The Contribution of Human Capital Formation to Post-War Economic Growth in Ireland

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Abstract: Following an account of the perceptions of the contribution of education to economic development among Irish policy makers since the second world war, this paper examines the performance of the Irish economy in the framework of a model of exogenous growth incorporating human capital formation. It is shown that when account is taken of the low level of income at the start of the period and the relatively high rate of human and physical capital accumulation, the Irish growth rate has been relatively low. Possible explanations for this poor performance are explored. Neither the structure of education nor low rates of return to additional years of schooling appear to explain it, but there is evidence that the quality of physical investment has been poor. In addition, high and selective emigration in certain periods may have deprived the country of some of the returns to the increased investment in education undertaken in recent decades. [JEL N14, 052]

1An earlier version of this paper was delivered at a CEPR Workshop on Human Capital and Post-War Economic Growth held at University College, Dublin, March 12-13th 1993. I am grateful to John Sheehan for his input to an earlier draft and to John Bradley and other participants at the Workshop for comments.
INTRODUCTION

The recent resurgence of interest in the contribution of education to economic growth builds on a long tradition that emphasised the economic significance of the health, education and motivation of the population. In the early 1960s Theodore Schultz highlighted the crucial importance of education in the development process; Selma Mushkin discussed health as an investment, and David McClellan stressed the importance of the emergence of elites with high "need achievement". In discussions of Ireland's post-war economic development, however, the contribution of education and human capital formation has not been emphasized. In part this reflects an antipathy towards viewing education as an input to the economic process, but it is also due to the fact that the systematic study of the determinants of growth has been somewhat neglected by Irish economists.3

This paper is intended to make a contribution to redressing these deficiencies by examining Ireland's recent growth record in the context of modern theories of economic growth in which human capital formation is one of the major explanatory variables.

The paper is organised as follows. The next section presents a very brief outline of the evolution of the Irish educational system. Section III surveys the views that have been expressed about the role of education in economic development in Ireland and documents the shifts that have occurred in attitudes towards the contribution of education to development. The fourth section reviews the level and trend of human capital formation in Ireland, while in the fifth section Ireland's growth record over the period 1960-1985 is reviewed. A model of exogenous growth is re-estimated to explore whether the Irish case should be regarded as an outlier in regard to the responsiveness of growth to human capital accumulation. The final section contains a discussion of the findings.

II. THE EVOLUTION OF THE IRISH EDUCATIONAL SYSTEM

State aid for primary education in Ireland was first made available when the National Board for Education was established in 1831. However, a Commission established in 1868 reckoned that the uptake of schooling was perhaps as low as one third and that many children never attended school. Despite the evidence of low participation in primary education, it was not recommended to make attendance compulsory. However in 1892 the Education (Ireland) Act, which was influenced by earlier legislation in England, made attendance at school compulsory in the urban areas for all children aged between six and fourteen years old. In 1898 compulsory attendance was extended to all areas of the country.

Although compulsory school attendance was initially opposed by the Catholic

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2Throughout the paper I am dealing exclusively with the Republic of Ireland.

3For a review of research in this area see Bradley and Whelan (1992).

4The brief historical summary in the text relies on Fahey (1992) and Curry (1993).
bishops as an unwarranted intrusion by the state into the domain of parental responsibility. Public opinion was increasingly behind stronger attendance laws and the newly independent Irish Free State reinforced the trend by enacting legislation in 1926 that required compulsory school attendance for 6 to 14-year olds for every day of the school year. The only concession made was to poor farming families, whose children could be absent from school for up to 15 days at both the spring and autumn peak seasons for farm work. To enforce the laws school attendance officers were appointed, the parents of truant children were visited, fines were imposed and as a last resort children were committed to industrial or reformatory schools, relatives or other "fit persons" if their parents were unable or unwilling to get them to attend. Fahey estimates that the proportion of families visited in connection with the enforcement of these provisions might have been as high as 15 to 20 per cent in the mid-1940s and comments school attendance enforcement introduced a regulation on families [in Ireland] that was unprecedented both in its scale of application and in the intrusive, coercive manner in which it affected families. (p. 383)

From the end of the nineteenth century onwards school attendance rates rose steadily. In the whole of Ireland, the average yearly attendance at primary schools was estimated as 63 per cent of the school-age population in 1902, rising to 76 per cent by 1908. In the Free State in 1926, just before the new legislation was introduced, average attendance was estimated at 68 per cent and by 1936 this had risen to 78 per cent. By the 1960s "non-enrolment in schools among children in the compulsory ages had become exceptional and average daily attendance rates had generally risen above 90 per cent" (ibid). Of course, it is impossible to say in what proportions this was due to coercion, increased provision of places and rising demand by parents.

The impact of the spread of the national primary educational system may be gauged from the fact that whereas in the Census of 1841 37 per cent of boys, and 42 per cent of girls, aged 11 to 15 years old could neither read nor write, by 1911 these proportions had fallen to 1.8 and 1.3 per cent.5 Not only is the absolute reduction in illiteracy, impressive, but it is also striking that the relative disadvantage of girls had been eliminated. It is significant too that the 1911 Census was the last in which information on literacy was collected.

State support for secondary education was introduced under the Intermediate Education Act of 1878; fees were paid to school managers on foot of the performance of their pupils in the state examinations, but schools had to rely heavily on students' fees to meet costs, with the result that the schools were concentrated in the more prosperous, urban areas. However, during the twentieth century the independent Irish state increased the financial support for secondary education. This trend culminated in the introduction of non-fee paying secondary schools for all in 1967-68.

One of the key features of the educational system that evolved between the mid-nineteenth century and today was that the majority of the schools were run and managed by religious orders and diocesan clergy with support from public funds. The curriculum, however, is determined by the requirement of preparing students for state examinations,
which is a condition for state aid. Over the years attempts at introducing an educational system outside religious control has not met with much success, the authorities and the vast majority of parents being generally content with the status quo. As the number of priests and nuns declined, however, the proportion of lay teachers increased and they now constitute the overwhelming preponderance of primary and secondary teaching staff.

Vocational or technical schools have never been under religious management or control to the extent that primary schools and traditional secondary schools were. It is often alleged that for this reason the religious establishment opposed the growth of a proper system of vocational education. The Vocational Education Act, 1930, provided for the establishment of thirty eight vocational educational committees as an adjunct of local government. The Catholic hierarchy was given assurances that the new branch of the educational system would not impinge on the fields covered by the existing, religiously-controlled secondary schools. Its dependence on local rates (property tax) ensured that it would remain the poor relation of the educational system. In effect, vocational education evolved as a class-segregated branch of the educational system, seen as suitable only for children of manual workers, and usually only the less gifted of these. Only in the 1970s did it begin to receive resources comparable with those available to the secondary branch.

