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## ABSTRACT

### **Earnings Inequality, Returns to Education and Immigration into Ireland\***

Increasing earnings inequality has been an important feature of the US and UK labour markets in recent years. The increase appears to be related to an increased demand for skilled labour and an increase in the returns to education. In this paper we examine what has happened to earnings inequality and the returns to education in Ireland between 1987 and 1997. We find that while both increased between 1987 and 1994, the increases slowed dramatically between 1994 and 1997. This is somewhat surprising as the exceptional growth in the Irish economy occurred from 1994 on. We look to immigration as being a contributing factor to this pattern because a large group of skilled workers flowed into the Irish labour market between 1994 and 1997. We develop a model of the Irish labour market and use it to simulate the impact of an increase in skilled labour. The simulation suggests that immigration did indeed reduce earnings inequality. This result is an interesting corollary to work from the US that shows the immigration of unskilled workers increasing earnings inequality.

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## INTRODUCTION

A central feature of the global economic environment against which recent Ireland's recent economic success has to be set is increasing earnings inequality within some major industrialised countries. Increasing earnings dispersion has been pronounced in the United Kingdom and the United States, and has given rise to a great deal of research there. The common factor in this research is the emphasis placed on rising returns to education and skill.<sup>1</sup> There has been less agreement on why this has happened, some for example attributing it to a shift in demand towards more skilled labour due to factors such as skill-biased technical change (Katz and Murphy, 1992) and others highlighting globalisation and competition from developing countries (Wood, 1994).<sup>2</sup>

Some industrialised countries have in fact experienced much smaller increases in inequality than the USA and the UK, while others again have maintained stability in their earnings distributions (OECD, 1993 and 1996). This has focused attention on the role of institutional factors. Countries such as Germany and the Netherlands that have seen little or no increase in earnings inequality have some form of centralized wage bargaining. This has led to the hypothesis that these wage setting institutions were the primary factor limiting the growth in inequality in those countries.<sup>3</sup> Labour market deregulation and declining union membership

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<sup>1</sup> See for example Gosling, Machin and Meghir (1994) and Schmitt (1995) for the UK, Levy and Murnane (1992) and Juhn, Murphy and Pierce (1993) for the USA

<sup>2</sup> US studies assessing such explanations include Bound and Johnson (1992), Borjas and Ramey (1994), and Burtless (1995).

<sup>3</sup> The role of institutional versus other factors in producing cross-country variation in the level and trends in earnings dispersion is discussed in for example Freeman and Katz (1995), Blau and Kahn (1996), and Gottschalk and Joyce (1997).

are widely seen to have played some role in widening dispersion in the UK, particularly the virtual elimination of minimum wages through the abolition of the Wages Councils (Gosling and Machin 1995 and Machin 1997), the decline of unions, and changes in collective bargaining arrangements (Leslie and Pu 1996). Declines in unionisation and in the real value of the minimum wage have also been advanced as important factors in rising US earnings dispersion by, for example, Freeman (1993), DiNardo, Fortin and Lemieux (1996), and DiNardo and Lemieux (1997).

Against this background Ireland offers a particularly interesting comparative case-study. As a small and extremely open economy, external influences should be even more important than in for example the UK, much less the USA. Unlike those countries, however, the strength of labour market and associated institutions has been increasing rather than declining. Over the period on which we concentrate Ireland has been characterised by highly centralised wage bargaining. In addition, minimum wage coverage has widened and welfare benefits have provided a floor for the unemployed. Finally, the supply of skilled labour has been increasing very rapidly but so has the demand, fuelled by inward direct investment (Barrett, Callan and Nolan, 1999a).

In this paper, we firstly look at the trend in earnings inequality in Ireland from 1987 to 1997. It will be seen that while there was a rapid increase in inequality between 1987 and 1994, this trend slowed dramatically between 1994 and 1997. As the high GNP growth rates of recent years began in 1994<sup>4</sup>, this is would appear to indicate that growth itself has not been responsible for increasing inequality. Given this pattern we go on to look at the trend in the returns to

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<sup>4</sup> Growth rates in GNP have been around 7 percent since 1994.

education. We find that the pattern observed in earnings inequality is repeated; in particular, while returns to education rose between 1987 and 1994, the evidence suggests that the returns were stable, or may even have fallen, between 1994 and 1997.

We then focus on one possible reason for the observed patterns. Borjas, Freeman and Katz (1997) have suggested that the increase in earnings inequality in the United States can be partly explained by the immigration of unskilled workers. As Ireland has experienced an inflow of skilled workers in the mid-1990s (Barrett and Trace 1998), this raises the possibility that the observed trend in earnings inequality in the mid 1990s is related to immigration. We test this hypothesis by simulating the effect of an increase in the supply of skilled labour using a simple model of the Irish labour market. The results suggest that the skilled inward migration did reduce earnings inequality. As such, our findings are an interesting corollary to the findings of Borjas, Freeman and Katz (1997).

## THE DISTRIBUTION OF EARNINGS IN IRELAND

In analysing the distribution of earnings across individual earners, the accounting period adopted can make a considerable difference to the extent of dispersion one observes. Hourly earnings, weekly earnings, earnings over a full year, or indeed lifetime earnings are all distinct measures and may show different patterns. Weekly earnings will be affected both by the hourly rate of pay and by the number of hours worked, annual earnings by the number of weeks spent in work as well as the weekly rate, and lifetime earnings by how much time one spends in work as well as the evolution of the annual rate of pay over the lifecycle. Each of these provides valuable information, and the choice of measure will depend both on the issue at hand and the available data. In analysing the distribution of earnings, a focus on hourly earnings provides the most direct measure of differences in pay rates abstracting from

variations in time spent working. It is also common practice in this context to examine the distribution of weekly earnings for full-time employees only, and that of annual earnings among full-time employees who have been working all year.

