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Working Paper No. 85

June 1997

The Earnings Distribution and Returns to Education in Ireland, 1987-1994

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Subsequently published in "Rising Wage Inequality, Returns to Education and Labour Market Institutions: Evidence from Ireland", British Journal of Industrial Relations, Vol. 37, No.1

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1. Introduction

The large volume of research that has been produced in the United States in recent years on the subject of the distribution of earnings has demonstrated quite consistently that inequality in earnings in the U.S. has risen and that returns to education and skill have also risen (Levy and Murnane, 1992). The United Kingdom has also been shown to have experienced a rise in earnings inequality and in the returns to education and skill (Gosling, Machin and Meghir, 1994). These observations have given rise to a range of explanations of the related phenomena; the explanations have included skill-biased technical change (Katz and Murphy, 1992), globalisation and competition from developing countries (Wood, 1994) and country-specific institutional changes such as labour market deregulation and declining union membership (Freeman, 1993). Other studies assessing such explanations against U.S. evidence include Bound and Johnson (1992), Borjas and Ramey (1994), Freeman and Katz (1995) and Burtless (1995).

Alongside the U.S. and U.K. experiences, it has also been shown that other countries have experienced much smaller increases in inequality, while others again have maintained stability in their earnings distributions (OECD, 1993 and 1996). These differences across countries also require explanation and Katz (1994) has attempted to meet the requirement in an intuitive and persuasive way. Broadly speaking, his argument is as follows. Differences in labour demand are unlikely to have produced the differences in growth in earnings inequality across the developed world because labour demand appears to be shifting towards more-skilled workers across these countries. However, the supply of workers of various educational levels has differed across countries and Katz argues that this supply effect reduced inequality growth. In addition, he argues that institutional factors such as centralised wage bargaining helped to reduce the growth in earnings inequality in some countries relative to the U.S. and the U.K.

It is in the context of these international differences in growth rates of inequality and Katz' explanations that Ireland emerges as a particularly interesting case. As a small and open economy, Ireland is likely to have experienced the same shifts in demand for labour of different types as the rest of the developed world. Hence, there would have been a tendency for earnings inequality and returns to education to grow in Ireland. However, the Katz arguments on how an increased supply of skilled labour and institutional factors could constrain this growth are also very relevant in Ireland. As will be discussed below in Section 4, there has been a significant increase in the level of educational attainment of the Irish labour force in recent years. The Irish labour market has also been characterised by highly centralised wage bargaining over this period and by improvements in the generosity of welfare benefits for the unemployed.

The expectation would therefore be that any increase in returns to education and in earnings inequality in Ireland would be lower than that experienced by the U.S. and the U.K. Our purpose in this paper is to explore recent changes in the structure of Irish wages to see if this is so. It will be seen below that this expectation is not borne out; instead, we find that between 1987 and 1994, Ireland actually experienced an increase in earnings inequality that exceeds the growth in most other OECD countries and that a significant part of the increase is explained by increases in the returns to education. This points to the strength of the demand side effect.

Until recently, it was not possible to explore such questions because no regular official source of survey or administrative data on Irish earnings existed. Such data is now becoming available from two large-scale household surveys carried out by the Economic and Social Research Institute. The first, in 1987, provided the basis for the detailed picture of the earnings distribution and the extent of low pay at that point in time presented in Nolan (1993), and an examination of returns to education (Callan 1993, Callan and Harmon 1997). In 1994 another large-scale survey has been carried out, the first wave of the Irish element of the European Community Household Panel, obtaining *inter alia* detailed information on earnings, education and experience for employees in sample households. Here, we use these data to compare the overall distribution of earnings and the return to different levels of educational attainment, in 1994 and 1987.

The paper is structured as follows. Section 2 describes the data. Section 3 examines trends in the overall earnings distribution between 1987 and 1994. Section 4 focuses on the education

levels attained by the labour force in each year, and the way earnings dispersion within and between education levels and age groups have evolved. Section 5 analyses rates of return to education via estimation of conventional human capital earnings functions and looks at how these have changed between 1987 and 1994. Section 6 looks at the contribution of changing rates of return to education, and changes in the educational profile of the labour force, to the observed trends in the earnings distribution. Section 7 summarises the conclusions.