Tussing (1978) drew attention to the paradox that a country as poor and agrarian as Ireland should have achieved relatively high educational standard by the early twentieth century. He suggested that this was made possible by the extraordinarily low cost of running the Irish educational system and offered three explanations for this. The first was that the Irish system was frugal in the extreme, with minimum expenditure on buildings, teachers' salaries and equipment. The second was the enormous interest by the Catholic clergy in education and the very substantial unpaid input by priests, nuns and brothers to organising and running the system. Finally, the emphasis of the curriculum on non-technical subjects also reduced the cost of the system. He pointed out that all three underpinnings of low-cost education were gradually being removed and that the real cost of maintaining existing levels of participation would rise very rapidly.

The extension of higher education beyond the relatively small elite attending Dublin University (Trinity College) was dogged by the religious question into the twentieth century. The Queen's Colleges in 1845, the Catholic University in 1854 and the Royal University in 1879 were precursors of the National University of Ireland which was founded in 1908 and facilitated the extension of university education to the growing Catholic middle classes.

The non-university third level system is essentially a creation of the 1960s and

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4After Independence, this was also the preference of members of the minority religions in the Free State/Republic of Ireland, who feared that a state-operated system, however secular in name, would in fact be Catholic in character.

5As Tussing pointed out, religious knowledge, Irish, English, History, Mathematics, Latin, Music (signing) and Greek, which occupied pride of place in the Irish curriculum, cost much less to teach than science subjects and modern continental languages.

6The Catholic hierarchy forbade their flock to send their children to Trinity College in 1875, and this ban was vigorously enforced in the Dublin area in the 1940s and 1950s.
1970s, building on existing technical and specialised institutions. This sub-sector has expanded rapidly, and now receives significant funding from European Community sources, which emphasis "training" as opposed to "education" in most of their programmes.

The salient features that emerge from this review of the evolution of the Irish educational system are (i) the rapid spread of basic education from the middle of the nineteenth century onwards, (ii) the unusual mixture of voluntary and state inputs to educational system, reflecting the strong influence of the religious on the primary and secondary branches, and (iii) the low status of vocational education and the minor role it played until recent years.

III. EDUCATION AND IRISH ECONOMIC DEVELOPMENT

Previous discussions of Ireland's economic performance have acknowledged in a general way the importance of education as a precondition for economic growth. Thus, for example, the Commission on Youth Unemployment, which reported in 1951,\(^5\) favoured the extension of compulsory education to older children on the grounds of the contribution which post-primary education can make indirectly towards increasing the prosperity of the country. The level of production in agriculture is low, due, we are informed, to a considerable extent to lack of application of modern technique. The farmer is as much alive to the profit motive as any other member of the community. If he has not hitherto adopted the most profitable technique, the fault is not entirely his; for the education of the majority of farmers has been inadequate... The over all efficiency of our other industries would, in our opinion, also be promoted if the worker commenced his career with a better basic education. Indeed we go so far as to say that, to obtain full advantage from the application of modern technical developments, industry requires an entrant with a post-primary education. (p. 17)

However, in view of the "very substantial difficulties to be overcome not only in the provision of accommodation and equipment, but even in the more important matter of the supply of experienced teachers" (p. 17), the Commission did not plump for raising the compulsory school-leaving age, recommending instead a gradual increase, on a local option basis, of part-time education for those aged 14 to 16 who had left school.

The Reports of the Commission on Emigration and Other Population Problems (1948-1954) also believed that education in industrial and agricultural techniques would "contribute to the improvement of the economy" (para. 445). However, it is interesting to note that even at this time, when secondary education was still largely restricted to a small

\(^{5}\)It was established in 1943 by the Minister for Industry and Commerce under the chairmanship of the Catholic archbishop of Dublin, Dr McQuaid. Perhaps because it took so long to report, it lost the services of three of its members due to death.
proportion of each generation, concern was expressed that too many young people were
being educated with a view to "white collar employment and professional careers" (para.
448), whilst it was noted that "there is general agreement that there can be hardly too
much vocational or technical education for young people and adults" (para. 449). Some
concern was expressed at the high proportion of university graduates who emigrated (para.
451).

review of the reasons for Ireland's economic stagnation during the 1950s. The implicit
economic model used was a Harrod-Domar growth model, in which the savings ratio and
the productivity of capital are the key determinants of the rate of growth. That the Irish
rate of savings was low by Western European standards in the 1950s "requires little
demonstration" (p. 35). This problem was compounded by the allocation of too large a
proportion of the available funds to "non-productive" uses, such as housing and social
infrastructure. In view of the urgent claims of consumption on income, whose level per
capita was very low, the scope for raising the domestic savings ratio was believed to be
limited, so the main hope of channelling additional funds into productive projects lay in
curtailing non-productive investment.\footnote{Some limited borrowing from external sources, primarily international institutions, was also envisaged.} An avenue through which this might be
accomplished was a reduction in spending on school building, which was included among
the non-productive uses of savings. Clearly, investment in education was not accorded a
high priority in this important review of the reason's for Ireland stagnation during the
1950s.

At this time agriculture was still viewed as the engine that would have to pull the
economy out of its stagnation, and in the chapters dealing with agriculture considerable
attention was paid to the importance of appropriate vocational training and education as a
way of raising the standard of Irish farming skills. The low status of vocational education
in general, and instruction in agricultural skills in particular was deplored:

Agriculture has for too long been the Cinderella of the educational
household, from primary school to university. Unless we are prepared to
accept indefinitely the consequences of this--a rather low standard of
production, and therefore of living, compared to most of Europe, and a
common tendency to regard farming as an occupation inferior to that of
clerk--it is of paramount importance that this most fundamental problem be
tackled now. (p. 109).

A similar note was struck, but more tentatively, in the discussion of industrial policy:

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 research in
scientific subjects. . . The place of vocational education itself in the life of the nation requires careful examination. . . Care must be taken, however, that the fundamental education given in these [vocational] schools is not swamped by purely technical training and instruction, important though these are. . . (pp. 161-164.)

Thus commentaries assigned a relatively minor to education as a factor in economic development in the early post-war years and as a corollary of this most discussions of Irish education devoted relatively little attention to its potential economic importance. For example, a report prepared by the Council of Education as late as 1962 stressed that even for the teaching of scientific subjects "the aim is cultural rather than practical" (cited in Sheehan, 1989).

A significant change of attitude is evident in the OECD-initiated and financed Report *Investment in Education* (the title itself is revealing), published in 1965. This document highlighted the deficits in Irish educational resources, which were blamed for the large disparities between social classes in participation in second and third level education and for a shortfall in the flow of qualified manpower onto the labour market. It was stated that a rapid rate of economic growth could not be sustained without a major injection of additional resources into the educational system. The publication of this report played a major role in the extension of free post-primary education in 1967/68 and the subsequent increase in the resources devoted to education.

Later documents setting out the government’s priorities in the economic field followed fairly closely the approach of the 1958 White Paper. The contribution of education to economic development was seen mainly as a by-product of specialised vocational education, which would raise the skills of the industrial labour force; raising the low skill level of the agricultural labour force was seen primarily as a task for various types of adult education extension programmes. Wider access to education was acknowledged mainly as a social objective, albeit one deserving a high priority.