In charting how earnings dispersion has evolved in Ireland in recent years we use data from nationally representative household surveys from 1987, 1994 and 1997. The 1987 and 1994 data sets have been used in earlier analyses of earnings such as Barrett, Callan and Nolan (1999a and 1999b) and descriptions of the data can be found there<sup>5</sup>. There are around 3,000 employees in each data set. Since we are focusing on individual earners rather than households, it is worth noting that validation against external sources has shown the employees in the samples to be representative in terms of age, occupational group and industrial sector.

Given appropriate data on individual earnings, there are various ways of assessing or presenting the shape of the distribution and the degree of dispersion. Most often, various percentiles of the distribution are expressed as proportions of the median. The median of the distribution is the earnings level above and below which half the earners are found. Ranking all employees by earnings from lowest to highest, the bottom decile cut-off is the earnings level below which the lowest 10 per cent of all earners fall, and the top decile the cut-off above which the highest 10 per cent are found. Correspondingly, the bottom and top quintiles are the cut-offs below/above which the bottom/top quarter of the distribution is found. A conventional approach to presenting the dispersion in earnings is then to express the bottom decile, bottom quartile, top quartile and

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<sup>5</sup> The 1994 data is actually the first wave in the Irish component of the European Community Household Panel (ECHP); the 1997 data is a later wave from this panel.

top decile as proportions of the median. While this gives a picture of a number of different points in the distribution, a single summary measure of dispersion may also be useful. It is also conventional to use for this purpose the ratio of the top to the bottom decile, though it is worth mentioning that different summary measures may not always lead to the same conclusions in terms of comparisons over time or across countries.

We focus first on the hourly earnings of all employees, and Table 1 shows the distribution of gross hourly earnings in the 1987, 1994 and 1997 surveys as captured by these measures. The table shows that from 1987 to 1994 there was a marked widening in dispersion at the top of the distribution. The ratio of the top decile to the median rose from 1.96 to 2.24, while the top quartile also moved further away from the median. In the bottom half of the distribution, the bottom quartile fell away from the median but the bottom decile did not. The overall picture is thus of widening dispersion throughout the distribution except at the very bottom, with the ratio of the top to the bottom decile rising sharply from 4.2 to 4.8.

**Table 1: Distribution of Hourly Earnings in 1987, 1994 and 1997, All Employees**

as proportion of median	1987	1994	1997
all employees, hourly earnings:			
Bottom decile	0.47	0.47	0.48
Bottom quartile	0.73	0.68	0.69
Top quartile	1.37	1.50	1.53
Top decile	1.96	2.24	2.33
Top decile/bottom decile	4.16	4.77	4.81

It is particularly interesting to see whether this trend continued from 1994 to 1997, as economic growth accelerated rapidly. We see that the top decile did continue to move away from the median, reaching 2.33 by 1997, with the top quartile also moving slightly further from the median. In the bottom half of the distribution, however, both the bottom decile and the bottom quartile now kept pace with the median, if anything increasing marginally faster. As a result, the ratio of the top to the bottom decile was essentially unchanged.

Over the whole period from 1987 to 1997, then, there was a substantial widening in earnings dispersion in terms of hourly wages among all employees. This was more pronounced in the 1987-94 period than from 1994 on, so rapid economic growth did not lead to an acceleration in the trend. It was primarily driven by relatively rapid increases for those towards the top of the distribution, with no indication that the bottom has been falling behind the median. In the light of the relatively rapid increase in the top decile compared with the median it is of interest to look at what was happening towards the very top. The 95<sup>th</sup> percentile (cutting off the top 5 per cent) rose even more rapidly than the 90<sup>th</sup> percentile, going from 2.4 times the median in 1987 to 2.8 in 1994 and 3.0 in 1997. The 99<sup>th</sup> percentile (cutting off the top 1 per cent) went from 3.6 in 1987 to 3.8 in 1994 and 4.3 in 1997. So over the whole period top earnings rose very rapidly, but it is only at the very top that there is any suggestion that this might have accelerated from 1994 to 1997.

It is also of interest to look at the distribution of weekly gross earnings among full-time employees. Various definitions and measures of what constitutes “full-time” are used in different countries or with different datasets, depending on custom and practice and the nature of the data available. In some cases survey respondents’ own categorisation of their status as full versus part-time is taken, in others different hours cut-offs are applied to

reported hours worked. Here we base the distinction on total hours of work reported by respondents, and count as full-time those reporting at least 30 hours usual work per week, the cut-off regarded as most suitable for comparative purposes by the OECD.<sup>6</sup> About 10% of employees worked less than this in 1987, but by 1994 the figure was up to 15% and by 1997 it was 19%. Table 2 shows the distribution of gross hourly and weekly earnings in 1987, 1994 and 1997 among full-time employees distinguished on this basis.

**Table 2: Distribution of Weekly Earnings in 1987, 1994 and 1997, Full-time Employees**

<i>Weekly earnings as proportion of median</i>	<i>1987</i>	<i>1994</i>	<i>1997</i>
Bottom decile	0.49	0.48	0.51
Bottom quartile	0.75	0.72	0.71
Top quartile	1.35	1.43	1.43
Top decile	1.82	1.97	2.02
Top decile/bottom decile	3.68	4.06	3.93

Once again we see that from 1987 to 1994 there was a consistent widening in dispersion at the top of the distribution. The top decile as a proportion of the median rose from 1.82 to

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<sup>6</sup> The recent study for the OECD by Van Baslelaer, Lemaitre and Marianna (1997) on how best to distinguish part-time from full-time employees for comparative purposes recommended that this 30 hours usual work per week be used.

