Why did earnings inequality increase in Ireland: 1987-1994?

Nuala O'Donnell[*]

European University Institute, Florence

email:odonnell@datacomm.iue.it

Abstract:

This paper reviews evidence on the distribution of earnings in Ireland between 1987 and 1994. Possible explanations within the Supply - Demand - Institutional framework are considered and changes in these factors in Ireland are described. Theil MLD indices are calculated and decomposed to assess why inequality has increased. Finally, changes in employment structure are decomposed to between and within industry components. Within industry changes are found to dominate, suggesting that technological change has been an important factor in explaining the rise in earnings inequality.

Section 1: Introduction

This paper considers earnings inequality in Ireland since 1987. This timeframe is used because of data availability. The broad picture is that earnings inequality in Ireland in an international context was high in 1987 and has increased a lot since that date, moreso than in other countries. This paper considers why that has been the case, looking at the issue from the commonly used Supply - Demand - Institutional (SDI) framework. As will be discussed below, supply and institutional factors were working in such a way as to lead one to expect a decrease rather than an increase in earnings inequality. In terms of supply, there were large increases in educational attainment over the period while with reference to institutions, centralised wage bargaining was re-introduced in 1987. It will be shown that the burden of explanation for increasing earnings inequality seems to fall on demand-side factors.

The structure of the paper is as follows. Section 2 describes how earnings inequality has changed, Section 3 describes the candidate explanations. Section 4 reviews how factors related to these explanations have changed for Ireland. Section 5 describes general economic trends in the period under review. Section 6 describes relevant previous work. Section 7 describes the data used and the analyses undertaken while Section 8 concludes.

Section 2: How earnings inequality has changed

Table 1: Distribution of Earnings, Ireland, 1987 & 1994

as proportion of median	1987	1994
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

Source: Barrett, Callan and Nolan 1997a

The above table is taken from Barrett, Callan and Nolan (1997a). It shows increased dispersion in the distribution of weekly earnings for full-time employees between 1987 and 1994, particularly so at the top of the distribution. The same pattern of widening dispersion holds true for hourly earnings among men and also for full-time adult men (defined as 21 years or more). The fall in the bottom decile relative to the median is actually more pronounced if one considers men only. However, for workers under 30, earnings dispersion

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increased at the top of the distribution but narrowed at the bottom. Thus, the ratio of the top to bottom decile was quite stable over the period (Barrett, Callan and Nolan, 1997b).

Earnings inequality in Ireland is high in an international context. Atkinson, Rainwater and Smeeding (1995), in a study of income distribution in OECD countries, consider the distribution of primary income[1]. This measure is however, not strictly comparable with earnings from employment, which is the focus of the analysis in this paper. On this measure, Ireland had the highest 75th, 90th and 95th percentile as a percentage of the median, 90/10 and 80/40 decile ratios and Gini and Atkinson coefficient, with the US the next highest on all these measures.

Barrett, Callan and Nolan (1997a) compare the results of the 1994 survey with measures of earnings dispersion for OECD countries. Considering weekly pay among full-time employees, the ratio of the top decile to the median was among the highest of the countries covered. The ratios of the median to the bottom decile and the top decile to the bottom decile were highest in Ireland, followed by Canada and the US on the median-bottom measure and the US and Canada on the top-bottom decile. Comparing the change in the ratio of the top to the bottom decile, the increase in Ireland between 1987 and 1994 was greater than in any other country, for a similar time period. Due to non-comparability of data, the US was not included in this examination of changes.

Section 3: Possible Explanations

As mentioned in the introduction, a supply - demand - institutional framework has been commonly used recently to explain changes in earnings inequality. Within the supply and demand framework, rising skill differentials are explained by an outward shift in the relative demand curve for skilled labour which also results in an increased employment share for skilled workers. Two leading candidate explanations for this increase in relative demand are trade induced changes in industrial structure or technological change which has increased the productivity of skilled workers.

The evidence seems to favour the technological change explanation. Studies have shown that the effect of the US trade deficit on relative skill demand is, in fact, quite small (Lawrence and Slaughter, (1993), Sachs and Shatz (1994)). Two facts which are used to support the technological change argument are that the largest part of the decrease in the proportion of unskilled labour in total

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[1] This covers wages, salaries and self-employment income, net of employer contributions for insurance and other benefits, but gross of such employee contributions and also excluding property income.

employment is not due to a decline in the employment share of low-skilled industries (which would be evidence for a trade effect) but has taken place within industries. Secondly, increases in the employment share of skilled workers which have taken place within industries are positively correlated with indicators of technological change.

How have changing labour market institutions affected wage inequality? The standard examples are the US and UK where wage inequality has increased while trade union power has been weakening and the importance of the minimum wage has declined. Several studies for both the US and UK attribute about 20 per cent of the relative increase in wage inequality to union decline (e.g., Freeman (1993), Gosling and Machin, (1995)). Machin and Manning (1994) attribute between 9 and 20 per cent of the increase in dispersion in low-pay sectors in the UK covered by the minimum wage, to reduced strictness in the minimum wage legislation.

The next section considers how factors in the SDI framework have been changing for Ireland.

