable measures of key economic indicators, such as the growth rate of real national income and output, and its components, stimulated a new approach to the study of economic growth in the late 1980s[1].

The recent resurgence of interest in the contribution of human capital to economic growth builds on earlier work that emphasised the significance of the health, education and the motivation of the population in the development process. For example, Theodore Schultz (1961) highlighted the importance of education, Selma Mushkin (1962) emphasised the role of health and David McClelland (1961) argued that the emergence of achievement-oriented elites was a precondition for modernisation.

In the 1990s the output of empirical studies of economic growth swelled to a torrent. These studies seek to identify the variables that account for cross-country variation in rates of growth and standards of living. Prominence has been given to those suggested by the Solow model, namely the saving rate and the rate of population growth[2]. But the role of a wide range of factors has been studied. These include openness to international trade, the composition of physical capital formation, the size of the public sector, the degree of political stability and openness, country size, natural resource endowment and geographical location. The rate of human capital formation or investment in education was identified early on as a key influence on

rates of economic growth (Barro 1991) and growth theorists now place great emphasis on this variable as a determinant of the wealth of nations[3].

A distinction should be made between the accumulation of human capital (that is, educated and trained men and women), on the one hand, and the accumulation and application of knowledge to the production process, on the other. The new growth theory is interested in explaining the accumulation of knowledge and technological change. The goal is to "endogenise" these variables, that is, to incorporate them in the model instead of treating them as a residual that cannot be explained. However, this research is more concerned with the *world-wide* growth rate than with cross-country differences in growth. A positive role is attributed to population and its growth rate on the grounds that the rate of technological change depends on numbers of people and interactions between them (Kremer 1993). Technology is assumed to diffuse quickly across countries, provided certain preconditions exist. Among these is a high level of human capital, which is a precondition for the adoption of modern technology.

For these reasons the rate of human capital accumulation has come to occupy an important place in studies of cross-country variations in growth rates. The results obtained by Barro (1991) and Mankiw, Romer and Weil (1992) (MRW) have had a great influence on subsequent research. MRW start from the basic Solow model, according to which cross-country differences in levels of real income per person and rates of economic growth should be explicable by variations in national saving (or investment) ratios and rates of population growth. The basic model provides a moderately good fit to the data for a large sample of countries over the period 1960-85, but is much less successful in explaining the variations between the rich countries that comprise the OECD. For both groups of countries the parameter estimates obtained are at variance with predictions based on economic theory and other empirical evidence.

To address these shortcomings of the traditional model, MRW develop an "augmented" Solow model that not only takes account of the accumulation of physical capital but of human capital accumulation as well. The rate of human capital accumulation is proxied by the participation rate in secondary schooling. It is acknowledged that this is an imperfect measure of the rate of investment in human capital but it may be proportional to the "true" measure. Adding this variable to the original Solow model provides clear evidence of the importance of human as well as physical capital accumulation in explaining the cross-country variation in standards of living and rates of growth. The authors state that "even using an imprecise proxy for human capital, we are able to dispose of a fairly large part of the model's residual variance" (p. 421). Moreover, the parameter estimates provided by the augmented model are more in line with those expected on theoretical grounds than those obtained from the basic model. The satisfactory performance of the educational variable in these models has highlighted the contribution of human capital to growth and has been used as a justification for increased public spending in this area. Adam Smith would have approved!

But even the augmented Solow model does not provide answers to all the questions. Like the original Solow model, it does not provide a good explanation of the data for the OECD countries. The coefficient of the educational variable is in fact not statistically significant in this sample of 22 countries. From a local perspective, it is striking that Ireland ranks eighth out of a sample of 121 countries on the measure of human capital accumulation used. Taking account of this, we should have grown more rapidly over the period 1960-85 than we actually did (Walsh 1993).