1.97, and the top quartile also moved further from the median. The bottom decile was just below half the median in 1987 and 1994 and just above it in 1997. The top half of the distribution showed little change between 1994 and 1997. Over the decade as a whole, then, the ratio of the top to the bottom decile increased markedly, but this was concentrated in the period from 1987 to 1994.

A comparative perspective on the Irish earnings distribution and the way it has been changing since 1987 can be obtained using measures of earnings dispersion for a range of developed countries brought together by the OECD. These figures generally refer to full-time employees and to weekly, monthly or annual rather than hourly gross earnings, so for Ireland we focus on the results for weekly earnings among full-time employees. Table 3 shows the ratio of the top to the bottom decile in 1987 and 1994 for Ireland and the other OECD countries for which figures are available for both these points in time, together with the more limited figures available for 1997. We see first that Ireland had a relatively high level of earnings inequality in 1987 compared with other OECD countries, only Canada and the USA having a higher ratio of top to bottom decile. We then see that the increase in earnings dispersion in Ireland between 1987 and 1994 was the greatest of any of the countries shown, although over the decade from 1987 the USA saw a more substantial increase in this measure. There are potentially important differences in definition and coverage across countries (including the period over which earnings are measured, how “full-time” is defined and measured, and whether all sectors are covered), so these comparisons should be treated with considerable care, but they certainly suggest that earnings dispersion in Ireland rose relatively rapidly over this period.

**Table 3: Trends in Earnings Dispersion, Ireland and other OECD Countries, 1987-1997**

	<i>top decile/bottom decile</i>			<i>Change</i>	
	<i>1987</i>	<i>1994</i>	<i>1997</i>	<i>1987-94</i>	<i>1987-97</i>
Austria	3.47	3.65		0.18	
Australia	2.81	2.86	2.95	0.05	0.14
Belgium	2.45	2.24*		-0.19	
Canada	4.45*	4.18		-0.27	
Finland	2.51	2.35	2.33*	-0.16	-0.18
France	3.18	3.08	3.06*	-0.10	-0.12
Germany	2.83	2.80		-0.03	
Ireland	3.68	4.06	3.93	0.38	0.25
Italy	2.30	2.33	2.39*	0.03	0.09
Japan	3.15	3.01	3.01	-0.14	-0.14
Netherlands	2.53	2.58		0.05	
New Zealand	2.83*	3.03		0.20	
Sweden	2.10	2.18	2.27*	0.08	0.17
United Kingdom	3.31	3.39	3.41	0.08	0.10
USA	4.24	4.52	4.61	0.29	0.37

Source: OECD Earnings Database. \* Figures refer to 1986 rather than 1987, 1993 rather than 1994, 1996 rather than 1997.

To explore in more depth the way the Irish earnings distribution has evolved, we focus once again on hourly earnings and distinguish men and women, part-time versus full-time employees, and different age groups. The increase in dispersion was in fact particularly marked among men, with the top decile as a proportion of the (male) median rising from 3.5 to 5.0 over the decade. This reflects the bottom decile lagging behind the median, falling from 0.53 to 0.47, but also the sharp increase in the top decile from 1.9 to 2.3 times the median. Although dispersion was greater among women than men employees in 1987 it rose

by much less over the decade. With the ratio of the top to the bottom decile increasing for women from 4.4 in 1987 to 4.6 in 1997, dispersion was by then less than for men. The gap between average male and female earnings also narrowed a good deal over the decade. Where in 1987 hourly earnings for women were 82% of the corresponding average for men, by 1997 this figure had risen to 85%. This represents a continuation of a longer-term trend and a range of influences is involved. For present purposes, in terms of overall earnings dispersion the continuing convergence of mean (and median) hourly earnings of men and women will have served to partially offset the increase in dispersion among women and more particularly among men.

Distinguishing part-time from full-time employees on the basis of a 30-hour per week cut-off, one finds that average hourly earnings are actually consistently higher for part-timers throughout the period. This reflects the fact that significant numbers in professional occupations, including in particular teachers, will be classed as part-timers on that basis. A comparison of median earnings for the two groups gives a rather different picture, with the median for part-timers below that for full-time employees, bringing out the different shapes of the two distributions. As already mentioned, the percentage working part-time had increased substantially over the period, from 10% in 1987 to 19% in 1997. The part-time/full-time distinction also sheds an interesting side-light on male versus female earnings. A much higher proportion of women than men work part-time – in the 1997 sample about one-third of full-time employees versus three-quarters of part-time employees were women. Among full-timers, the average hourly wage for women went from 77% of the male average in 1987 to 84% in 1997.

When employees are categorised by age, the most striking feature over the decade from 1987 is the increase in dispersion within age ranges rather than across them over the decade. Within the 25 to 34 age range, for example, the ratio of the top to the bottom decile rose from 3 to 3.6, while within the 35 to 44 range it went from 3.7 to 4.4. There was also some increase in variation of median earnings across the age groups, however. The median for employees aged under 25 went from 70% of the overall median in 1987 down to 66% in 1997, while the 55-64 age group saw its median rise from 116% to 126%.

Bringing age and gender together, it is of interest to abstract for a moment from the impact of part-time working and focus employees on full time “adult” wages. Table 4 shows the way the distribution has evolved for full-time men aged 21 or over.