2 The Data

The data employed in this paper come from two large-scale household surveys carried out by the ESRI. The first is the Survey of Income Distribution, Poverty and Usage of State Services carried out in 1987, which obtained responses from a sample of 3,294 households, with a response rate of 64% of valid addresses contacted. The sampling frame was the Register of Electors and the survey was designed to provide a national sample from the population resident in private households. The sample has been reweighted to correct for non-response, on the basis of four variables - number of adults in the household, urban/rural location, age and socio-economic group of household head - using external information from the much larger Labour Force Survey. The representativeness of this sample data has been validated by comparison with a variety of external information, and it has been used extensively in research on poverty and tax and social welfare policy in Ireland. (A full description of the survey is in Callan, Nolan *et al.,* 1989, and an overview of that research is in Nolan and Callan 1994). Information on earnings, education, labour market experience and other characteristics of about 2,700 employees in sample households was obtained. This sample appears to represent employees well when compared with available data from the Census of Population and the Labour Force Survey, and has served as the basis for analysis of the extent and nature of low pay, the determinants of individual earnings, male-female wage differentials, and returns to education in Ireland.[1]

[1] Nolan (1993) analysed low pay, earnings functions estimated with this dataset have been presented in Callan (1991) for married men and married women, Nolan (1993) for the entire sample, and Callan and Wren (1994) for men and women and for married versus single men and women, and returns to education have been examined in Callan (1993) and Callan and Harmon (1997).

The more recent source of data on earnings and poverty is the 1994 Living in Ireland Survey, the first wave of the Irish element of the European Community Household Panel (ECHP) being carried out for Eurostat by the ESRI. This obtained information for 4,048 households, a response rate of 62.5% of valid addresses contacted; once again the Electoral Register was the sampling frame and the responses were reweighted to accord with the Labour Force Survey in terms of key household characteristics. First results from this survey on household poverty have been published in Callan *et al* (1996), which also contains a comprehensive description of the survey itself. The sample contains over 3,000 individual employees who responded fully to questions about their earnings and hours of work, occupation, labour market experience, and education. As in the 1987 survey, employees were asked about the gross pay they received in their last pay period, and about how long this covered (week, fortnight, month etc.) and the hours worked during that period. They were also asked whether this was the amount they usually receive, and if not what was their usual gross pay and hours usually worked. In looking at the distribution of earnings, for the 5% of respondents who stated that their last pay was not usual we use the amount usually received, and for the remaining 95% we use current weekly reported gross pay.

3. The Distribution of Earnings

In looking at the distribution of earnings across individuals, it is customary to focus on either hourly earnings, or on weekly earnings for full-time employees only. In the Irish case 18 hours per week is the statutory cut-off for social insurance purposes, and about 7% of employees in 1994 worked less than this, up from 4% in 1987. We therefore look at both the distribution of hourly earnings among all the employees in our samples, and at the distribution of weekly earnings among those working 18 hours or more per week. Table 1 shows the distribution of gross hourly and weekly earnings in Ireland in 1987 and 1994 on this basis, as measured by the bottom decile, bottom quartile, top quartile and top decile as proportions of the median. We see that from 1987 to 1994 there was a consistent widening in dispersion for both weekly and hourly earnings, particularly at the top of the distribution. The ratio of the top decile to the median rises from 1.96 to 2.24 for hourly earnings, and from 1.84 to 1.96 for weekly earnings among full-time employees.

For hourly earnings the bottom decile is the same proportion of the median in 1987 and in 1994, but for weekly earnings among full-time employees the bottom decile falls from 0.45 to 0.43 of the median. For both hourly and weekly earnings the bottom and the top quartile each move further away from the median over the period. The ratio of the top to the bottom decile, commonly used as a single summary inequality measure in this context, rose from 4.2 to 4.8 for hourly earnings and for weekly earnings of full-time employees the increase was from 4.1 to 4.5.

Table 1: *Distribution of Earnings, Ireland 1987 and 1994*

as proportion of median	1987	1994
all employees, hourly earnings:		
bottom decile	0.47	0.47
bottom quartile	0.73	0.68
top quartile	1.37	1.50
top decile	1.96	2.24
full-time employees, weekly earnings:		
bottom decile	0.45	0.43
bottom quartile	0.72	0.68
top quartile	1.39	1.43
top decile	1.84	1.96

This widening in earnings dispersion is not attributable simply to changing numbers of male versus female or "young" versus adult employees. Table 2 shows that a sharp widening took place between 1987 and 1994 in the distribution of hourly earnings among men only, and also among full-time adult (21 years or over) men. Indeed, the fall in the bottom decile as a proportion of the median is considerably larger when one concentrates on men only than for the sample as a whole.