Only from the 1980s onwards is an explicit emphasis apparent on the need to guide educational resource allocation in accordance with the manpower requirements of the economy. However, the wheel has turned full circle now, and in recent years the belief has gained ground that Ireland's failure to produce a successful indigenous business sector, and continued reliance on grant- or tax-aided foreign investment, is a reflection of the value system inculcated in Irish schools. Thus, for example, the most recent of many reviews of Irish industrial policy, known as *The Culliton Report*, (Report of the Industrial Policy Review Group, 1992), asserted 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

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11These apparent shortages arose in a context of continuing heavy net emigration from Ireland. In the past this emigration had served mainly as a vent for surplus unskilled labour, but the average quality of the emigrants rose markedly during the 1960s.
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)

In fact, the factual basis for these assertions is shaky. There is no evidence of crowding out or of a drift towards liberal arts or professional qualification (Sheehan, 1992 and section IV, below). None the less, recent pronouncements on educational policy echo these views. The Green Paper Education for a Changing World published in 1992 set the following goals, among others, for the educational system:

Irish education, particularly now, must equip students so that they have the best chance of entering employment or of making a successful career in self-employment.

In the business world there is wide recognition that many Irish young people tend to lack:

* The range of technical skills needed in today’s industry;
* The communication and other interpersonal skills sought by employers;
* The critical thinking, problem-solving ability and individual initiative that an enterprise culture requires;
* The language skills to work and win markets across the EC, and to take part in tourism-related activities. (p. 11)

The overall impression conveyed by these commentaries is that, now as in the past, there is less need to expand the level of national resources allocated to education, compared with that of altering the content of the educational curriculum so that it is better attuned to the needs of the economy. The trend away from traditional liberal subjects is also reinforced by the substantial financial assistance the European Community offers to national "training" (as distinct from "educational") efforts.

### IV. THE RATE OF HUMAN CAPITAL ACCUMULATION IN IRELAND

As we have noted, by the beginning of the twentieth century the Irish population was well-educated relative to the country’s level of economic development. This view

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12However, in an echo of earlier debates, the Catholic hierarchy, in their comments on the 1992 Green Paper on education, were critical of the emphasis on an "entrepreneurial ethos" in the schools.
was held by commentators even when considering problems such as youth unemployment. For example, the Commission on Youth Unemployment stated:

In this country the view has been held, and in our opinion rightly held, that the standard of education of our people compared not unfavourably with that of the peoples of other countries. We keep abreast of educational developments elsewhere. (p. 17)

None the less, most children still left school at age 14, only a small elite finished secondary education or went on to university and the schooling received by most was perhaps too "academic" rather than vocational or practical. Moreover, there was (and still is) the complication that since Independence considerable educational resources have been devoted to reviving the Irish language. Although the vast majority of children come from homes where no Irish is spoken or even comprehended, all have to spend many hours a week on the study of the language and, more often in the past than now, receive some of their instruction in other subjects through its medium.  

A major expansion in the rate of human capital accumulation occurred in Ireland during the post-war period, particularly after 1960. This may be seen from Table 1 which shows the proportion of the 14-19 age group classified as "at school or students" in successive censuses. The sharp increase in educational participation during the 1960s reflects the introduction of non-fee-paying secondary schools in 1968. The effect of this on the age at which young people finished their schooling is also clear from census data, which since 1966 have provided details of the age at which the population finished their full-time education.

<table>
<thead>
<tr>
<th>Year</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>23.4</td>
</tr>
<tr>
<td>1961</td>
<td>36.6</td>
</tr>
<tr>
<td>1971</td>
<td>52.2</td>
</tr>
<tr>
<td>1981</td>
<td>62.2</td>
</tr>
</tbody>
</table>

Table 1: Proportion of the Population aged 14-19 Classified as "At School or Students" in the Census of Population.

<table>
<thead>
<tr>
<th>Year</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960/61</td>
<td>20.0</td>
</tr>
<tr>
<td>1982</td>
<td>15.2</td>
</tr>
<tr>
<td>1990</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Table 2: Proportion of school-leaving cohort with no formal qualifications

Source: OECD, 1966, Chapter 6 and Department of Labour (1982 and 1990)

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13The satirist Brian O’Nolan, also known as Myles na gCopaleen, jibed that the Irish educational system produced children illiterate in two languages.
The problems faced by early school-leavers and those who have not acquired any formal qualifications on entry to the labour market are well-known. It may be seen from Table 2 that in the early 1960s a sizeable minority of the Irish population & 2 was leaving the school system without completing a basic education or acquiring a formal qualification. By the 1980s the age of compulsory education had been extended to 16 and the proportion of school leavers without educational qualifications had fallen sharply. At the same time level qualifications increased from 10.7 per cent of labour force entrants in 1982 to 19.8 per cent in 1990 (Department of Labour and Higher Education Authority, 1982 and 1990). Figures 1 and 2 show that among those aged 20-24 at the time of the census, the modal age of school-leaving was "under 15" in 1966, but by 1981 this had risen to age 17-19. The smaller proportion of young women than men finishing their education at an early age is also apparent.

<table>
<thead>
<tr>
<th>Year</th>
<th>Real Current Expenditure</th>
<th>Index of School-aged population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Index</td>
<td>Percent of GNP</td>
</tr>
<tr>
<td>1962</td>
<td>100.0</td>
<td>3.1</td>
</tr>
<tr>
<td>1967</td>
<td>135.5</td>
<td>3.8</td>
</tr>
<tr>
<td>1972</td>
<td>208.2</td>
<td>4.9</td>
</tr>
<tr>
<td>1977</td>
<td>271.4</td>
<td>5.9</td>
</tr>
<tr>
<td>1982</td>
<td>316.6</td>
<td>6.4</td>
</tr>
<tr>
<td>1987</td>
<td>344.5</td>
<td>6.8</td>
</tr>
<tr>
<td>1989</td>
<td>310.7</td>
<td>6.4</td>
</tr>
</tbody>
</table>


Finally, there was a three-fold increase in the real volume of spending (including public and private sources of funds) between 1962 and 1989 and a doubling of the proportion of GNP allocated to education (Table 3). This more than matched the growth in the school-aged population, which increased by 25 per cent between the beginning of the 1960s and of the 1980s, but has declined since then.
these indicators of human capital formation—enrolment, school-leaving age and expenditure—do not provide any information on the quality of the education. Undoubtedly a significant proportion of the rise in expenditure on education reflected higher teachers' income and lower pupil/teacher ratios, as well as a shift towards more expensive areas of instruction such as technical and scientific subjects and modern languages. Nor can it be ruled out that the rise in the participation led to a fall in the private and/or social returns to education. The extension of post-primary education to a larger proportion of the population could have resulted in a decline in the average ability of the students. However, available evidence does not indicate that the private returns to education have declined over the period since the first estimates were prepared. A comparison of the effects of education on earnings in 1972 with those estimated for 1987 shows no reduction in the return to additional years of education over this interval.