**Table 4: Distribution of Hourly Earnings in 1987, 1994 and 1997, Full-Time Male  
Employees Aged 21 or Over**

as proportion of median	1987	1994	1997
Hourly earnings:			
Bottom decile	0.63	0.55	0.57
Bottom quartile	0.78	0.74	0.75
Top quartile	1.33	1.42	1.44
Top decile	1.79	2.04	2.07
Top decile/bottom decile	2.86	3.68	3.61

We see that there has been a pronounced increase in dispersion among this group. The top decile has gone from 2.9 to 3.6 times the median over the decade, with most of this change

occurring by 1994. Among full-time women aged 21 or over, by contrast, there was very little change in dispersion over the period.

## THE RETURNS TO EDUCATION

In the introduction to this paper, we discussed how the increase in earnings inequality that has been observed in some countries has in turn been linked to increasing returns to skills, and in particular to education. We now explore the degree to which the trends in earnings inequality in Ireland described in the previous section are also linked to this factor. One would certainly expect the demand for educated and skilled workers to have increased in the Irish case given the pace and nature of economic growth during the 1990s. However, it is possible in the light of the rapid educational expansion in recent years that increasing demand for skills was actually met with an increased supply on a similar scale. The return to those skills could then have remained unchanged.

In order to provide a sense of the increase in the supply of skilled labour in the Irish labour market in recent years, Figure 1 shows estimates of skilled and unskilled labour supply<sup>7</sup> over the last 25 years. Skilled labour is defined as those members of the labour force who have at least a leaving certificate (high school graduation) and unskilled as those with lower levels of educational attainment. From the early 1980s onwards the supply of unskilled labour fell quite rapidly, as a result of increasing educational participation at second level. There may also have been a “discouraged worker” effect in the 1980s due to the prolonged recession. In the 1990s the fall in supply of unskilled labour has continued, albeit more slowly. It has been

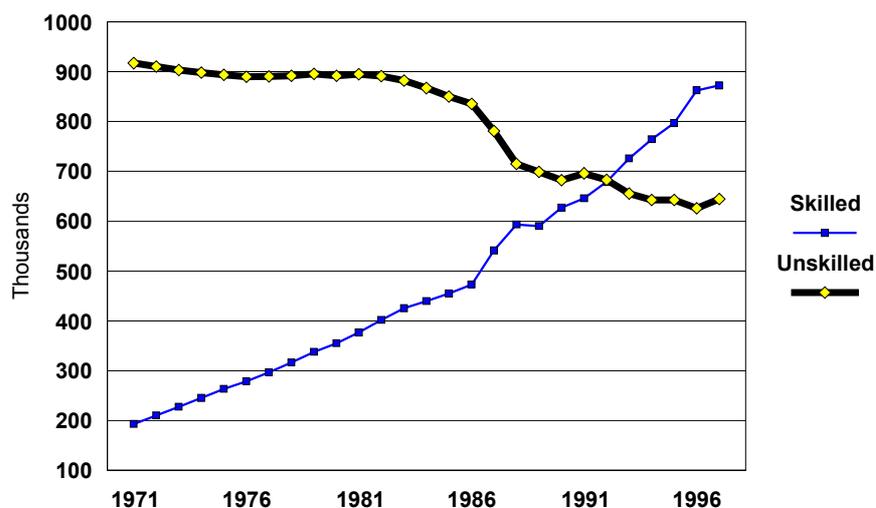
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<sup>7</sup> Here total labour supply is defined as the labour force as estimated by the Central Statistics Office for each year. The data used in the graph up to 1987 are obtained from successive censuses by interpolation. From 1988 onwards the numbers are taken from an analysis of the Labour Force Survey micro data.

modified in recent years by rising labour force participation among women with limited educational attainment.

Over the whole period from 1971 to 1997 the supply of skilled labour has risen rapidly and fairly continuously. The one exception was the late 1980s, when emigration, predominantly of skilled people peaked. Between 1971 and 1981 supply of skilled labour rose by 95 per cent, between 1981 and 1991 it rose by over 72 per cent and between 1991 and 1997 there was a further increase of 35 per cent. In the 1990s immigration and rising female labour force participation have contributed to the increase in skilled labour.

**Figure 1 Labour Supply by Educational Attainment**



As regards labour demand, rising demand for skilled labour occurred throughout the industrialised economies (Nickell and Bell, 1995) over the 1980s and the 1990s. However, the shift in demand in Ireland has been accentuated by the impact of foreign direct investment on the economy. The bulk of the foreign direct investment has, until recently, gone to the

manufacturing sector. By 1997 almost 50 per cent of all employment in manufacturing was in foreign owned firms and a quarter of all employment was in US owned firms (Table 5). The bulk of this employment in foreign owned firms was in the high-technology sector, broadly defined.

**Table 5: Share of total manufacturing employment by sector and by ownership**

	Irish Owned	Foreign Owned	Of which: US Owned	Total
Other	40.1	17.3	7.1	57.4
High Tech.	12.1	30.5	18.2	42.6
Total	52.2	47.8	25.2	100.0

In the 1960s the two sectors of the economy that employed the bulk of the skilled labour force were financial and professional services. They still are the major employers of skilled labour, but the gap in levels of human capital employed in these sectors and in the rest of the economy has narrowed considerably, with a general upgrading of the skill levels in high-technology manufacturing (engineering, including computers, and chemicals). The high technology manufacturing sector, driven by the inflow of foreign firms, now has an above average level of human capital in its labour force. The most rapid increase in the demand for skilled labour in the 1990s has occurred in the high technology manufacturing and in financial services, both of which are affected by the inflow of new firms from abroad.