These puzzles can be resolved by a further augmentation of the Solow-MRW model, namely by allowing for the contribution of higher levels of education to growth. When the measure of human capital accumulation is extended to reflect investment in third level education the residual variance among the OECD countries is dramatically reduced (Walsh 1996). A similar conclusion is reached by adding expenditure on R&D as a proxy for the accumulation of technical knowledge (Nonneman and Vanhoudt 1996). At OECD levels of income participation rates in first and second level education are high and relatively uniform and do not help to explain variation in living standards and rates of economic growth. Differences in rates of investment in higher levels of education do help explain this variation, however. Moreover, when the model includes investment in third level education the Irish situation no longer appears anomalous. Our relatively modest rate of investment in higher education over the period 1960-85 seems to be an important part of the explanation of our growth record over these years.

We should note that the research on the link between investment in education and economic growth does not provide estimates of the rate of return to investment in education, other than that it is positive. The thrust of the research has been to establish that human capital accumulation contributes to economic growth and to derive estimates of the elasticity of output with respect to education. MRW estimate an elasticity of output with respect to human capital formation of 0.8, compared with 1.7 for physical capital. The question of the optimal rate of investment in human capital accumulation is not addressed and no guidance is provided as to whether individual countries have invested “too much” or “too little” in education.

Cause or effect?

A methodological *caveat* applies to many of these studies. The existence of a correlation between a variable and economic growth does not establish a causal connection between them. It has been shown that the correlation between present levels of physical capital accumulation and past rates of economic growth is higher than that between present levels of economic growth and past rates of capital formation. This suggests that causation may run from growth to investment rather than *vice versa* (Blomstrom, Lipsey and Zejan 1996).

In the case of education it is clear that causality might run in either direction or that the correlation might be due to a common external factor. Richer countries can

afford to spend more on education. Education contains a large consumption component and the demand for it is highly income-elastic. As income grows educational standards rise, but we cannot be confident that economic growth is caused by higher educational standards. Even if investment in education does cause faster economic growth, there are difficulties in identifying the timing. Investment in education may have a long and variable gestation period. The rate of human capital accumulation rose sharply in Ireland between 1960 and 1985, but this would not have been fully reflected in the average growth rate over the period. Moreover, a significant proportion of the return to Ireland's investment in education over this period was reaped in other economies due to the high rate of emigration and the increasing dominance of relatively well educated individuals in the emigrant stream. Thus uncertainty remains about the exact contribution of Ireland's investment in education to its long-run rate of economic growth.

The use of educated personnel

Another *caveat* about the link between education and economic growth is that the contribution of educated people to growth obviously depends on how they are used by the economy. In addition to the fact that many of our educated people emigrated in the past, there has been a tendency for the public sector to absorb a large proportion of those who stayed at home. As Griliches (1997) noted:

> *"One does not have to be a Marxist to worry about whether in emphasizing the importance of education for economic growth we may be somewhat self-serving, especially if we do not worry about the fact that much of the highly educated labour force winds up working for governments or various international agencies, and its subsequent contribution to economic growth is problematic, at best." (p. S339)*

He cites the high propensity of the Israeli public sector to absorb highly educated Israelis. Some relevant data for Ireland are provided in Table 1.

Table 1 Allocation of growth in highly educated labour force, 1971-1991

Sector	1971-1981	1981-1991	1971-1981	1981-1991
	Thousands		% of total increase	
Insurance, finance etc.	20.6	15.8	8.8	12.2
Public administration	25.5	5.3	10.9	4.1
Professional services	58.8	32.0	25.1	24.6
Total of above sectors	*105.0*	*53.1*	*44.8*	*40.9*
Total at work	234.4	129.9	100.0	100.0

Note: "Highly educated" = full-time education ceased at age 18 or later.
Sources: Census of Population 1971, Vol. 12, Table 22
Census of Population 1981, Vol. 10, Table 17
Census of Population 1991, Vol. 9, Table 12.

We can see that in Ireland non-traded sectors absorbed a substantial proportion of the growth in the highly educated workers in the 1970s and 1980s. However, the share absorbed by the public sector was much lower than in Israel, where "public services" absorbed 48 per cent of the increase of highly educated personnel between 1980 and 1990. Moreover, in Ireland this share also fell significantly in the 1980s.