This contrasts with the fall in education differentials documented by Davis (1992) for several countries. Furthermore, very large differentials in unemployment rates by level of education have also persisted in Ireland, with those leaving school without qualifications

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14 The participation rate of children from lower social classes in post-primary education increased dramatically between 1960 and 1980, but it remains much lower than that of children from the higher income and professional classes, which led one set of commentators to conclude, perhaps too bluntly, that "little headway has been made in terms of the lessening of class disparities in educational outcome" (Breen, Hannan, Rottman and Whelan, 1990, p. 133.)

15 Callan and Whelan (1976).

16 Callan and Wren (1993).
Table 4: Relative Earnings of 45-64 Year Olds Classified by Educational Level  
(second level = 100)

<table>
<thead>
<tr>
<th>Country</th>
<th>Lower Secondary</th>
<th>Higher Education (Non-university)</th>
<th>Higher Education (University)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>75</td>
<td>103</td>
<td>146</td>
</tr>
<tr>
<td>Canada</td>
<td>92</td>
<td>116</td>
<td>175</td>
</tr>
<tr>
<td>Denmark</td>
<td>85</td>
<td>100</td>
<td>145</td>
</tr>
<tr>
<td>Finland</td>
<td>94</td>
<td>131</td>
<td>189</td>
</tr>
<tr>
<td>Ireland</td>
<td>76</td>
<td>135</td>
<td>195</td>
</tr>
<tr>
<td>Netherlands</td>
<td>86</td>
<td>123</td>
<td>178</td>
</tr>
<tr>
<td>Sweden</td>
<td>90</td>
<td>116</td>
<td>153</td>
</tr>
<tr>
<td>U.K.</td>
<td>84</td>
<td>131</td>
<td>163</td>
</tr>
<tr>
<td>U.S.</td>
<td>64</td>
<td>132</td>
<td>190</td>
</tr>
</tbody>
</table>

Note: Data refer to period 1985-89, depending on country.  
No controls for experience, industry, or other relevant variables are included.  


spending much more of their time in unemployment than is the case for those with qualifications. Finally, the data in Table 4 show that the incremental earnings associated with higher levels of education are as high, if not higher, in Ireland than in other countries for which apparently comparable data are available.

IV. IRELAND'S GROWTH: THE CONTRIBUTION OF HUMAN CAPITAL

Dr Johnson remarked that the Irish are a very fair-minded people, they never speak well of one another. Perhaps this has something to do with the fact that most Irish economic and social commentaries bemoan the country's poor performance throughout the

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period since Independence. However, as we shall see in this section, establishing the true situation with regard to Ireland’s relative economic performance is not a straightforward issue.

The high emigration recorded during the 1950s, which caused Ireland’s population to decline at a time when the rest of western Europe was growing quite vigorously, is usually taken as conclusive evidence of the lack dynamism of the Irish economy. But even Ireland’s post-war population history can be interpreted in a more favourable light. While it is true that the stagnation of the country’s population between 1951 and 1971 was unique, over the post-war period as whole the population increased by almost 20 per cent, which is roughly the same percentage increase as was recorded in Belgium, Denmark, Portugal and Sweden. Ireland’s high emigration for the most part only offset the country’s exceptionally high rate of natural increase (see Ó Gráda and Walsh, 1993). Furthermore, the population decline was confined to the rural areas: the urban population increased throughout the post-war period, indeed it has grown between each census since 1901, and is now two million compared with just under one million at the time of Independence.

Data on the growth of GDP (total, not per capita) show that the Irish economy grew more rapidly than the OECD as a whole during the 1970s, but less rapidly during the 1950s, 1960s and 1980s. If we confine attention to the years since 1960s, for which reliable estimates of GDP are available, it is instructive to relate the behaviour of Irish output to that of the OECD, of which it forms a tiny part. (In 1991 Ireland’s GDP amounted to one quarter of one percent of the OECD total.) Table 5 reports the results obtained from estimating an error correction model of the Irish growth rate as a function of the OECD or the UK growth rate over the period 1960-91. It is striking that a better fit is obtained when the OECD growth rate, rather than that of the UK, is used. The opening up of the economy to free trade in the 1960s, and the growing importance of European and wider influences on the economy is reflected in the relatively weak association between British and Irish growth rates. On the other hand, the data accept the restriction that the coefficients of the Irish and OECD growth rates are equal, which means that we cannot reject the hypothesis that the Irish economy has responded, albeit with lags, pari passu to OECD growth over these thirty years.

While the fact that Ireland performed in line with the OECD as a whole runs counter to the gloomier views of our relative performance, the lack of evidence of catching-up or convergence is disappointing: Ireland’s GDP per person was one of the lowest in the OECD in 1960, and remained close to the bottom of the league table in

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18The latest contribution in this tradition, however, is by a Norwegian, commissioned by the National Social and Economic Council (NESC) to compare Ireland’s performance with that of Austria, Denmark, Finland, Sweden and Switzerland: see Mjøset (1992).

19Irish national accounts estimates continue to be plagued by problems arising in part from the openness of the economy and the persistence of large unrecorded flows across the balance of payments. Even following recent revisions, the net residual or balance of the combined current and capital accounts, amounted to almost +6 per cent of GDP in 1990.

20The variables are I(0).
Table 5: Error Correction Model of Irish Growth Rate ($y_{IRL}$), OECD Growth Rate ($y_{OECD}$) and British Growth Rate ($y_{UK}$), 1960-1991

Dependent variable = $\Delta y_{IRL}$.

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.0058</td>
<td>0.0116</td>
<td>0.0169</td>
<td>0.0157</td>
</tr>
<tr>
<td></td>
<td>(0.58)</td>
<td>(0.90)</td>
<td>(1.86)</td>
<td>(1.52)</td>
</tr>
<tr>
<td>$\Delta y_{OECD}$</td>
<td>0.4673</td>
<td>0.6045</td>
<td>(2.32)</td>
<td>(2.97)</td>
</tr>
<tr>
<td></td>
<td>(2.32)</td>
<td>(2.97)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(y_{OECD})_{t-1}$</td>
<td>0.5399</td>
<td>0.8538</td>
<td>(2.32)</td>
<td>(3.15)</td>
</tr>
<tr>
<td></td>
<td>(2.32)</td>
<td>(3.15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta y_{UK}$</td>
<td>0.2441</td>
<td>0.2488</td>
<td>(1.31)</td>
<td>(1.30)</td>
</tr>
<tr>
<td></td>
<td>(1.31)</td>
<td>(1.30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(y_{uk})_{t-1}$</td>
<td>0.3682</td>
<td>0.3762</td>
<td>(1.53)</td>
<td>(1.52)</td>
</tr>
<tr>
<td></td>
<td>(1.53)</td>
<td>(1.52)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(y_{IRL})_{t-1}$</td>
<td>-0.6560</td>
<td>-0.7667</td>
<td>(3.56)</td>
<td>(4.18)</td>
</tr>
<tr>
<td></td>
<td>(3.56)</td>
<td>(4.18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC</td>
<td>0.0128</td>
<td>0.0016</td>
<td>(1.98)</td>
<td>(0.26)</td>
</tr>
<tr>
<td></td>
<td>(1.98)</td>
<td>(0.26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.41</td>
<td>0.47</td>
<td>0.31</td>
<td>0.28</td>
</tr>
<tr>
<td>$F$ test for residual serial correlation</td>
<td>4.0987</td>
<td>0.9515</td>
<td>3.43</td>
<td>3.53</td>
</tr>
<tr>
<td></td>
<td>[p=0.054]</td>
<td>[p=0.339]</td>
<td>[p=0.076]</td>
<td>[p=0.060]</td>
</tr>
<tr>
<td>Wald test ($\chi^2$) for restriction of equality of coefficients on $X$, $Y$</td>
<td>0.2086</td>
<td>0.1106</td>
<td>1.38</td>
<td>3.72</td>
</tr>
<tr>
<td></td>
<td>[p=0.648]</td>
<td>[p=0.739]</td>
<td>[p=0.24]</td>
<td>[p=0.054]</td>
</tr>
</tbody>
</table>