We now turn to our estimation of the relative impacts of increasing labour supply and labour demand on the returns to education. We estimate earnings functions and examine the return to different levels of educational attainment in the years 1987, 1994 and 1997, once again drawing on the household survey data sets. Before presenting our estimates of the returns to

education, we will briefly discuss the method used. We estimate regression equations in which the dependent variable is the logarithm of hourly earnings. We include as independent variables a range of factors that influence earnings, including education. While this type of earnings equation is used extensively in analyses of this sort, there is not general agreement on what dependent variables to include. For this reason, we estimate a range of specifications and present the results of each. It will be seen that while the coefficients on the educational categories vary across specifications, a general picture emerges which sheds additional light on the findings of the previous section.

In order to enter education in the regressions as a categorical variable, we set up a number of education categories based on the highest level of schooling attained. These are as follows:

“Primary only”: This includes those who left school at the end of primary level, or did some second-level schooling but obtained no qualification.

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, plus a small number with qualifications under the Post Leaving Certificate and Vocational Preparation and Training Programmes.

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.

In each of the regressions, “primary” is the omitted category and so the returns to each level of education is measured relative to that group.

We estimate five specifications of the wage equation for each of the three years. The variables included are as follows:

*Specification 1:* Age and its square, the educational categories, and sex interacted with marital status (married man, married woman and single 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 training or further education after first leaving the full-time education system, years not worked and its square,<sup>8</sup> the educational attainment 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).

The choice of these five specifications is designed to address three main issues. First, what is the impact of the inclusion of measures of actual experience on the education coefficients?

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<sup>8</sup> This specification seeks to capture the effects of experience more adequately than via simply age, by including a measure of years since first leaving full-time education broken down into years spent in work, years spent in training or back in full-time education, and years spent out of work.

Many studies do not have access to such data and are forced to rely instead on potential experience as measured by age or age since leaving school. Comparisons based on specifications (1) and (3) and (2) and (5) can help to address this issue. Second, how are (changes in) the returns to education affected by allowing for possible time-related differences in returns; there are many reasons why the premia commanded by particular levels of educational qualification may vary for younger and older age groups. The specifications interacting education levels and age-bands allow for some such variation, whereas the more common practice of assuming a single premium attaching to the educational level across all age groups does not. Comparisons based on specifications (1) and (2), and (3) and (5) can help to address this issue. Third, the impact of the inclusion of measures of the industry- and occupation-specific unemployment rates in the wage equation can be examined by comparing specifications (3) and (4). Identical specifications were used for the 1987, 1994 and 1997 analyses<sup>9</sup>.

In Table 6, we present the estimates of the returns to education from Specification 1, 3 and 4 for the three years. As would be expected, the returns relative to the contrast category rise with level of education. For example, from Specification (1) in 1987 we can read that those with junior cycle qualifications earned 17 percent more per hour than those with only primary schooling; those with leaving certificates earned 37 percent more and those with degrees earned 86 percent more.

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<sup>9</sup> The earnings equations are estimated including both men and women. When estimating such equations for women, selection correction techniques are often employed, to account for women who do not work and so for

Turning to the comparison of these returns over time, we will firstly look at the change between 1987 and 1994. While there is some movement in the point estimates between 1987 and 1994, the only differences that are statistically significant are those for university degrees. All three specifications show the returns to the highest education increasing. This finding is consistent with the increase in earnings inequality between 1987 and 1994, documented above. It suggests that in spite of increased numbers of skilled employees and centralised wage bargaining, the increase in the demand for skilled labour was sufficiently strong for the price of that labour to be bid up.

If we compare the returns to education in 1994 and 1997, a slightly more mixed picture emerges. According to Specifications (1) and (3), the returns to university education in 1997 were statistically the same as in 1994. However, Specification (4) indicates that the return actually fell. As this specification includes measures of unemployment in occupations and industries, and as these numbers changed substantially between 1994 and 1997, the change in the point estimate may reflect interactions in the effects of education and unemployment on earnings. A conservative summary of the results between 1994 and 1997 would be to say that the increase in returns to university education that was observed between 1987 and 1994 did not continue between 1994 and 1997. Again, this is consistent with the reduction in the growth of earnings inequality between 1994 and 1997.

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whom no wage is reported. As the equations with men only showed a similar pattern to those presented here, we opted for the simpler approach.

**Table 6: Estimates of Returns to Education: 1987, 1994 and 1997**

<i>Wage equation specification</i>	<i>Highest educational qualification</i>	<i>All Employees</i>		
		<i>1987 coefficients (standard errors)</i>	<i>1994 coefficients (standard errors)</i>	<i>1997 coefficients (standard errors)</i>
(1)	Group, Inter., Junior Cert.	0.17 (0.03)	0.22 (0.03)	0.20 (0.03)
	Leaving Certificate	0.37 (0.03)	0.41 (0.03)	0.43 (0.03)
	Diploma or other 3rd level	0.58 (0.04)	0.54 (0.03)	0.61 (0.04)
	University degree	0.86 (0.04)	1.01 (0.03)*	1.02 (0.03)
(3)	Group, Inter., Junior Cert.	0.12 (0.03)	0.18 (0.03)	0.15 (0.03)
	Leaving Certificate	0.36 (0.03)	0.36 (0.03)	0.33 (0.03)
	Diploma or other 3rd level	0.59 (0.04)	0.53 (0.03)	0.56 (0.04)
	University degree	0.88 (0.04)	1.01 (0.03)*	0.95 (0.04)
(4)	Group, Inter., Junior Cert.	0.11 (0.03)	0.17 (0.03)	0.12 (0.03)
	Leaving Certificate	0.34 (0.03)	0.34 (0.03)	0.27 (0.03)
	Diploma or other 3rd level	0.56 (0.04)	0.51 (0.03)	0.48 (0.04)
	University degree	0.85 (0.04)	0.98 (0.03)*	0.85 (0.04)*

Note: \* indicates an estimate that is statistically different from the corresponding estimate in the earlier year.