Table 2: *Distribution of Hourly Earnings Among Men, Ireland 1987 and 1994*

as proportion of the median	1987	1994
hourly earnings: all male employees		
bottom decile	0.53	0.47
bottom quartile	0.76	0.72
top quartile	1.35	1.47
top decile	1.86	2.18
hourly earnings: full-time adult male employees		
bottom decile	0.62	0.55
bottom quartile	0.77	0.74
top quartile	1.34	1.44
top decile	1.84	2.09

A comparative perspective on both the Irish earnings distribution in 1994 and on the way it has changed since 1987 can be obtained using measures of earnings dispersion for a range of developed countries recently brought together by OECD (1996). There are potentially important differences in definition and coverage across countries (including whether earnings are weekly or annual), so these comparisons should be treated with extreme care, but they can serve to highlight some key features of the Irish results. First, Table 3 shows measures of the level of earnings dispersion in 1994 for Ireland and other OECD countries, for weekly pay among full-time employees (since the figures brought together by the OECD generally refer to full-time employees, and to weekly, monthly or annual rather than hourly gross earnings). Ireland is seen to have a particularly high level of earnings dispersion. The ratio of the top decile to the median is among the highest of the countries covered, while the ratio of the median to the bottom decile is the highest of any of the countries shown and so is the ratio of the top decile to the bottom decile. With the top decile/bottom decile summary measure, Ireland is seen to have greater earnings inequality than even the USA which is generally the outlier in this context.

Table 3: *Summary Measures of Earnings Dispersion, Ireland and other OECD countries, 1994*

	top decile/median	median/bottom decile	top/bottom decile
Sweden	1.59*	1.34*	2.13
Belgium*	1.57	1.43	2.24
Germany*	1.61	1.44	2.32
Finland	1.70	1.40	2.38
Netherlands	1.66	1.56	2.59
Switzerland	1.68	1.58	2.65
Italy*	1.60	1.75	2.80
Australia	1.75	1.64	2.87
Japan	1.85	1.63	3.02
New Zealand	1.76	1.73	3.05
France	1.99	1.65	3.28
United Kingdom	1.86	1.78	3.31
Austria	1.82	2.01	3.66
Canada	1.84	2.28	4.20
United States	2.07	2.10	4.35
Ireland	1.96	2.32	4.54

* = 1993

As far as the trend in earnings dispersion is concerned, Table 4 shows the ratio of the top to the bottom decile in 1987 and 1994 for Ireland and the other OECD countries for which the figures are available for both points in time. We see that once again Ireland is an outlier: the increase in earnings dispersion is the greatest of any of the countries shown, by a substantial margin. (The USA is not included in this table because OECD 1996 gives only US figures for men and women separately, but from these it appears that the increase in earnings dispersion in the USA over the period may be similar in scale to that seen for Ireland).

Table 4: *Trends in Earnings Dispersion, Ireland and other OECD Countries, 1987-1994*

	top decile/bottom decile		
	1987	1994	change
Canada**	4.44	4.20	-0.24
Germany*	2.54	2.32	-0.22
Belgium*	2.44	2.24	-0.20
Finland	2.52	2.38	-0.14
Japan	3.15	3.02	-0.13
Sweden	2.09	2.13	0.04
Australia	2.81	2.87	0.06
Netherlands	2.53	2.59	0.06
France	3.19	3.28	0.09
United Kingdom	3.20	3.31	0.11
New Zealand**	2.92	3.05	0.13
Austria	3.47	3.66	0.19
Italy*	2.42	2.80	0.38
Ireland	4.07	4.54	0.47

* = 1993 not 1994; **= 1988 not 1987.

The OECD (1996) study also looked at the extent of low pay, defining low-paid workers as full-time workers who earn less than two-thirds of the median weekly earnings. Applying this criterion to the Irish data, 21 % of employees were low paid in 1987, and by 1994 this had risen to 24%. On this basis Ireland in 1994 has one of the highest levels of low pay of the OECD countries covered in the comparative tables, the only country with a higher percentage of employees below the OECD benchmark being the USA with 25%.

The high level of earnings dispersion and relatively rapid increase in dispersion from 1987 compared with other developed countries would in themselves make Ireland a particularly interesting case to study. However, as mentioned in the introduction, the rise in dispersion is all the more interesting when viewed against the increase in the skill levels of the Irish labour force and

the high degree of centralisation of wage bargaining since 1987. In the following sections, we explore the education dimension more fully.

4. Education Profile and Earnings Dispersion

During the 1980s and into the 1990s, there has been a rapid rise in the level of education of those leaving the Irish education system. This reflects substantially higher numbers completing full second-level education rather than leaving early, and a marked increase in the proportion going on to third-level education. As cohorts containing a high proportion with relatively low levels of education retire and those with relatively high levels enter the labour force, this has produced the rather dramatic change in the education profile of employees between 1987 and 1994 shown in Table 5. Whereas in 1987 18% of employees had primary education only, by 1994 this had fallen to 8%. This was accompanied by a rise in the percentage with post-secondary school attainment levels from 18% to 28%.