Notes:
- t-ratios in parentheses.
- $X$, $Y$ refer to real GDP.
- $EC$ is a dummy variable for EC membership, taking the following values: 1960-69=0, 1970=0.25, 1971=0.5, 1972=0.75, 1973-87=1, 1988-91=2.
1991. It is, however, interesting to note that there was an improvement in the country’s performance since joining the European Community, which added 1.3 per cent to the annual growth rate for the period 1973-88 and 2.6 per cent in the last three years.²¹

Because of the openness of the economy and the importance of factor income flows across the balance of payments, the choice of the output or income variable on which to base a comparison of Ireland’s recent economic performance is not straightforward. Both net factor income and net transfer payment from the rest of the world have an exceptional impact on Irish living standards. The relationship between the different measures of national income has changed dramatically over the period since 1968 (the first year for which estimates of Gross National Disposable Income were published), as maybe seen from Table 6. Both GNP and GNDI have grown less rapidly than GDP since the 1960s. The main reason for this is the reversal of the net inflow of factor income from abroad, which amounted to +2 per cent of GDP in 1968 but -12 per cent in 1985. The net outflow now occurring is comprised of about equal amounts of interest on the national debt and profit repatriation by foreign-owned companies. The net inflow of current transfers has risen from 3 to 6 per cent of GDP and its principal component has changed from emigrants’ remittances to EC current grants.²²

Recent growth literature has highlighted the importance of controlling for the level of human capital, or the rate of its accumulation, when studying the convergence issue. The recent studies by Barro (1991) and Mankiw, Romer and Weil (MRW) (1992) report highly significant results from the inclusion of human capital variables in cross-country econometric studies of (i) the level of income per person and (ii) the growth rate of income per person. Both studies use various school-enrolment data as proxies for the rate of human capital accumulation.²³

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>1985</td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>GNP</td>
<td>102</td>
<td>89</td>
</tr>
<tr>
<td>GNDI</td>
<td>105</td>
<td>94</td>
</tr>
</tbody>
</table>

²¹The definition of the EC variable allows for an anticipation of the effects of member before 1973 and the increased transfers after 1988.

²²Capital grants amounted to an additional 1.3 per cent of GDP in 1991.

²³Both studies acknowledge the crudeness of the measures of human capital used, which rely entirely on school enrolment data, and omit third level education. Barro tried some refinements to measure the quality of the schooling.

²⁴The enrolment rate would only be a valid measure of the stock of human capital if it had been stable for a long time.
Very significant coefficients are obtained for these variables in regressions with the growth rate in real per capita income 1960-85 as dependent variable. This is interpreted as showing that "for a given starting value of per capita GDP, a country’s subsequent growth rate is positively related to these measures of initial human capital" (p. 409). He also finds that, provided the initial level of human capital is controlled, "higher initial per capita GDP is substantially negatively related to subsequent per capita growth" (p. 415).

Barro notes that the level of human capital in some groups of countries helps explain some well-known features of comparative economic performance. For example, the high level of human capital, relative to initial levels of GDP, in many of the Pacific rim countries may account for their subsequent rapid growth, and the low level, relative to GDP, in many sub-Saharan African countries may explain their poor performance.

Table 7: Educational Participation as a Function of Income

Dependent variable = ln(SCHOOL)
Sample = 22 OECD countries

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONSTANT</strong></td>
<td>-0.629</td>
<td>-1.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.57)</td>
<td>(0.94)</td>
<td></td>
</tr>
<tr>
<td>ln(GDPAV)</td>
<td>0.307</td>
<td>0.346</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.54)</td>
<td>(2.95)</td>
<td></td>
</tr>
<tr>
<td><strong>IRL</strong></td>
<td>0.394</td>
<td>0.394</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.75)</td>
<td>(1.75)</td>
<td></td>
</tr>
<tr>
<td><strong>R^2</strong></td>
<td>0.21</td>
<td>0.28</td>
<td></td>
</tr>
</tbody>
</table>

Note: t-ratios in parentheses.

\[ GDPAV = \text{average level of constant price GDP, 1960 and 1985.} \]

For definition of SCHOOL see MRW.

The SCHOOL data used by MRW to proxy \( s_1 \) may be used to establish whether the rate of human capital formation in Ireland is unusual by international standards. They define this variable as the ratio of those aged 12 to 17 enrolled in school to the working age population, averaged over 1960-85. The value of SCHOOL given by MRW for Ireland, 11.4, is surpassed only by seven values\(^{25}\) in the sample of 121 countries included

\(^{25}\)Those for Bahrain, Finland, Barbados, Guyana, Panama, the United States and New Zealand.
in the study. To assess whether Ireland’s rate of human capital accumulation is exceptionally high SCHOOL has been regressed on the average level of GDP, GDPAY, for the OECD countries included in the MRW study. The results shown in Table 7 are suggestive but inconclusive. The association between the educational and income variables is highly significant and the coefficient on the dummy variable for Ireland, IRL, is positive but significant only at the 10 per cent level. Thus, there is some evidence that Ireland’s rate of human capital formation was exceptionally high in relation to the level of income.

The MRW study is grounded in the tradition of the Solow exogenous growth model. One of its aims is to defend the claims of models with decreasing returns to capital over those of endogenous models which assume constant or increasing returns to capital. What is important from our perspective is that the former predict that income levels converge over time; there is no such tendency in the latter, where differences among countries in income per capita can persist or even increase over time. However, the MRW model predicts convergence only after controlling for the determinants of a country’s steady state level of income. Moreover, they argue that the textbook Solow growth model should be expanded to take account of human, as well as physical, capital accumulation. They conclude that "using even an imprecise proxy for human capital, we are able to dispose of a fairly large part of the [textbook Solow] model’s residual variance" (p. 421) and that, when the influence of population growth and capital accumulation are taken into account, countries with lower initial levels of income have grown faster over the period 1960-85. Thus, both the Barro and the MRW models predict convergence conditional on the level of human capital accumulation. Given its low initial level of output per capita and level of human and physical capital formation, the implications are positive for Ireland.