What type of education?

Most studies of the economic contribution of education do not explore the effects of different types of education on economic growth. Investment in liberal arts studies is regarded as valuable as investment in technical, vocational or professional studies. However, some economists have argued that what matters is getting talented individuals into productive occupations. Young people should be encouraged to devote their energies to problem solving, raising productivity, and economic innovation rather than the variety of *rent-seeking* activities (military conquest, political scheming, religious argumentation, tax farming, legal ingenuity, etc) that have attracted talented individuals throughout most of human history. Murphy, Shleifer and Vishny (1991) (MSV) suggest that the extent to which a country's educational system achieves this could be measured by looking at the proportion of university students in legal studies (preparing for careers as rent-seekers!) relative to the proportion in engineering (preparing for productive careers!). MSV find some empirical evidence to support the view that the structure of education, measured in this fashion, contributes to our understanding of economic growth. They report that countries with high proportions of lawyers among their student populations have lower rates of economic growth, *ceteris paribus*.

This finding would have pleased generations of economic commentators on the Irish educational system, who repeatedly deplored its "liberal bias". In 1954, for example, the Commission on Emigration in its Majority Report expressed concern that too many people were being educated with a view to "white collar employment and professional careers" (para. 448) whilst "there is general agreement that there can hardly be too much vocational or technical education" (para. 449).

The White Paper *Economic Development* (Department of Finance, 1958) acknowledged these criticisms, without wholeheartedly endorsing them:

> *Comment has been made from time to time about the disproportionate number of arts and medical graduates being produced by the universities and the desirability of greater concentration on training and scientific subjects…Care must be taken, however, that the fundamental education given in [vocational] schools is not swamped by purely technical training and instruction, important though these are. (p. 161)*

The Report of the Industrial Policy Review Group (Culliton, 1992) was less circumspect. It urged that

> *A higher priority should be attached in the education system to the acquisition of usable and marketable skills (p. 11). . . Over the past twenty-five years numbers in the education system have increased by more than a half. . .Despite the rapid increase in student numbers, the education system has become progressively more academic in nature. . .vocational education is being crowded out by the academic stream. . .Despite the high academic rating of the system, it provides a poor platform for subsequent vocational or industrial training. (p. 53)*

There are numerous limitations to the use of the composition of the stock of students as a measure of how a society allocates talent. If there is free enrolment in liberal arts faculties but restricted entry to law, the proportions studying law will be low. The operation of a *numerus clausis* on the places offered in a faculty may allow it to cream off the academically best qualified: although few, the students admitted to such faculties may be among the most talented. In Ireland, competition for the limited number of places for medical (human and animal) and legal studies may have the effect of attracting highly qualified students who would find other fields of study more congenial. Talented students may also be attracted to professions where the system of reward is "winner-take-all", that is, where small differences in performance give rise to very large differences in income. It is claimed that this considerably distorts the educational and career choices of young people in the United States (Frank and Cook 1995).

Tables 2 and 3 contain international data on the share of engineering and legal studies in third level education. The limitations of these figures as a guide to the allocation of talent are obvious. The high proportion of law students in Spain in 1960, for example, probably reflects the fact that a law degree traditionally served as a general primary qualification rather than as a way into the legal profession. The very low proportion of students in law in Ireland in 1960, on the other hand, may be attributed to the tendency for most entrants to the legal profession to go the apprenticeship route.

Taking the data in Table 2 at face value, they show that the share of lawyers in the Irish third level student population was below the OECD average, while the share of engineers was close to the average. (Further examination of the data show that Ireland had relatively high proportions in the liberal arts and medicine.) Table 3 contains more up-to-date information for the OECD countries on the importance of science and engineering degrees. This confirms that Ireland is close to the average in terms of the share of science and engineering degrees. It also shows that our output of these degrees per 1,000 in the labour force is one of the highest in the OECD.

There is no evidence, therefore, that the structure of third level education in Ireland reflects a tendency for talented young people to gravitate towards, or to be directed into, "rent-seeking" occupations to the detriment of "productive" ones[4].