Table 5: *Education Level, Full-time Employees, Ireland 1987 and 1994*

education level	1987 (%)	1994 (%)
Primary only	17.9	8.6
secondary/ Group Cert.	18.8	14.0
Inter./Junior Cert.	15.7	16.3
Leaving Cert.	29.9	33.2
Certificate/Diploma	7.5	11.7
Degree	10.1	16.1
All	100.0	100.0

This pattern in the 1987 and 1994 samples is consistent with the rapid increase in educational participation rates in Ireland in the preceding years, with roots going back as far as the introduction of free secondary education in the late 1960s. Reasonably reliable comparative data are available only from the mid-1980s (OECD 1996b), and show participation in third-level education expanding more rapidly in Ireland than in most other European Union countries from

1985 to 1994. Over that period the proportion of those aged 18-21 enrolled in tertiary education doubled in the Irish case.[2] By 1994, the proportion of 16-17 year-olds still in education was also relatively high in the Irish case.[3] This enhancement in levels of educational attainment of those entering the labour force in the 1980s and 1990s, together with the exit from the labour force of older age groups with much lower levels of attainment, will have been reflected in the relatively rapid change observed in the educational profile of employees between 1987 and 1994.

What is the relationship between this changing education profile and the distribution of earnings? We begin exploration of this key question by looking in Table 6 at median earnings by education category and how this evolved between 1987 and 1994.

Table 6: *Median Earnings by Education Category, Full-Time Employees, 1987 and 1994*

education level	Median	Median	% +	group median /overall median	
	1987	1994		1987	1994
Primary only	160.5	240.0	49.5	0.91	0.96
secondary/Group Cert.	162.0	222.4	37.3	0.92	0.89
Inter./Junior Cert.	150.0	220.0	46.7	0.85	0.88
Leaving Cert.	178.0	225.6	26.7	1.01	0.90
Certificate/Diploma	222.0	254.1	14.4	1.25	1.02
Degree	286.7	425.0	48.2	1.62	1.70
All	177.0	250.0	41.2	1.00	1.00

We see that there was a good deal of divergence across education levels in the growth in median earnings, with the greatest percentage increase at the bottom and the top levels of educational attainment. The relatively high increase for the bottom group is strongly influenced by the fact that it has been shrinking rapidly in size. Those with such a low level of education

[2]OECD (1996b) Table P6t, p. 130.
[3]OECD (1996b) Table P3, p. 122.

attainment are predominantly older workers, and a significant proportion of the lowest-paid among them have exited into unemployment and early retirement over the period. Table 7 looks at dispersion within education categories, in terms of the ratio of the top to the bottom decile. This measure shows that while the degree of dispersion within the bottom and the top education categories was less than in the other categories, it rose rapidly for those groups between 1987 and 1994.

Table 7: *Distribution of Earnings Within Education Categories, Full-Time Employees, 1987 and 1994*

education level	1987			1994		
	P10	P90	P90/P10	P10	P90	P90/P10
Primary only	87.0	251.0	2.89	100.0	385.0	3.85
Secondary/Group Cert.	70.0	280.0	4.00	100.0	370.0	3.70
Inter./Junior Cert.	60.0	261.0	4.35	90.0	398.0	4.22
Leaving Cert.	76.6	320.0	4.18	100.0	420.9	4.21
Certificate/Diploma	110.0	357.9	3.25	107.7	500.0	4.64
Degree	163.0	470.6	2.89	204.5	718.7	3.51
All	80.0	326.2	4.08	105.0	488.7	4.65

With the balance between men and women in the workforce changing, it is also interesting to look at male employees only. The educational profile of male employees has changed in very much the same way as that seen for all employees in Table 5, and the pattern of increases in median earnings by education category for men only is also very similar to that seen in Table 6. However, as far as dispersion within education categories is concerned, there was a rather smaller change in dispersion within the top and bottom education categories between 1987 and 1994 than seen for all employees.

It is also instructive to take an exploratory look within particular age ranges. Focusing on men aged 25-39, once again there has been a substantial shift in educational profile between

1987 and 1994. The percentage with only primary education fell by 11% to only 3% of this sub-set, and the percentage with a university degree rose by 7%. However there is now little difference across the education categories in the rise in median earnings between 1987 and 1994, and the lowest level of educational attainment shows a below-average increase. The overall dispersion in earnings has risen much more modestly for this sub-set than for all men, with the ratio of the top to the bottom decile going from 2.6 to 2.8. Dispersion has also increased within most education groups.

Such analyses of trends in earnings of employees cross-classified by sex, age and education category are useful, but the influence of different factors, notably returns to education, can be distinguished more easily using estimated earnings equations, to which we turn in the next section.

5. Educational Wage Differentials, 1987 and 1994

What has been the role of changing wage premia for educational qualifications in the observed increase in wage dispersion? In order to explore this issue in more depth, we estimate standard human capital-type wage equations, based on educational qualifications and a number of other relevant characteristics, for both 1987 and 1994. In this section, we outline the alternative specifications of wage equation which were estimated, and examine the nature and extent of changes in "returns to education" - as measured by the wage premia associated with different educational qualifications.[4] In the following section, we examine the extent to which these changes in education premia - and the returns to other characteristics - help to explain the increase in wage dispersion.