In Table 7, we present the estimates of education returns by age categories. The point estimates are now based on smaller cell sizes and so the standard errors are correspondingly larger. For this reason, it is less likely that we will observe differences that are statistically significant. We can still consider the pattern of coefficients and draw conclusions, even though they are on a weaker statistically footing.

We now see that for the youngest age group, the returns to university education were either identical or increased slightly between 1987 and 1994, at least in terms of point estimates. The increases in these returns in Table 6 are now seen to have been concentrated on the middle or older age groups. For the middle-aged group, the increase is statistically significant in Specification (5); it is also relatively large in Specification (2). For the older group, the differences in the point estimates are also relatively large.

This different trend in returns to university education across age groups between 1987 and 1994 calls for an explanation. One possible explanation is based on the notion that the skilled labour market is not homogeneous but rather is differentiated by experience levels. By this we mean that inexperienced skilled workers are not perfect substitutes for experienced skilled workers. As the increase in supply of educated workers would have been made up of those leaving the education system, they would have been primarily in the younger age category. If the skilled labour market is indeed differentiated between the newly-skilled and the more experienced skilled employees, the increase in supply of newly-skilled employees would not have an impact in the market of experienced skilled workers. Hence the increase in demand for skills was met with a supply increase in one part of the skilled market and so the price did not rise; in the other part of the market, i.e. the experienced skilled market, no supply increase was forthcoming and so prices did rise.

**Table 7: Estimates of Returns to Education by Age Category: 1987, 1994 and 1997**

Wage equation specification	Highest educational qualification	All Employees		
		1987 coefficients	1994 coefficients	1997 coefficients
(2)	Age group 15-32			
	Group, Inter., Junior Cert.	0.08	0.11	0.23 (0.05)
	Leaving Certificate	0.23	0.21	0.38 (0.04)*
	Diploma or other 3rd level	0.39	0.26	0.53 (0.06)*
	University degree	0.73	0.73	0.85 (0.06)
	Age group 33-49			
	Group, Inter., Junior Cert.	0.18	0.24	0.14 (0.04)
	Leaving Certificate	0.42	0.52	0.42 (0.04)
	Diploma or other 3rd level	0.56	0.67	0.66 (0.05)
	University degree	0.90	1.13	1.10 (0.05)
	Age group 50-64			
	Group, Inter., Junior Cert.	0.21	0.14	0.13 (0.06)
	Leaving Certificate	0.49	0.35	0.52 (0.06)*
	Diploma or other 3rd level	0.87	0.71	0.65 (0.09)
	University degree	0.94	1.04	1.06 (0.06)
	(5)	Age group 15-32		
Group, Inter., Junior Cert.		0.05	0.14	0.13 (0.05)
Leaving Certificate		0.26	0.26	0.21 (0.05)
Diploma or other 3rd level		0.46	0.39	0.40 (0.06)
University degree		0.86	0.91	0.74 (0.06)*
Age group 33-49				
Group, Inter., Junior Cert.		0.12	0.18	0.11 (0.04)
Leaving Certificate		0.38	0.42	0.29 (0.04)
Diploma or other 3rd level		0.54	0.60	0.52 (0.05)
University degree		0.88	1.06*	0.91 (0.05)*
Age group 50-64				
Group, Inter., Junior Cert.		0.16	0.13	0.06 (0.05)
Leaving Certificate		0.45	0.34	0.38 (0.05)
Diploma or other 3rd level		0.79	0.63	0.49 (0.08)
University degree		0.78	0.95	0.83 (0.06)

Comparing the return to education between 1994 and 1997, and again focussing on the returns to university education, we can see that the returns appear to have either stayed the same as 1994, or to have fallen, for all age groups. Either way, it can be said that no age group continued to enjoy increases in return between 1994 and 1997. Specification (2) does

show a rise in the returns for the youngest age group but this is not statistically significant and under Specification (5), a statistically significant fall is observed. Once again, an explanation is required especially as it might have been assumed that increased economic growth would have led to further increases in the return to university education.

Above we suggested that the relative stability of the return for the youngest age group between 1987 and 1994 was the result of an increased supply of younger skilled workers and this argument can be advanced here also to explain the fall for younger workers. However, we need to look elsewhere for an explanation of the decline in the return for older workers, especially the middle-aged group for whom a statistically significant fall in observed.

We draw on another supply explanation. The growth in the economy in recent years has brought with it the return to Ireland of former emigrants and the entry of immigrants. Two characteristics of the inflow are relevant to our findings. First, although there was a net inflow of 16,400 between 1994 and 1997, this aggregate figure hides large differences across age groups. For those aged 15-25, there was a net outflow of 44,100; for those aged 25-44, there was a net inflow of 27,400<sup>10</sup>, which is about 3 percent of the population of that age. The second relevant characteristic of the inflow relates to its educational composition. Barrett and Trace (1998) have shown that both returning migrants and immigrants in the years 1994 to 1996 had higher levels of educational attainment than the domestic population. For example, while 12.7 percent of the domestic labour force aged 30 to 39 had university degrees, 28 percent of returning migrants in that age group had degrees. The corresponding figure for immigrants was 43.2 percent. Hence, the inflow of skilled workers in this middle age group

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<sup>10</sup> All figures are derived from a Central Statistics Office (1999) release on migration statistics.

would be substantially higher as a percentage of the corresponding age/education population than the 3 percent mentioned above. This may explain the possible fall or stability in the return to university education for this group over that period.