Section 4: Changes in supply and institutional factors in Ireland: 1987-94

Supply
Supply factors in Ireland over the period of this study have been changing in such a way that one would have expected earnings inequality to fall rather than rise. This has been a time of increased educational attainment, which has dramatically altered the educational profile of the labour force. For example, between 1985 and 1994, the proportion of 18-21 year olds in tertiary education doubled (Barrett, Callan and Nolan, 1997a). This was against a background of falling youth employment, high unemployment and migration in the economy at large and a continuation of the pattern of increased enrollment since the introduction of free secondary education in 1967.

At least until the early 1990s, it seems that for many, the decision to invest in education was seen as an alternative to unemployment.

Hughes and O'Connell (1995) present evidence on the increase in university qualifications between 1981 and 1991. In 1981, 22 degrees were awarded per 1,000 population aged 20-24. By 1991, the figure had increased to 40. The rate of increase in awards was higher for Masters and Doctoral degrees than for undergraduate degrees.

The number of 18 year olds in the economy, the population from which University entrants are generally drawn, had increased by 6% over the period, compared with a 75% increase in the number of degrees awarded.

Analysis of unemployment and migration rates for university graduates over this period suggests that third-level students extended their time in college in response to falling demand by employers, rather than in response to increased demand for highly skilled workers. An over-supply of highly skilled labour was evident in the economy, resulting in under-employment of human capital. However, the picture has changed in recent years. Barrett, Callan and Nolan (1997a) find that the returns to higher levels of education have risen. In the years of strong economic growth, increased employment and reduced migration following the earlier study, the demand for skilled labour had increased, absorbing the increased supply, without reducing the returns to education.

As older less educated workers retired and new entrants brought high educational qualifications, the educational profile of the workforce was enhanced. Barrett, Callan and Nolan (1997a) show that between 1987 and 1994, the proportion of full-time employees with only primary education fell from 18% to 8.6% while the proportion with a post second-level diploma increased from 17.6% to 27.8%. *Ceteris paribus*, this outward shift in the relative supply curve of skilled workers should have reduced rather than increased skill differentials and earnings inequality.

To compare briefly with the situation in the US and UK, in the US during the 1970s, in the 25-34 age-group, the supply of male college graduates increased by 85% with a 151% increase for females. The figures for high-school graduates were 13% and 66%. This drove down the earnings premium for a college degree in the 1970s, at a time of relatively stable earnings inequality . In the 1980s, there was a sharp decrease in the rate of growth of college graduates as a proportion of the labour force while the education premium increased strongly, at a time of rapidly rising earnings inequality (Levy and Murnane, 1992).

In the UK in the 1970s, increases in the supply of skilled labour drove down education differentials as the wage distribution became compressed. In the 1980s, earnings inequality rose as did skill differentials despite continued growth in skilled labour supply (Schmitt, 1994).

Institutions

Wage setting

Centralised pay arrangements have been in place in Ireland since 1987. The current agreement will last until 1999. Bargaining had been previously centralised from 1970 to 1981, but became decentralised from then to 1987.

The Programme for National Recovery (PNR) was negotiated in 1987 between government, trade unions and employers. Controlling wage inflation was seen as central to increasing competitiveness and to restoring order to the public finances, which were then in a state of crisis. Given the deflationary agenda of the government, it was important to have the unions, especially those in the public sector, on side (Roche, 1994a).

Pay increases of 2.5% were agreed for each of the years 1988 - 1990. In the event, higher increases were negotiated in the private sector. In the public sector, the 2.5% increase was paid during the PNR but special awards were made under the Programme for Economic and Social Progress (PESP), which was negotiated to run from 1990 to 1993. The PESP and its successor, the Programme for Competitiveness and Work (PCW) had explicit targets for the reduction of the Debt/GDP ratio. Unlike the PESP, however, the PCW did not include a Local Bargaining Clause, which allowed for the negotiation of additional pay rises of 3 per cent in the second year of the programme. Roche takes the positive view that many of the awards under this clause in the PESP, were as part of agreements for increased productivity. The current programme, the Partnership 2000 for Inclusion, Employment and Competitiveness (P2000) includes this Local Bargaining Clause.

Commentators disagree as to the nature of the current arrangements, i.e., the extent to which they can be described as social corporatism and also on their impact. Durkan (1992) argues that the special awards along with higher increases in basic rates of pay and reductions in personal taxation in the first two programmes, improved the incomes of trade unionists over the period of the agreement, with little regard for the unemployed. A more benign view is taken in a subsequent paper (Durkan and Harmon, 1996) which finds negative coefficients on dummy variables representing the PNR and PESP in regressions to explain wage inflation and the unemployment rate. "There is definitely some evidence that unemployment was exerting downward pressure on wage rates, and that this was operationalised via the system of centralised bargaining" (pg. 11).

A positive view is also taken by O'Donnell and O'Reardon (1997) who argue that the agreements amounted to social partnerships which produced and

sustained the economic recovery and subsequent growth, while also aiding Ireland's participation in the European Monetary System (EMS).