The dependent variable in all the estimated wage equations is the log of the usual gross hourly wage, constructed as described in Section 2. Five specifications of the wage equation were used, in order to explore the possible sensitivity of the results – in terms of changes in returns to education, and their impact on the distribution – to the specification used. In each

[4]In the context of explaining changes in wage dispersion, the term "returns to education" is widely used in this sense. Broader issues concerning the extent to which educational qualifications confer other advantages in the labour market - such as lower unemployment rates - and the extent to which the measured association between educational qualifications and higher wages represents a return to "ability" rather than schooling are considered elsewhere (Callan, 1993; Callan and Harmon, 1997).

specification we estimate returns to 4 levels of educational qualifications (each measured against a base of "no qualification beyond primary level" defined to include those with some second level education but no qualification). The educational categories are:

- Junior cycle: This includes the Group and Intermediate Certificates, as well as their recent replacement, the Junior Certificate. These are exams taken at the midway stage of second level education.
- Leaving Certificate: This is the qualification obtained by those successfully completing the senior cycle of second-level education.[5]
- Diploma or other third-level: This includes non-degree qualifications from such institutions as regional technical colleges.
- University degree: This includes both primary and higher degrees.

The five wage equation specifications are as follows

- Specification 1: Age and its square, the educational categories, and sex interacted with marital status married man and married woman (the omitted category being single men);
- Specification 2: As specification 1, but with the educational categories interacted with age bands (15-32, 33-49, and 50-64);
- Specification 3: Years worked and its square, years spent in a return to training or education, years not worked and its square, the educational categories, and the sex/marital status dummies.;
- Specification 4: As specification 3, but with occupation- and industry-specific unemployment rates (obtained on a 1 digit basis from the large-scale *Labour Force Survey* conducted by the Irish Central Statistics Office) added to the control variables;
- Specification 5: as specification 4, but with interaction terms for the levels of education and three age bands (15-32, 33-49, and 50-64).

Given the complexities arising from the endogeneity of female labour supply with respect to the wage rate and the rise in women's labour force participation over the period, we have

[5]Also included in this category are a small number of individuals who obtained qualifications under the PLC (Post Leaving Certificate) and VPTP (Vocational Preparation and Training Programmes).

performed the analyses for the full sample, and, in addition, for men only. Identical specifications were used for the 1987 and 1994 analyses. Table 8 shows the estimates of returns to education under specifications 1, 3 and 4 (the specifications which do not involve interactions between age-bands and educational qualifications). The general picture is one of increased returns to university degrees and to the junior cycle qualifications, with approximate stability for the returns to the Leaving Certificate qualification. There is some evidence of a slight decline in returns to non-university third level qualifications, though not in the results for the male samples.

Table 8: *Estimates of Returns to Education, 1987 and 1994*

		All		*Males*	
Wage equation specification	*Highest educational qualification*	*1987 coefficients*	*1994 coefficients*	*1987 coefficients*	*1994 coefficients*
(1)	Group, Inter., Junior Cert.	0.17	0.22	0.18	0.24
	Leaving Certificate	0.37	0.41	0.36	0.38
	Diploma or other 3rd level	0.58	0.54	0.47	0.47
	University degree	0.86	1.01	0.76	0.89
(3)	Group, Inter., Junior Cert.	0.12	0.18	0.13	0.21
	Leaving Certificate	0.36	0.36	0.35	0.37
	Diploma or other 3rd level	0.59	0.53	0.49	0.52
	University degree	0.88	1.01	0.79	0.95
(4)	Group, Inter., Junior Cert.	0.11	0.17	0.13	0.21
	Leaving Certificate	0.34	0.34	0.32	0.37
	Diploma or other 3rd level	0.56	0.51	0.46	0.52
	University degree	0.85	0.98	0.74	0.95

Table 9 reports the results for specifications involving age-banding (specifications 2 and 5). Again we find evidence of increased returns to university degrees, particularly in the middle and older age groups. Returns to the junior cycle qualifications have increased for the

younger age groups, but fallen for those aged over 50. Returns to diploma qualifications have increased for the middle and older age groups, but declined for the youngest age group. Returns to the Leaving Certificate have declined for the oldest age group, but appear roughly stable or slightly increasing for the two younger age groups.