In the original Solow model, the economy moves to the steady state consistent with its savings rate (s or I/Y), rate of population growth (n), depreciation rate (δ) and rate of technological progress (g). MRW extend the savings rate, s, to include both physical capital accumulation, s_p, which they measure as the investment ratio, I/Y, and the rate of human capital accumulation, s_h. They therefore estimate the following model:

\[
\ln(y) = a - (\alpha + \beta)/(1 - \alpha - \beta)\ln(n + g + \delta) \\
+ \alpha/(1 - \alpha - \beta)\ln(s_p) + \beta/(1 - \alpha - \beta)\ln(s_h)
\]

where \( y \) = steady-state income per worker and \( \alpha, \beta \) are the exponents of physical and human capital in the production function, respectively.

They also estimate a conditional convergence model, in which the growth of income is a function of the initial level of income, \( y_o \), and the determinants of the steady state, \( (n + g + \delta), s_p \), and \( s_h \):

They define SCHOOL as the ratio of the school-going population aged 12-17 to the working-age population. If all those aged 12-17 were at school, this ratio would be just over 16 per cent in Ireland. The highest value in the MRW sample is 12.1 per cent (Bahrain and Barbados).
\( \ln \left( \frac{y_8}{y_{60}} \right) = a + b \ln(n + g + \delta) + c \ln(s_8) + d \ln(s_{60}) + e \ln(y_{60}) \)

where the parameters of (2) equal the corresponding parameters of (1) multiplied by \(- (1 - e^{-\lambda})\), where \(\lambda\) is the rate at which the economy moves towards its steady-state.\(^{27}\) The Solow model predicts that a higher savings ratio leads to a higher steady state level of income per person. In the augmented MRW model, higher rates of human capital accumulation also lead to higher steady state income levels.

A number of potential problems should be considered when this model is applied to the Irish economy. The first is the use of the investment ratio to measure the savings ratio, which is common in studies of this type and justified by appealing to the Feldstein-Horioka thesis that national investment is strongly correlated with national savings. In fact, however, the Irish case is a distinct exception to this "law". Honohan (1992) has shown that national savings and investment are only weakly correlated in Ireland due to the size and volatility of the current account of the balance of payments. In the early 1980s, the current account deficit reached 15 per cent of GNP, whereas by 1993 it is projected that there will be a surplus of over 8 per cent. The unusually weak correlation of national savings and investment in Ireland might result in it being an outlier in models that treat \(I/Y\) as equivalent to \(S/Y\).

Secondly, the model may also be affected by the fact that the determinants of the steady state level of income, especially \(s_8\) and \(s_{60}\), were strongly trended in Ireland over the period 1960-85. Is the relevant steady-state GDP for Ireland that associated with the initial or terminal year level of these variables? The reported elasticity of GDP with respect to \(SCHOOL\) (the measure of \(s_8\) used by MRW) is 0.66, so that the steady state GDP associated with its end-of-period level would be two-thirds higher than that associated with the start-of-period level. Similarly, \(I/Y\) (the ratio of physical capital formation to GDP, which is the measure of \(s_8\) used) was much higher towards the end of the period than at the beginning, rising from 16.5 per cent of GDP in 1960 to a peak of 28.4 per cent in 1981. For OECD countries MRW estimate \(\lambda = 0.0173\), which implies a rate of convergence to the steady state of 1.7 per cent a year. Thus it would take an economy over forty years to move halfway between an initial level of income and the steady state. If the determinants of the steady state change very substantially over much shorter periods, there must be a question of the relevance of the concept for empirical analysis.\(^{28}\)

Finally, the treatment of the growth of the labour force, \(n\), as an exogenous variable is questionable in the case of a small economy with an open labour market. In Ireland the growth of the labour force is clearly not exogenous, but to a large extent a reflection of how the economy is performing. Despite the fact that the potential (that is, in the absence of net migration) growth rate of the Irish labour force has been the range 1.0 to 1.5 per cent a year since 1951, the actual growth rate has fluctuated very widely as

\(^{27}\)Note that \(\lambda = (n + g + \delta) (1 - \alpha - \beta)\).

\(^{28}\)The problem is lessened, but hardly removed, by averaging the variables over the period, as is done by MRW.
may be seen from the following table:

<table>
<thead>
<tr>
<th>Table 8: Annual average growth rate of Irish labour force</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951-61</td>
</tr>
<tr>
<td>1961-71</td>
</tr>
<tr>
<td>1971-81</td>
</tr>
<tr>
<td>1981-91</td>
</tr>
</tbody>
</table>

The disparity between the actual and potential growth of the active population reflected the rate of net external migration, which was heavily influenced by the relative performance of the Irish economy. The endogeneity of the growth rate of the labour force has been neglected in most empirically-estimated growth models.  

With these caveats in mind, the remainder of this section is concerned with evaluating whether Ireland constitutes an outlier from the sample of developed countries studied by MRW. Bearing in mind the high level of SCHOOL for Ireland, it seems that not only did Ireland fail to catch up over the period 1960-85 with countries that started from higher levels of income per person, but also the country failed to achieve the growth rate that would have been expected on the basis of its relatively high rate of human capital accumulation. These issues can be explored more formally by re-estimating the MRW model of steady-state income (Table 9) and their tests for conditional convergence (Table 10), concentrating on the 22 OECD countries. In both equations the coefficient of IRL is negative. It is significant at the 10 per cent level in Table 9 but just short of this in Table 10. If however GNP is substituted for GDP for Ireland, on the grounds that it is the more relevant index of economic performance (see Table 6, above), the IRL variable becomes significant at the 5 per cent level. There is, therefore, some evidence that Ireland underperformed over the quarter of a century studied by MRW, in the sense that the level of GDP per adult reached in 1985 was lower than would have been expected on the basis of its initial level in 1960, the rate of growth of the labour force and the rates of human and physical capital formation. Moreover, it is interesting to note that the inclusion of IRL in these equations has a more marked effect on the coefficient of SCHOOL than on those of the other variables. The effect of including Ireland is to lower the estimated elasticity of GDP with respect to human capital formation from 0.88 to 0.77.

In interpreting this finding, however, the influence of the factors mentioned above (the endogeneity of the rate of growth of the labour force, the at times marked divergences between the national savings and investment ratios, and the marked upward trend in the human and physical capital formation rates over the period) should be borne in mind. They could account for the tendency of Ireland to be an outlier from the sample of

---

30The model by Dolado, Goria and Ichino (1993) discussed below endogenises the growth rate of the labour force by incorporating a model of migration.