### TESTING THE IMMIGRATION HYPOTHESIS

We test this immigration hypothesis following an approach used by Borjas, Freeman and Katz (1997). While many studies have looked at the labour market impact of immigration by relating changes in wages to inflows of migrants across regions, Borjas et al have criticised this approach. They argue that adjustments to immigration may take the form of native workers not moving to areas that have experienced large inflows of immigrants. If this does occur, immigrants may have effects on the national labour market that are not observed in inter-regional comparisons. For this reason, Borjas *et al* simulate the impact of immigrants on wages in a national framework. They do so by comparing the nation's supplies of skilled and unskilled labour under different immigration levels and then assessing the relative wage impacts.

Broadly following this approach, we develop a simple model of the Irish labour market that allows us to compare outcomes with and without an inflow of skilled immigrants. The model is based on a theoretical structure, the parameters of which are then estimated using data from 1971 to 1996.

The structure of the model can be found in the Appendix so here we provide only the essential features. The model consists of two kinds of labour - skilled and unskilled. Within the model, the wages of the skilled and employment levels of both the skilled and unskilled

are determined, along with output<sup>11</sup>. Among the specific features are the following. While the supply of unskilled labour is assumed to be inelastic, the elasticity of supply of skilled labour is assumed to be greater. This reflects the fact that the skilled elasticity has been unusually high because of the ready movement of skilled labour in and out of the country and because of the elasticity of supply of skilled female labour. The elasticity of substitution between skilled and unskilled labour in Ireland has been found to be relatively low (Kearney, 1999) and this is incorporated into the model by assuming that the elasticity of substitution is zero. Regarding output, an equation is used to reflect the fact that Irish output is quite sensitive to the relative cost (or profitability) of producing in Ireland compared to other countries (Bradley and Fitz Gerald, 1988 and Bradley, Fitz Gerald and Kearney, 1993). At the level of the Irish economy skilled and unskilled labour are assumed to be complements - a rise in the cost of either factor will reduce Irish output and employment of both kinds of labour. Because of the assumed zero elasticity of substitution between the two kinds of labour within the economy the output (or scale) effect dominates any substitution effect (Bradley, Fitz Gerald and Kearney, 1993).

Within this model the effect of immigration of skilled labour is to reduce upward pressure on the skilled wage rate. In turn, this reduces the cost of producing in Ireland and increases output. Because Irish skilled and unskilled labour are complements, the increase in competitiveness due to falling skilled wage rates also increases the demand for unskilled labour. Thus the effect of skilled migration is to reduce the pressures for growing inequality in wage rates through reducing skilled wage rates and tightening the market for unskilled labour.

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<sup>11</sup> The wages of the unskilled are assumed to be a fixed mark-up on social welfare payments.

Over the four years 1996 to 1999 net immigration averaged 16,000 a year. As Barrett and Trace (1998) have shown, the bulk of these people, whether they were returning emigrants or foreigners, had a high level of education. As a result, they significantly increased the supply of skilled labour over that period. Applying an increase in skilled labour of this magnitude to the labour market model described above allows us to estimate the impact of immigration into Ireland<sup>12</sup>.

The estimates of the effects are presented in Table 8. Four years after the shock, the impact of the immigration was to increase the supply of skilled labour by 3.2 per cent and to reduce skilled wage rates by 4.7 percentage points. (The model assumes that due to high levels of unskilled unemployment unskilled wage rates are unaffected by demand.)<sup>13</sup> As a result, the model would suggest that the impact of net immigration of skilled labour was to narrow the gap between skilled and unskilled wage rates by around 4.5 percentage points compared to the situation with no net migration.

This relaxation in the skilled labour supply constraint, and the resulting reduction in skilled wage rates, made Ireland more competitive on world markets. The model would suggest that this raised the level of GNP in the short run by 1.5 percentage points. The long run impact would be substantially greater, due to the slow adjustment of productive capacity to changing economic circumstances. Ultimately the model would suggest that the impact of the

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<sup>12</sup> As there were 1.5 million in Ireland's labour force in 1996, the increase of 64,000 is 4.3 percent.

<sup>13</sup> However, recent evidence suggests that this may no longer be the case and that the tightening of the unskilled labour market is exerting upward pressure on wage rates.

improved competitiveness would be to raise the level of GNP by around 4 percentage points. With rapid adjustment of both skilled and unskilled employment (they are complements) to the changed circumstances, the unemployment rate is estimated to have fallen by around 0.7 percentage points, all of which is concentrated among those members of the labour force with limited education.

**Table 8: Effects of Net Migration in the Four Years Ended 1999**

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Skilled Labour Supply	%	3.2
Skilled Wage Rates	%	-4.7
GNP	%	1.5
Total Employment	%	3.2
Unemployment rate	Percentage points	-0.7

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Of course this analysis is only partial in nature as it does not take account of the wider impact of higher growth in putting increased pressure on existing infrastructure, in particular on housing. The model also incorporates some simplifying assumptions that are probably inappropriate under current circumstances. While the model assumption that unskilled wage rates are unaffected by labour market pressures was reasonably appropriate in the 1980s and early 1990s, it is clearly unrealistic under current circumstances. To the extent that the tightening of the unskilled labour market impacts on unskilled wage rates, the narrowing in wage dispersion arising from immigration will be even greater than shown in Table 8.