Table 9: *Estimates of Age-specific Returns to Education, 1987 and 1994*

		All		*Males*	
Wage equation specification	*Highest educational qualification*	*1987 coefficients*	*1994 coefficients*	*1987 coefficients*	*1994 coefficients*
(2)	*Age group 15-32*				
	Group, Inter., Junior Cert.	0.08	0.11	0.11	0.19
	Leaving Certificate	0.23	0.21	0.19	0.22
	Diploma or other 3rd level	0.39	0.26	0.29	0.26
	University degree	0.73	0.73	0.65	0.63
	Age group 33-49				
	Group, Inter., Junior Cert.	0.18	0.24	0.12	0.23
	Leaving Certificate	0.42	0.52	0.43	0.46
	Diploma or other 3rd level	0.56	0.67	0.46	0.58
	University degree	0.90	1.13	0.78	0.97
	Age group 50-64				
	Group, Inter., Junior Cert.	0.21	0.14	0.23	0.15
	Leaving Certificate	0.49	0.35	0.64	0.38
	Diploma or other 3rd level	0.87	0.71	0.67	0.55
	University degree	0.94	1.04	0.80	0.95
(5)	*Age group 15-32*				
	Group, Inter., Junior Cert.	0.05	0.14	0.07	0.21
	Leaving Certificate	0.26	0.26	0.19	0.30
	Diploma or other 3rd level	0.46	0.39	0.34	0.42
	University degree	0.86	0.91	0.78	0.86
	Age group 33-49				
	Group, Inter., Junior Cert.	0.12	0.18	0.08	0.22
	Leaving Certificate	0.38	0.42	0.40	0.47
	Diploma or other 3rd level	0.54	0.60	0.48	0.62
	University degree	0.88	1.06	0.78	1.06
	Age group 50-64				
	Group, Inter., Junior Cert.	0.16	0.13	0.15	0.15
	Leaving Certificate	0.45	0.34	0.53	0.38
	Diploma or other 3rd level	0.79	0.63	0.58	0.55
	University degree	0.78	0.95	0.66	0.95

Overall this pattern indicates that returns to university education have increased, or at worst remained constant, despite a very large increase in the supply of graduates to the labour market.

6. Impact of Changes in Returns to Education and Other Characteristics on the Earnings Distribution, 1987-1994

To what extent does the pattern of changes in returns to education, and the other characteristics included in the estimated earnings functions, explain the increase in wage dispersion? In order to answer this question, we consider a decomposition of wage changes between 1987 and 1994.

We start with the simple wage equations :

$$w_{ij}=X_{ij}b_i+e_{ij} \qquad i=1987, 1994 \qquad (1)$$

The change in wages between 1987 and 1994 can therefore be decomposed as (we drop the j subscript for clarity):

$$w_{94} - w_{87} = X_{94}(b_{94}-b_{87}) + (X_{94}-X_{87})b_{87} + e_{94}-e_{87} \qquad (2)$$

or as

$$w_{94}-w_{87} = X_{87}(b_{94}-b_{87}) +(X_{94}-X_{87})b_{94} + e_{94}-e_{87} \qquad (3)$$

where the first term on the right-hand side of each equation can be taken as a measure of the impact of changing returns (or the "prices" of characteristics). A more extensive decomposition into price, quantity and error effects is undertaken for the USA by Juhn, Murphy and Pierce (1993). It partitions the remaining change into components attributable to changes in quantities and changes in the error terms. Given that our focus in this paper is on returns to education and not on returns to unobservables, we use a simple and natural alternative approach to focus on the impact of changes in the supply of highly-educated labour to the Irish labour market, based on reweighting of the data to reflect the change in the age-education profile of employees

Using this approach, we can construct the following counterfactual wage distributions:

(A) The wage distribution for the 1987 population, assuming that their characteristics were rewarded in line with the estimated returns from 1994;

(B) The wage distribution for the 1994 population, assuming that their characteristics were rewarded in line with the estimated returns for 1987.

Using these wage distributions we can find the impact on measures of wage dispersion (e.g., the ratio of the wage at the 90th percentile of the distribution to the wage at the 10th percentile) of a change from the actual 1987 distribution to distribution (A), or from distribution (B) to the actual 1994 distribution. (The levels of these distributional measures are very slightly different from those reported in earlier sections, as some cases were dropped due to lack of information on the independent variables).

In order to examine the effects of changes in the educational profile of the labour force, we have constructed alternative weights for the 1994 survey which ensure that the 1994 data reflect the 1987 distribution of employees across age and educational categories. Similarly, we have constructed alternative weights for the 1987 survey which ensure that it can be adjusted to reflect the 1994 age-education profile. These weights are derived as simple ratio weights from age/education crosstabulations for the two years. The distributional measures can again be obtained using these counterfactual weights. We use these first to look at the impact of simply changing the age-education profile in this way, with no change in returns to education or other characteristics. Table 10 shows that this pure "quantity" effect does increase dispersion at the top, but by much less than the increase actually observed in the top decile as a proportion of the median or the bottom decile. It has virtually no impact at the bottom.