31The data contained in the MRW Appendix was used and their results replicated except for the intercept terms. They appear to have used the log to base 10 for their dependent variables, but the natural log for their regressors.
Table 9: Re-estimation of MRW's Augmented Solow Model for Steady State Level of Output Per Capita

Sample = 22 OECD countries
Dependent variable = lnGDP85

<table>
<thead>
<tr>
<th></th>
<th>Estimate 1</th>
<th>Estimate 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.69</td>
<td>3.69</td>
</tr>
<tr>
<td></td>
<td>(1.59)</td>
<td>(1.59)</td>
</tr>
<tr>
<td>ln(I/Y)</td>
<td>0.28</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>(0.71)</td>
<td>(0.72)</td>
</tr>
<tr>
<td>ln(n+g+δ)</td>
<td>-1.08</td>
<td>-1.06</td>
</tr>
<tr>
<td></td>
<td>(1.42)</td>
<td>(1.49)</td>
</tr>
<tr>
<td>ln(SCHOOL)</td>
<td>0.77</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>(2.62)</td>
<td>(3.11)</td>
</tr>
<tr>
<td>IRL</td>
<td>-0.59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.82)</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.24</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Notes:
t-ratios in parentheses.

GDP85 is real GDP per adult 1985.
I/Y is gross investment as a percentage of GDP, average of 1960 and 1985
n = the rate of growth of the working-age population 1960-85,
g + δ assumed equal to 0.05 for all countries.

developed countries over the period.

The Barro and MRW studies treat education at a very aggregate level. Other studies, Murphy, Shleifer and Vishny (MSV) (1992) for example, have focused on the composition of education as a factor explaining differential growth performance. As we have seen, this has also been the focus of much discussion in Ireland. Starting from the proposition that talented people contribute to growth by innovating and organising production, but retard growth when they devote their energies to rent seeking, MSV identify engineering with productive activities and the legal profession with rent-seeking. Taking college students as the talented elite, they use
Table 10: Re-estimation of MRW's Tests for Conditional Convergence

Sample = 22 OECD countries

Dependent variable = ln(GDP85/GDP60)

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.18</td>
<td>0.31</td>
</tr>
<tr>
<td>ln(GDP60)</td>
<td>-0.40</td>
<td>-0.43</td>
</tr>
<tr>
<td>ln(I/Y)</td>
<td>0.33</td>
<td>0.32</td>
</tr>
<tr>
<td>ln(n+g+δ)</td>
<td>-0.86</td>
<td>-0.87</td>
</tr>
<tr>
<td>ln(SCHOOL)</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>IRL</td>
<td>-0.25</td>
<td></td>
</tr>
</tbody>
</table>

\[ \hat{R}^2 = 0.65 \quad 0.68 \]

Notes:
- t-ratios in parentheses.

*GDP85* is real GDP per adult 1985.

*GDP60* is real GDP per adult 1960.

*I/Y* is gross investment as a percentage of GDP, average of 1980-85.

\[ n = \text{the rate of growth of the working-age population 1960-85,} \]

\[ g + \delta \text{ assumed equal to 0.05 for all countries.} \]
data on the proportions of students enrolled in law and engineering to extend Barro’s results to show that the distribution of students between disciplines, as well as the overall level of education, influences economic performance. Their hypothesis is that, other things equal, higher proportions of lawyers, and lower proportions of engineers, retard economic development. The mean proportion of engineers among college students was 10.4 and of lawyers 8.9 in the sample of countries studied by MSV. The available data for Ireland, summarised in Sheehan (1992), show that engineers constituted 9.3 per cent of the outflow from Irish universities in 1980 and 13.8 per cent in 1988. Lawyers, on the other hand, declined from 3.8 per cent of the total in 1980 to 2.9 per cent in 1988. More refined comparisons suggest that Ireland has a rate of output of graduates in the scientific and technological areas broadly similar to that of the major OECD countries with the exception of Japan (Table 11).

Table 11: Outflow from the Higher Education System

<table>
<thead>
<tr>
<th>Country</th>
<th>Natural Sciences</th>
<th>Engineering</th>
<th>Mathematical Sciences</th>
<th>Graduates as % of Cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>3.1</td>
<td>23.0</td>
<td>n.a.</td>
<td>26.3</td>
</tr>
<tr>
<td>USA</td>
<td>5.5</td>
<td>8.7</td>
<td>4.8</td>
<td>25.6</td>
</tr>
<tr>
<td>Germany</td>
<td>7.8</td>
<td>18.7</td>
<td>2.8</td>
<td>13.3</td>
</tr>
<tr>
<td>France</td>
<td>10.4</td>
<td>21.6</td>
<td>7.7</td>
<td>12.1</td>
</tr>
<tr>
<td>N’thlands</td>
<td>8.3</td>
<td>15.1</td>
<td>1.4</td>
<td>11.4</td>
</tr>
<tr>
<td>Denmark</td>
<td>5.8</td>
<td>18.7</td>
<td>1.3</td>
<td>10.1</td>
</tr>
<tr>
<td>Ireland</td>
<td>14.1</td>
<td>12.3</td>
<td>2.6</td>
<td>19.2</td>
</tr>
</tbody>
</table>


It should be borne in mind, however, that the structure of the educational system, especially at higher levels, reflects influences from both the demand and supply side of the market. MSV use the proportion of lawyers as a measure of talent allocated to rent-seeking and of engineers of talent allocated to entrepreneurship. But when the number of entrants to a profession is rationed, abnormal profits may arise and competition for the limited number of places available may drive the average academic standard above the level required by the intrinsic difficulty of the course of study, with adverse implications for the allocation of talent. In Ireland the number of places in law and medical schools are severely limited by *numerus clausus* and these disciplines attract students with high scores on their secondary school examinations; the sciences and the liberal arts, where more places are available, accept students whose average academic standard is lower than would gain admission to the restricted disciplines. Engineering lies somewhere in between. This feature of the educational system may affect the allocation of talent in a
manner not reflected in data on the composition of educational flows. However, despite this caveat, we can be reasonably sure that the subject-mix of the Irish educational system is not exceptional compared with that of other OECD countries and hence would not account for the country's relatively poor growth record over the post-war period.

Another recent study provides us with a further opportunity to assess Ireland's performance in a comparative perspective. In his case study of the economic performance of Hong Kong and Singapore, Young (1992) concludes:

The early educational superiority of the Hong Kong labor force, when combined with the economy's higher rate of TFP growth, provides further evidence, in addition to that garnered in numerous cross-national regressions, in favor of models of endogenous technical change that emphasize the supply of human capital as determining the ability of an economy to absorb new technologies (p. 45).

He finds corroboration for this view in the fact that when the regression \( \ln(O/L) = \alpha + \beta \ln(K/L) \) is estimated for a large sample of countries, the Hong Kong estimate for \( \beta \) is 0.81, one of the largest of any country in the world. The estimate of \( \beta \) for Singapore is only 0.39, just equal to the share of capital in its national income. Given that Hong Kong relied largely on endogenous capital accumulation, whereas in Singapore capital increased exogenously due to direct foreign investment and government targeting, the low estimate of \( \beta \) for Singapore is taken as evidence that the supply of human capital determined the ability of an economy to absorb new technologies and to reap the positive externalities associated with them.