Table 2 Law and Engineering graduates as a percentage of total

Country	Law			Engineering		
	1960	1985	Average	1960	1985	Average
Australia	4.4	2.8	3.6	10.0	6.3	8.2
Austria	21.1	10.2	15.7	16.6	8.3	12.5
Belgium	4.4	3.9	4.2	11.1	6.2	8.7
Canada	3.1	1.9	2.5	11.5	10.3	10.9
Denmark	2.9	2.1	2.5	9.5	9.8	9.7
Finland	3.6	2.4	3.0	7.0	24.0	15.5
France	8.6	13.6	11.1	19.6	5.6	12.6
Germany (FR)	6.5	3.1	4.8	33.4	9.4	21.4
Greece	11.1	7.8	9.5	5.1	12.1	8.6
Ireland	1.8	4.3	3.1	6.7	14.2	10.5
Italy	22.8	10.6	16.7	10.6	6.6	8.6
Japan	9.3	n.a.	9.3	12.6	17.0	14.8
Netherlands	2.1	4.7	3.4	41.1	15.3	28.2
New Zealand	2.2	3.8	3.0	3.4	5.5	4.5
Norway	6.7	0.7	3.7	20.4	9.2	14.8
Portugal	7.1	6.1	6.6	8.2	13.3	10.8
Spain	22.3	8.1	15.2	9.9	7.0	8.5
Sweden	4.3	1.8	3.1	13.0	30.0	21.5
Switzerland	11.1	14.4	12.8	18.9	7.1	13.0
Turkey	12.2	3.9	8.1	18.1	21.1	19.6
UK	8.2	n.a.	8.2	27.7	15.7	21.7
USA	2.1	2.3	2.2	9.2	5.5	7.4
Average (unweighted)	8.1	5.4	6.8	14.7	11.8	13.3

Source: UNESCO Statistical Yearbook.

The growth of total factor productivity

Another approach - albeit an indirect one - to measuring the contribution of education to a country's rate of economic growth is derived from the basic Solow model. According to this model, the rate of growth of output can be decomposed into the parts attributable to the rate of growth of the conventional inputs (physical capital and labour) and a residual that is attributable to technological progress. The basic equation is:

$$\dot{y} = a\,\dot{k} + (1 - a)\,\dot{l} + \dot{A}$$

where y = real income,

k = the effective capital stock,

l = hours worked,

A = technological change and

α = capital's share in national income.

A dot superscript indicates the rate of change.

Applying this "growth accounting" approach to the historical record usually shows that a large proportion – a half or more – of the growth of output is not attributable to the growth of capital and labour inputs but to technological change, *A*, or the growth of total factor productivity (TFP). While this residual factor has been labelled by Solow himself a "measure of our ignorance", it is recognised that in the long run it is the key to sustained increases in living standards[5].

Table 3 Measures of the importance of scientific and engineering subjects in the educational system, 1992

	Engineering Degrees	Science and Engineering degrees	Science and engineering degrees
	As percentage of all degrees awarded		Per 100,000 labour force aged 25-34
Australia	5.1	18.5	921.7
Belgium	22.0	29.4	n.a
Canada	6.1	16.2	667.7
Denmark	15.8	21.2	682.5
Finland	23.2	35.0	792.0
Germany (FRG)	19.2	32.9	650.3
Greece	12.8	25.6	500.3
Ireland	11.8	28.6	950.9
Italy	7.1	16.6	187.4
Japan	21.6	25.4	974.3
Netherlands	15.0	20.6	691.0
New Zealand	3.7	12.9	453.0
Norway	20.6	26.7	854.8
Spain	8.0	17.2	557.7
Sweden	15.9	26.6	457.5
Switzerland	7.4	23.9	302.3
United Kingdom	13.0	29.0	989.4
United States	7.2	16.0	688.0
OECD average:	13.6	23.8	649.9

Source: OECD, 1995,Table R15.