Table 10: *Impact of Changes in Age-Education Profile on the Earnings Distribution, Ireland 1987-1994*

Percentile ratio	*Total Change, 1987-1994*	*Quantity effect on 1987 population*	*Quantity effect on 1994 population*
P90/P50	0.26	0.04	0.07
P50/P10	0.03	0.01	0.01
P90/P10	0.60	0.10	0.17

Table 11 then reports the results of the decomposition identifying the price effects and the combined effects of price and quantity, taking all characteristics into account. The pure "price" effects, i.e. changes in the returns to measured characteristics, account for between about 40% and 60% of the total change in the dispersion in the top of the distribution (measured by the ratio of the wage at the 90th percentile to the median wage) under either decomposition approach. There was little change in dispersion at the bottom, as measured by the ratio of the median to the bottom decile, to be explained. Looking at the impact of the change in returns to measured characteristics together with the change in the age-education profile of employees, the combined price plus quantity effects account for between about 55% and over 90% of the observed change in dispersion at the top, depending on the specification of the wage equation and whether the decomposition takes 1987 or 1994 as base.

Table 11: *Impact of Changes in Returns to All Measured Characteristics and Age-Education Profile on the Earnings Distribution, Ireland 1987-1994*

Wage equation specification	*Percentile ratio*	*Total Change, 1987-1994*	*Price effect on 1987 population*	*Price effect on 1994 population*	*Price & qty effect on 1987 pop.*	*Price & qty effect on 1994 pop.*
(1)	P90/P50	0.26	0.14	0.15	0.22	0.22
	P50/P10	0.03	0.05	0.05	0.07	0.11
	P90/P10	0.60	0.37	0.44	0.61	0.69
(2)	P90/P50	0.26	0.15	0.16	0.22	0.24
	P50/P10	0.03	-0.02	0.05	0.00	0.08
	P90/P10	0.60	0.25	0.43	0.45	0.67
(3)	P90/P50	0.26	0.13	0.10	0.16	0.16
	P50/P10	0.03	-0.02	0.00	0.05	0.07
	P90/P10	0.60	0.21	0.22	0.43	0.50
(4)	P90/P50	0.26	0.12	0.10	0.21	0.14
	P50/P10	0.03	-0.03	-0.01	0.03	0.05
	P90/P10	0.60	0.18	0.20	0.49	0.42
(5)	P90/P50	0.26	0.13	0.12	0.21	0.16
	P50/P10	0.03	-0.03	-0.04	-0.02	0.04
	P90/P10	0.60	0.20	0.17	0.37	0.42

Table 12 reports a similar analysis where we construct a distribution which takes account only of the changes in returns to education, not other characteristics. The results shows that from about one-third up to about 60% of the total increase in dispersion at the top of the distribution (measured by P90/P50) is explained by the changes in rates of return to education alone. The combination of returns to education and changes in the age-education profile account for 42-88%, with the gap between price only and price plus quantity effects considerably wider when using 1987 rather than 1994 as base.

Table 12: *Impact of Changes in Returns to Education, and Age-Education Profile on the Earnings Distribution: Ireland 1987-1994*

Wage equation specification	*Percentile ratio*	*Total Change, 1987-1994*	*Price effect on 1987 population*	*Price effect on 1994 population*	*Price & qty effect on 1987 pop.*	*Price & qty effect on 1994 pop.*
(1)	P90/P50	0.26	0.09	0.11	0.17	0.12
	P50/P10	0.03	-0.02	0.01	0.03	0.01
	P90/P10	0.60	0.13	0.27	0.39	0.29
(2)	P90/P50	0.26	0.15	0.16	0.19	0.23
	P50/P10	0.03	-0.06	0.03	0.03	0.04
	P90/P10	0.60	0.18	0.41	0.43	0.57
(3)	P90/P50	0.26	0.09	0.11	0.17	0.12
	P50/P10	0.03	-0.06	0.00	0.02	0.02
	P90/P10	0.60	0.05	0.25	0.37	0.30
(4)	P90/P50	0.26	0.09	0.12	0.17	0.11
	P50/P10	0.03	-0.05	0.00	0.02	0.03
	P90/P10	0.60	0.07	0.26	0.39	0.30
(5)	P90/P50	0.26	0.09	0.15	0.16	0.18
	P50/P10	0.03	-0.07	0.00	0.00	0.00
	P90/P10	0.60	0.34	0.32	0.33	0.38

Finally, it is worth looking at the same decomposition analysis confined to males only, since much of the international literature has tended to concentrate on that sub-sample. As far as quantity effects alone are concerned, results in Table 13 (corresponding to Table 10 for the whole sample) show that the change in age-education profile accounts for between about 12% and 45%

of the observed increase in dispersion at the top among men. In contrast to the sample as a whole, there is an increase in wage dispersion in the lower half of the male distribution, but the table also shows that changes in the age-education profile do not contribute to explaining this increase - on the contrary, taken alone they would have contributed to reducing dispersion at the bottom.