## CONCLUSIONS

Increasing earnings dispersion and rising returns to education and skill have received a great deal of attention internationally, and the aim of this chapter has been to document what has been happening in Ireland in this regard. We saw that over the period from 1987 to 1997

there was a substantial widening in earnings dispersion in terms of hourly wages among all employees. This was more pronounced in the 1987-94 period than from 1994 on, so rapid economic growth did not lead to an acceleration in the trend. It was primarily driven by relatively rapid increases for those towards the top of the distribution, with no indication that the bottom has been falling behind the median. Ireland already had a relatively high level of earnings inequality in 1987 compared with other OECD countries, and the increase in earnings dispersion was also relatively rapid.

From the early 1970s the supply of skilled labour in Ireland has risen rapidly as a consequence of educational expansion, with immigration becoming an important factor in the 1990s. The supply of unskilled labour, on the other hand, fell quite rapidly from the early 1980s as a result of increasing educational participation at second level. As regards labour demand, rising demand for skilled labour occurred throughout the industrialised economies over the 1980s and the 1990s; in Ireland, this has been accentuated by the scale of foreign direct investment in the high-technology sector. To tease out the relative impacts of increasing labour supply and labour demand on the returns to education, we estimated earnings functions and examined the return to different levels of educational attainment for 1987, 1994 and 1997. The results suggested an increase in returns to third-level education between 1987 and 1994, but this was confined to the middle or older age groups and did not continue from 1994 to 1997 – indeed declining returns for the middle age ranges were then seen.

Immigration of skilled and experienced workers – particularly returning migrants – became substantial in the mid 1990s and this may explain the stability or even decline in the return to university education for this group over that period. Such an immigration effect on the

differential between skilled and unskilled wages was consistent with the results from a simple model of the Irish labour market, with parameters estimated using data from 1971 to 1996, that allowed outcomes with and without an inflow of skilled immigrants to be compared. So while immigration into the United States may have been a source for increased earnings inequality, the evidence presented here suggests that the opposite was true in Ireland.

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## APPENDIX

### Labour Market Model

Equations determining labour force participation rates:

$$N_h / POP_h = f(w_h, p_c, z_h)$$

$$N_l / POP_l = f(w_l, p_c, r, z_l)$$

The first equation determines  $w_h$

The second equation determines  $N_l$

The unskilled wage rate:

$$w_l = \gamma r$$

This determines  $w_l$ . Post 1980 until the late 1990s it is driven by the rate of social welfare (replacement rate)  $r$ . For the 1970s and for recent years an alternative formulation is needed.

Immigration:

$$M_h = f(w_h, w^u, UR, UR^u) \quad \text{This equation determines } M_h.$$

$$M_l = 0$$

Post 1980:  $M_l = 0$ .

Irish Output is a function of world output and competitiveness (vis a vis the UK).

$$Q^i = f(Q^w, w^i, w^u, tax^i, tax^u, time) \quad \text{This equation determines GNP}$$

The weighted average wage rate for Ireland:

$$w^i = \alpha w_h + (1 - \alpha) w_l$$

This equation determines  $w^i$

The labour demand equation for the composite labour input L:

$$L = f(Q^i, \frac{w}{p_c}, time) \quad \text{This equation determines } L$$

The shares of skilled and unskilled labour in the labour bundle of inputs is purely a function of technical progress (time). It is assumed that there is zero elasticity of substitution between the two types of labour (see Kearney, 1998)

$$\frac{L_h}{L_l} = f(time) \quad \text{This equation determines } L_h$$

Total employment:

$$L = L_h + L_l \quad \text{This equation determines } L_l$$

Skilled labour is assumed to be fully employed – frictional unemployment is defined by  $\beta$

$$\frac{L_h}{N_h} = \beta \quad \text{This equation determines } N_h. \text{ Full employment is defined by } \beta.$$

The labour force:

$$N = N_h + N_l \quad \text{This equation determines } N.$$

The unemployment rate:

$$UR = (N - L) / N * 100 \quad \text{This equation determines the unemployment rate } UR$$

Population:

$$Pop = Pop_h + Pop_l \quad \text{This equation determines } POP.$$

$$Pop_h = DelPOP_h + M_h \quad \text{This equation determines skilled population aged 20-64}$$

$$Pop_l = DelPOP_l + M_l \quad \text{This equation determines the unskilled population aged 20-64}$$

Where:

$N_h$  = Labour supply - skilled

$N_l$  = Labour supply – unskilled

$w_h$  = Wage rate - skilled

$w_l$  = Wage rate – unskilled

$w^u$  = Wage rate - UK

$p_c$  = Consumer prices

$r$  = rate of social welfare

$Q^i$  = Irish Output

$Q^w$  = World Output

$w^i$  = Average wage rate in Ireland

$L_h$  = Employment – skilled

$L_l$  = Employment – unskilled

$L$  = Total employment

$M_h$  = Immigration, skilled

$M_l$  = Immigration, unskilled

$N$  = Labour supply

$UR$  = unemployment rate

$UR^u$  = unemployment - UK

$tax^i$  = Tax wedge in Ireland

$tax^u$  = Tax wedge in UK

$\Delta POP_h$  = Natural increase in skilled population aged 20-64.

$\Delta POP_l$  = Natural increase in unskilled population aged 20-64.

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