The link between the growth of TFP and education lies in the fact that a country's ability to adopt modern technology depends on the educational standards of its labour force. Education not only makes the work force directly more productive, it

also increases its ability to benefit from the transfer of technology facilitated through an inflow foreign direct investment (FDI).

Ireland's record since the 1960s is reassuring on this score. Walsh (1997) shows that the contribution of TFP growth over the period 1960-1997 was both absolutely and proportionately more important in Ireland than in the EU. He also concluded that this approach does not reveal a "miraculous" transformation of the economy since the mid-1980s or in the 1990s. The most striking feature of the accelerated growth of TFP since the mid-1980s has been the remarkable growth of the numbers at work, rather than a sudden surge in their productivity. Durkan, Harmon and FitzGerald (1998) reach a similar conclusion. They refine the measure of the labour input to take account of the growth of educational attainment. This yields a higher estimate of the rate of growth of the effective labour force. They calculate that whereas the numbers at work increased by 1.7 per cent a year between 1986 and 1996, the effective, or education-adjusted, work force increased by 2.7 per cent a year. Recalculating the contribution of capital, labour and TFP to the growth of output (GNP) using the education-adjusted measure of the work force shows that TFP contributed 2.7 per cent, out of a total annual average growth of 5.3 per cent, over the period. This is still a very creditable contribution from TFP, both absolutely and relatively.

How much of the contribution of TFP to Ireland's growth should be attributed to investment in education is not clear. The growth of productivity in the industrial sector owes much to the increasing share of foreign firms in the total. In 1993 value-added per employee in foreign-owned manufacturing firms was almost three times that in Irish-owned firms. It is undoubtedly the case that we are reaping the returns to R&D carried out elsewhere, principally in the United States, but this would not be possible in the absence of a labour force capable of adopting new technologies[6]. Moreover, a study of workplace innovations has found that Irish-owned firms have not been laggards (McCartney and Teague 1997).

The growth of TFP also reflects the reallocation of resources from low productivity sectors, such as subsistence farming and family-owned businesses in the distribution sector, to high productivity industrial and service activities. While this redistribution cannot be entirely attributed to investment in education, it may be claimed that the availability of a labour force with a high educational attainment was a necessary precondition for effecting it.

The contribution of education to Ireland's current boom

In his recent essay on Ireland's current boom, Paul Krugman noted:

> *Labour costs in Spain are similar to those in Ireland; those in Portugal and Greece are far lower. Yet foreign investment into those economies has been substantially lower. True, in the case of the really low-wage countries lack of infrastructure and poor access to markets limit their usefulness as export platforms. And there is, of course, the huge advantage of a work force that is not only well-educated but English speaking. (Krugman, 1997, p. 47). (Underlining added)*

There can be little disagreement over the validity of this claim. But it remains none the less difficult to know how much weight to attribute to the educational level of the labour force among all the factors that have contributed to Ireland's current boom. As recently as the second half of the 1980s we saw very high rates of emigration of well-educated young people (Ó Gráda and Walsh 1994). We should not forget the lessons of that period, one of which is that the availability of a skilled, English-speaking labour force is not a sufficient condition to ensure rapid economic growth. The Irish economy would not now be reaping the return to its past and current high levels of investment in education had we not put in place a number of preconditions and supporting policies during the 1980s. These include:

- The fiscal stabilisation, above all getting the public finances on a sustainable trajectory and restoring investors' confidence in the economy.
- Moderation in labour costs. This was undoubtedly helped by the stark discipline of an 18 per cent unemployment rate and by a return to "social partnership" or "corporatism".
- The reversal of the upward trend in the overall burden of taxation and that on labour and other factors of production in particular. Since the mid-1980s the burden of taxation has eased in Ireland while in the main European economies it has increased.
- Averting a sustained over-valuation of the exchange rate. Three sizeable devaluations in the European Monetary System were crucial in this regard.
- Avoiding the labour market rigidities that now plague the main continental economies. An Anglo-Saxon approach to these affairs has prevailed over enthusiasm for the EU Social Charter.
- A reduced emphasis on regional targets in our industrial policy. The relaxation of regional objectives allowed the development of a critical mass of firms in selected sectors in the larger urban areas, especially Dublin.