The value of \( \beta \) reported by Young for Ireland is 0.47, which is 17th out of the 22 countries with good quality data in the study, and much closer to Singapore than Hong Kong. Perhaps this is unsurprising in that Ireland resembles Singapore more than Hong Kong in (i) not having experienced an a large inflow of educated migrants, (ii) relying heavily on exogenous capital formation (represented by branch plants of multinational corporations) and (iii) having a public sector that directly or indirectly controls a large proportion of total capital formation. 31

It is also natural to consider a possible role for migration in explaining the relatively poor performance of the Irish economy over the years. In most growth models migration is given no explicit role, although to the extent that it raises (lowers) the rate of growth of the labour force it will lower (raise) the level of steady-state income in Solow-type models. Over the past two hundred years migration has had a proportionately greater impact on Ireland than on any other country in the world. Until the 1960s large-scale emigration was composed predominantly of young people drawn from a background of subsistence farming, unskilled labouring, domestic service and unemployment. The main effect of this outflow on the Irish economy was to curb the growth of unemployment and to upgrade the structure of the remaining labour force (see Ó Gráda and Walsh, 1993, for

31 Barro reports a negative association between (i) the share of government in total investment or income and (ii) the share of government consumption in total income. All of these ratios are high in Ireland, especially in relation to the level of real income.
Emigration declined during the 1960s, and during the 1970s a sustained net inflow of population was recorded for the first time. International mobility was very low during the early 1980s due to the impact of the recession on employment opportunities abroad. During the boom in Britain in the second half of the decade, emigration from Ireland resumed on a large-scale. During the current recession, it has again fallen to a low level.

The selectivity of migration by educational characteristics is a crucial issue in a country where the annual net outflow of population has exceeded 3 per cent of the working-age population. Data, now available for the first time, on migration from Ireland by level of education reveals a very different picture from the traditional one in which the outflow was dominated by people with low levels of formal education. The rate of emigration is now much higher among those with third level education than among those whose education ended at secondary school (Figure 3). The changed pattern of the outflow is understandable in light of the probable change in the returns to mobility, which now appear to be directly related to educational level. While it has been shown that emigration per se does not explain the performance of the Irish economy in the past, but is explained by this performance, it is generally feared that heavy emigration of relatively highly skilled people would lower the rate of growth of GDP (Ó Gráda and Walsh, 1993).

The model constructed by Dolado, Goria and Ichino (1993) [DGI] incorporates

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23It is likely that those who do not complete secondary school are even less mobile.
both the rate and composition of migration in an augmented Solow growth framework. This model implies that the effect of migration on the growth rate and steady-state level of output per capita depends critically on the level of the human capital of migrants relative to that of the native population (e). While dealing mainly with host countries, the model also encompasses sending countries and predicts that their steady state level of output per capita will be positively related to the rate of emigration if e < 1, that is, if the emigrants are on average less well educated than those who remain and immigrants less well educated than the population of the host country. The DGI estimate of e for Ireland is 0.75, indicating that over the period 1960-85 this was indeed the case. This implies that an exogenous increase in emigration from Ireland, due for example to more rapid growth in Britain, would have raised the growth rate and the steady-state level of output per capita.

However, as pointed out above, the composition of the emigrant stream changed significantly over the post-war period. Figure 3 shows that by the end of the 1980s it could hardly be maintained that the emigrants had on average less human capital than the native population. This implies e > 1. In fact e > 1 seems plausible for the entire period since the ending of the massive outflow of unskilled workers during the 1950s, including the 1970s when there was a significant net inflow of population to Ireland, with relatively skilled and experienced workers predominating in the inflow. Thus, on the basis of a Solow-type model augmented to allow for the effects of human capital formation on growth and of migration on the former, it seems more plausible to argue that the effects of emigration on economic growth in Ireland since the 1960 have been negative rather than positive, and of immigration positive rather than negative, as implied by the DGI model. If this is accepted, the unusually high and volatile rate of migration could account for the tendency of Ireland to be an outlier in cross-country studies of growth. However, in the absence of reliable information on the human capital characteristics of the migrant flows to and from Ireland, these effects are as difficult to establish in the framework of the new growth models as they have been using more traditional approaches (Ó Gráda and Walsh, 1993).

VI. CONCLUDING COMMENTS

The material presented in this paper showed that Ireland’s growth rate since 1960 has been about average when crudely compared with that of the OECD as a whole. When account is taken of the low level of income at the start of the period and the relatively high rates of physical and human capital accumulation, the Irish performance appears less satisfactory. Although the evidence is not overwhelming, it does appear that the economy grew less rapidly over the period 1960-85 than would have been expected given the level of these variables.

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39In the case of sending countries, e is the ratio of the emigrants' average human capital to that of the remaining population; in the case of receiving countries it is the ratio of immigrants' average human capital to that of the native population.

30It is important to be aware that e is an estimated parameter of the DGI model, rather than one of the regressors. The estimate reported for Ireland has a t-ratio of only 0.30 and, unlike the major host countries, no independent estimate is available for it.
Several possible explanations may be advanced to account for this poor performance. One is the poor quality of physical capital accumulation in Ireland. The low elasticity of output with respect to capital reported for Ireland is evidence of this. It could be due to the high proportion of total investment controlled, directly or indirectly, by the public sector. Moreover special considerations apply to the use of the national investment ratio in growth models in countries such as Ireland where the correlation between national savings and investment has not been high. It is likely that there was a reduction in the quality of investment in the late 1970s and early 1980s when the exceptionally high investment ratio reflected a large balance of payments deficit financed mainly by government external borrowing, while in more recent years the counterpart of the high national savings ratio has been a growing balance of payments surplus rather than a high national investment ratio.

Turning to the high rate of human capital accumulation, there is no evidence in the data on the structure of the outflow from the educational system or on the rates of return to additional years of schooling to indicate that a low quality of human capital formation should be invoked to explain Ireland’s poor growth performance.

A possible explanation of the apparently low national return to human capital accumulation in Ireland is emigration. The effect of emigration on growth depends crucially on the average human capital endowment of the flow relative to that of the native population. In the 1950s, when net emigration was at an exceptionally high rate, the outflow was concentrated among the unskilled and would have had the effect of curbing the growth of unemployment and upgrading the occupational structure of the remaining population. However, a higher propensity to emigrate among those with higher levels of education to emigrate is evident in more recent data. This may have deprived the country of some of the returns to the increased investment in education undertaken since 1960 and have reduced the average human capital endowment of the remaining population.

Further research on the role of education and human capital formation in Irish economic growth offers the promise of shedding light on the contribution of human to capital growth which, as Crafts (1992) pointed out, is a crucial part of the agenda of the new growth economics.

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Barro finds the net influence of the ratio of public to total investment on growth is negative.
REFERENCES


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