Table 13: *Impact of Changes in Age-Education Profile on the Male Earnings Distribution, Ireland 1987-1994*

Percentile ratio	*Total Change, 1987-1994*	*Quantity effect on 1987 population*	*Quantity effect on 1994 population*
P90/P50	0.26	0.03	0.12
P50/P10	0.29	-0.05	-0.07
P90/P10	1.08	-0.05	0.07

Table 14 reports the results of the price and price plus quantity analysis for men (similar to Table 11 for the whole sample). Looking at the top of the distribution, the percentage of the observed increase in dispersion accounted for by the changes in returns to characteristics now ranges from 35% to 80%. At the bottom, between 10% and about 50% of the increase in dispersion can be explained by changes in the returns to measured characteristics, depending on the specification adopted and whether the effect is measured using 1987 or 1994 as base. The combined effects of price and quantity accounts for between 65% and 90% of the increase in dispersion at the top. At the bottom, the combined effects of price and quantity are less than those of price alone.

Table 14: *Impact of Changes in Returns and Age-Education Profile on the Earnings Distribution, Males, Ireland 1987-1994*

Wage equation specification	*Percentile ratio*	*Total Change, 1987-1994*	*Price effect 1987 on population*	*Price effect 1994 on population*	*Price & qty effect on 1987 pop.*	*Price & qty effect on 1994 pop.*
(1)	P90/P50	0.26	0.12	0.21	0.18	0.20
	P50/P10	0.29	0.11	0.14	0.05	0.11
	P90/P10	1.08	0.45	0.70	0.43	0.62
(2)	P90/P50	0.26	0.09	0.20	0.21	0.23
	P50/P10	0.29	0.08	0.11	0.02	0.05
	P90/P10	1.08	0.32	0.63	0.41	0.55
(3)	P90/P50	0.26	0.13	0.19	0.18	0.18
	P50/P10	0.29	0.08	0.11	0.01	0.06
	P90/P10	1.08	0.39	0.60	0.34	0.47
(4)	P90/P50	0.26	0.11	0.18	0.18	0.21
	P50/P10	0.29	0.09	0.06	0.03	0.03
	P90/P10	1.08	0.39	0.48	0.39	0.49
(5)	P90/P50	0.26	0.09	0.21	0.17	0.22
	P50/P10	0.29	0.08	0.03	0.05	0.04
	P90/P10	1.08	0.30	0.48	0.41	0.52

Isolating again the effect of returns to education, we found that between about 20% and 65% of the total change at the top could be explained by changes in this one price, depending on which base was used. The effect at the lower end of the distribution was to reduce the growth in inequality, although the effect was relatively small. Overall, this points again to the contribution of returns to education in this remarkable growth in Irish earnings inequality.

7. Conclusions

We began this paper by referring to the literature which describes and seeks to explain the increase in earnings inequality and returns to education that has occurred in the U.S. and the U.K. in recent years. We pointed out that other OECD countries have not experienced the same degree of growth in earnings inequality or in returns to education. We also discussed that these different experiences across countries may be because of increases in the supply of skilled workers and institutional factors such as centralised wage bargaining. Given the relevance of these factors to

the Irish labour market our expectation had been that Ireland would have displayed a lower rate of inequality growth than elsewhere.

However, evidence from the large-scale household survey carried out by the ESRI in 1994 shows that the earnings distribution in Ireland exhibited a very high degree of dispersion at that point compared with other OECD countries for which data is available. What is more, compared with the similar 1987 ESRI survey, the increase in dispersion between 1987 and 1994 was much higher than in most of these countries. This increase in dispersion was pronounced at the top of the distribution, and is seen for hourly earnings, for weekly earnings among full-time employees, and for men only.

Estimated wage equations for the sample of employees in 1987 and 1994 show increased returns to higher levels of education, especially university education, over the period.. A substantial proportion of the increase in earnings dispersion can be explained by these increased returns to higher levels of education. Taken together, the combination of the change in the age-education profile of employees and higher returns to education account for much of the observed increase in dispersion, though precisely how much depends on the specification of the wage equation and other aspects of the decomposition methodology employed. The returns to education effect in particular appears to demonstrate the strength of the growth in demand for skilled labour, given the increase in the supply of skilled labour and the institutional factors which would have tended to constrain the growth in earnings inequality.

These findings raise a number of issues to be pursued in future work with the 1987 and 1994 datasets. These include exploration of alternative decomposition methodologies, analysis of trends in differentials between sectors, between the skilled and unskilled, between men and women, and across occupational groups. It is worth noting that over the period 1987-1994 when earnings dispersion was widening, the link between low pay and household poverty has not become closer (Nolan and Hughes 1997), and the distribution of disposable income among households has been stable. It will therefore also be important to trace the ways in which trends in individual earnings impact on household incomes.

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