3. MICROECONOMIC STUDIES OF THE RETURN TO EDUCATION

Recognition of the importance of education as a source of income differentials is as long-standing as an awareness of its contribution to economic growth. The fact that better educated people tend to earn more than the uneducated is well documented. Economists are conscious, however, that all of the higher earnings should not be regarded as a return to education. Several issues arise in trying to estimate this return.

Pitfalls

A basic problem is the need to control for individual ability when estimating the returns to education. It is important to avoid conflating the returns to an individual's ability and the returns to his or her schooling. A second problem arises from the fact that more talented individuals derive greater benefit from schooling. They may therefore decide to invest more in education. The returns that talented individuals reap from education may not be available to all. Measurement errors may also introduce bias in the estimates of the return to education. Our measures of education tend to be crude – typically the numbers of years of schooling, without any adjustment for the quality or even the type of education obtained. Misreporting of years of education, as well as lack of information on its quality, may render estimates of the return to it unreliable.

A broader issue arises from the fact that employers are not able to observe factors such as motivation and dedication. If they believe educational attainment is a good proxy for these important attributes, they will specify it as a requirement when advertising vacancies. From the view of the employer, this is an efficient way of *screening* applicants, separating the highly motivated (and well-educated) sheep from the poorly motivated (and uneducated) goats. A collateral effect of this approach to hiring is that job seekers are encouraged to acquire educational qualifications, not for their intrinsic value, but as a *signal* to potential employers of how highly motivated they are. These two phenomena are referred to as *sorting models* because in both education is used to sort workers according to unobserved characteristics (Weiss 1995). Finally, it is always possible that employers are simply impressed by qualifications and these become *credentials* that must be obtained to gain entry to certain jobs.

A vast quantity of research has been undertaken to establish the net effect of years of schooling on individuals' earnings. Since the early microeconomic research on the returns to education (Mincer 1958) economists have come a long way from naively attributing all of the higher earnings of better-educated workers to education. Increased statistical sophistication has allowed researchers to control for the potential biases listed above. Controls (such as scores on standardised aptitude or IQ tests) have been introduced to take account of difference in ability and motivation. A small number of studies have used data for twins to control for genetic and other unobservable factors. The choice of investment in education by individuals has been

modelled together with the earnings function. These studies have generally found that when the biases present in the first generation studies are eliminated, the estimated returns to education are reduced but remain very significant. In fact some more recent studies have even found that when these biases are removed, higher estimated returns to education are obtained (Callan and Harmon 1997).

However, some sceptics remain unconvinced that we have succeeded in netting out the pure productivity enhancing effect of education from its value in sorting good workers from bad:

> *. . . courses, test scores, and measurable learning in secondary school can explain at most one quarter of the increased earning associated with completing high school, and probably considerably less (Wiess, 1995, p. 141.)*

Findings

When reviewing this topic, it is invaluable to have to hand a survey of no fewer than 97 different studies that estimate the returns to schooling (Ashenfelter, Harmon, and Oosterbeek 1998). These studies covered a wide range of countries and used a variety of statistical techniques. Many included controls for individual ability and a few were based on comparisons of twins. The average estimate of the rate of return to a year's additional schooling was found to range between 6 and 9 per cent.

Recent estimates for Ireland fall into this range. Callan and Harmon (1997) estimated an 8 per cent return per schooling year. They found that completion of higher levels of education had a pronounced effect on earnings: the earnings of individuals with an Intermediate Certificate were, for example, 20 per higher than those of people who lacked this qualification. However, the authors report a sharp drop in the return to the Leaving Certificate and non-university third level qualifications among younger age groups, suggesting that the dramatic increase in the proportions of the more recent cohorts completing these qualifications has resulted in a fall in the return to them. Interestingly, though, no such result is found for university level qualifications.

The return to education can take the form not only of enhanced income while at work but also of a lower risk of unemployment. It has been found that the relative risk of unemployment in Ireland decreases sharply with rising education attainment. Men with only a primary school qualification have a risk of unemployment 12 per cent higher than those who have completed the Leaving Certificate, and almost 20 per cent higher than university graduates (Murphy and Walsh 1996).

Detailed research has been conducted on rates of return to education in countries around the world (Psacharopoulos 1994). The following findings have been repeatedly supported:

- The rate of return tends to be higher in low income countries.
- Primary education makes the most valuable contribution in developing countries.
- The rate of return declines with the level of schooling and the country's per capita income.
- Investment in women's education tends to yield a higher rate of return than investment in men's education.
- The return to educated people is generally higher in the private, competitive sectors than in the public sector.
- Finally - a finding of relevance to recent changes in Irish educational policy - publicly financed higher education is regressive, benefiting higher income groups more than the poor.

Education versus training

Numerous studies have shown little if any beneficial effect of vocational training, especially at the secondary school level.

> *"Vocational training at other than the highest level does not seem to yield any incremental effect on earnings over and above basic low-level academic qualifications" (Cohn and Addison 1997, p. 61).*

There is more evidence of the benefits of enterprise-based training and conventional apprenticeships. On-the-job training also appears to yield significant returns, but these may accrue largely to the employer, who has an incentive to provide mainly firm-specific training.

The lack of evidence of a return to vocational training is puzzling in light of the overwhelming evidence of a link between formal education and earnings.

Implications for policy

We should start from the presumption that education should be privately financed. If an individual obtains a highly paid job by having an educational qualification, that qualification yields a return to him or her. This is a private return and it is reasonable to expect the individual (or his or her parents) to pay for this, much as they are expected to finance any other investment that yields them a return. If the qualification is valuable merely as a sorting device that matches good workers with employers, there will be over-investment in education even when it is privately financed. It is possible that the same result could be achieved at lower cost by some other mechanism, such as thorough interviewing and screening.

When justifying public support for education, the distinction between the *private* and *social* return becomes crucial. As the quotations at the start of this paper illustrate, economists have for long accepted this case for public spending on

education on the grounds that it yields significant social returns. These returns are varied. They take the form of *positive spillovers* associated with having a well-educated population. The most basic example is that the whole body politic benefits from a literate and numerate electorate. More ominously, it is now seen as essential to set a floor under the educational qualifications of the population and to avert the emergence of an uneducated underclass that would be excluded from participation in a modern economy. High minimum standards of education would reduce the long-term, structural unemployment that is so serious a problem in modern economies. A lower unemployment rate benefits all taxpayers and not just those who would otherwise be unemployed.

In Ireland we have paid relatively little attention to this dimension of our education achievement. Despite a high average standard of educational attainment, it is clear that enormous inequalities persist and that a significant proportion of the current school-leaving cohort lacks any basic education qualification. Even in 1991 over a quarter of those aged 20-24 had left school before the second stage of second level education, that is with at best an Intermediate or Group Certificate. It is likely that the highest social return to further publicly financed investment in education would come from reducing this proportion.

The case may also be made that there are external benefits from the existence of a ready supply of skilled workers, who act as a magnet for employers and lead to the enlargement of a region's or country's economic base. Higher levels of education may also result in a higher level of applied research and development, with benefits for the whole economy. In Marshall's example, cited at the start of this paper, Bessemer's inventions would repay a large investment in education. This is a line of reasoning often used in Ireland to justify expenditure on education, training and research in specialised areas. As noted above, there is strong evidence of an association between investment in human capital and the rate of economic growth. But this does not justify a wholesale shifting of the cost of general scientific, business, or liberal arts education from the individual student to the taxpayer. Nor does it warrant asking the taxpayer to shoulder the cost of professional training and education, the benefits of which accrue almost entirely to the educated individuals.

The existence of high private rates of return to education acts as a signal to individuals to acquire additional schooling. Provided access to education is open, young people and their parents are responsive to the signals sent by the market place. They tend to gravitate towards courses and subject areas that offer good employment prospects. But they may also need to be reminded that the returns to general education can be longer lasting than those to more specific training. It is myopic to push young people into courses that have an immediate pay off or to tailor the educational system too closely to the immediate needs of the economy. Pleas for a more "vocational" and less "academic" slant in education need to be assessed in light of the lack of evidence that the former has as high a return as the latter.

The spillover effects of research and development may be used to justify selective subsidies to centres of excellence of pure and applied research. But we should bear in mind that the fruits of pure research tend to be quickly diffused. Small countries can free ride on general research undertaken in larger countries and are unlikely to achieve the scale required to make an impact in any but very well defined research niches. The highest rate of return is derived from private spending on research and development by firms that hope to profit from the fruits of this spending. None the less, governments will continue to set tasks for the scientific research community. The best way to achieve value for money in this area is to set specific goals and to invite competitive tenders for this work, while recognising the role of peer review in the *modus operandi* of academic research.

4. CONCLUSION

There is a consensus among economists that human capital formation is at least as important as physical capital formation among the determinants of a country's long-run growth record. Evidence that the type of schooling provided matters is less strong, although there is some evidence that societies that encourage talented young people to become lawyers, instead of engineers, are less successful economically. The return to investment in formal academic education seems to be higher than that to investment in vocational training, especially when the latter is not on-the-job. Cross-country evidence also suggests that the return to education is higher the lower the initial level of a country's educational attainment, and that investment in primary education has a higher return than investment in higher levels. Educating women seems to be more profitable than educating men.

The evidence on the association between investment in education and Irish economic growth does not allow us to conclude whether Ireland has under- or over-invested in education. Nor is it possible to assess with any degree of precision the contribution of past investments in education to the current economic boom. While its role was undoubtedly significant, other factors were crucial. Our experience in the late 1980s illustrates how investment in education can lead to a brain drain rather than higher economic growth.

The existence of high rates of private return to education provides an incentive for individuals to invest in schooling. For the most part, they themselves reap the benefits of this investment and should be expected to bear its cost. The case for subsidies to education is strongest at the lower levels, where the social benefits are highest and the obstacles to private investment are largest.

The case for public support for education is now so widely accepted that the pendulum may have swung too far in this direction. It is important to recognise the return to education does not warrant writing a blank cheque to subvent education at all levels for all comers. We should have faith in the ability of individuals to recognise the benefits that may be reaped from investment in their own potential and that of their children.

Footnotes

1. The most important of these research projects was the International Comparison Project, which resulted in the World Penn Tables, now in its fifth variant and available to students over the Internet. These data sets were built on pioneering empirical research by Angus Maddison and others and utilise a key statistical method developed by R. C. Geary while he was at the Irish Central Statistics Office. See Summers and Heston 1991.
2. The basic model relates the steady state level of income per person to the saving ratio, the rate of population growth, the rate of depreciation, and the rate of technological progress. If the last two variables are assumed equal in all countries, the burden of explanation lies on the first two.
3. A search of *EconLit* reveals that 293 books or articles have appeared since 1990 with "growth" and either "human capital" or "education" in the title!
4. In fact there is little evidence that this factor is a significant determinant of economic performance. When enrolment in third level education is included in the MRW growth equation for the OECD countries, a variable measuring the share of engineers in the student population is not statistically significant (Walsh 1996).
5. In a controversy that has taken on added interest because of recent events in East Asia, Alwyn Young (1992) drew attention to the poor performance of some of the "Asian Tigers" – especially Singapore – when measured by this criterion. For a review of this debate see Sarel 1997.
6. The use of Gross *National* Product (as distinct from Gross *Domestic* Product) as the measure of growth in the calculation of TFP reduces the force of the criticism that much of the credit should be allocated abroad. Royalty and patent payments are now treated as invisible imports in the Irish national income accounts and netted out of GDP. The profits remitted to non-resident owners of firms operating in Ireland are taken out of GNP.

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