Teague (1995) addresses the issue of whether the pay deals can be described as social corporatism. He argues that under a social corporatism regime, the wage setting process should have one or more of the following aspects; competitiveness, employment, stabilisation and equity. With regard to the equity function, Teague argues the pay deals had little effect in the private sector and increased inequality in the public sector, with the highest increases going to those at the highest wage levels. Roche (1994a) argues that the fact that well-paid and profitable sectors accorded with the agreements constrained market forces and was progress itself and states that unions sought to and were successful in increasing the value of social programmes under the agreements, such as expenditure on health and social welfare programmes. Changes in employment legislation were also implemented. The current agreement (P2000), places explicit emphasis on social measures to reduce poverty and exclusion, with commitments to adopt a national anti-poverty strategy, focusing on long-term unemployment, educational disadvantage and low incomes.

But whatever the redistributive content of the agreements, they could not, at least until 1994, constrain forces causing increased earnings inequality. This is at variance with the situation in the UK when income policies were in place in the 1970s and wage dispersion narrowed (Machin, 1996). Could wage drift have played a role in the failure of the bargaining agreements to compress the wage distribution? This was found to be the case for Italy in 1980s (Erickson and Ichino, 1994) and a feature of the Swedish wage bargaining system (Hibbs, 1991). Roche (1994a) states that this was not a problem during the first agreement, the PNR while under the PESP, local bargaining increases in the private sector were contained within the 3 per cent limit and were productivity related. Hardiman (1992) states that pay increases above the PNR norms were negotiated in the pharmaceuticals, chemicals and electronics sectors, which, as will be described below, are areas dominated by foreign firms.

Unionisation
Union density rates increased in the 1970s (OECD, 1994) in common with the majority of OECD countries (see Table 2 below). This was a time of a slightly increasing share for manufacturing employment in total employment, a sector that is normally relatively strongly unionised. Foreign multinationals investing in Ireland in the 1970s were strongly encouraged to recognise unions (Callan and Reilly (1993), Roche (1992)). However, these foreign-owned industries may have pursued their own agenda as regards wage setting. Hardiman (1992), considering the collective bargaining agreements of the 1970s, states that "the

most the Federated Union of Employers...could do was to encourage these firms to make additional payments in ways that would not involve too transparent a breach of the terms of the centralised agreements," (pg. 341).

Union density rates fell in the 1980s, again mirroring a pattern in the rest of the OECD. Roche (1994b) highlights the fall in the share of the manufacturing sector, the increase in services employment and the proportion of the increase which took place outside the highly unionised commercial sector along with the increase in female and white-collar employment, as reasons for falling union density. There also seems to have been a shift in industrial policy away from encouraging new foreign investors to recognise unions.."Unions have also complained that the IDA (*Industrial Development Authority*) has tacitly retreated from its traditional policy of encouraging incoming multi-nationals to adapt to local industrial relations practices," (McGovern (1988) cited in Roche (1990), pg. 320).

Roche (1994a) suggests that one of the reasons why the union movement entered into centralised bargaining in 1987, as discussed above, was to stem the decline in membership and to avoid marginalisation. However, unions still face obstacles to recognition at company level, both from indigenous owned and foreign owned companies. Employers resisted an attempt to include a provision for union recognition in the Programme for Competitiveness and Work (Roche, 1994a).

Table 2: Trade Union Density Rates
1970   53.1
1980   57.0
1990   49.7
Source: OECD (1994), union membership as a per cent of wage and salary earners, based on employed members only.

In a study of the effect of unions on wage levels and dispersion, Callan and Reilly (1993) using data for 1987 on full-time male non-agricultural workers, find a mark-up of 20% for union members, high by European standards. They posit that this may be due to the high-paying foreign companies, who were strongly encouraged in the 1970s to recognise unions, as noted above.. Considering dispersion, smaller variance was found in the wages of union members. Decomposition showed that most of this difference was due to different wage structures between the union and non-union sectors, with a smaller impact from less dispersed characteristics among union members. Thus, it is relevant to consider if the decline in union membership has been a factor towards increasing earnings inequality. Have the obstacles to union membership in the foreign-

owned sector contributed to high skilled/unskilled wage differentials? This will be touched upon in Section 7.

Section 5: General Economic Trends

The Irish economy changed significantly over the period under analysis. From a poor performance in the first half of the 1980s when GNP growth averaged 0.4% per annum, the economy began to recover towards the end of the decade until stung by the global recession of 1991. After this point growth in GNP again picked up, reaching 7.4% in 1994 (see Table 3 below).

Table 3	% change in real GNP	Unemployment Rate
1988	2.5	16.7
1989	5.4	15.6
1990	7.3	13.4
1991	1.9	15.5
1992	2.0	16.3
1993	3.0	16.7
1994	7.4	15.6

The unemployment rate remained high over this period as the labour force increased, due to increased female participation and poor conditions in the UK labour market, which choked off emigration, especially after 1991 (Table 3 above).

A large negative Balance of Trade at the start of the 1980s became strongly positive in mid-decade, due to strong export growth, helped by a devaluation of 11% in 1986. This was accompanied by a 6% increase in manufacturing employment over the period 1987-93. The share of manufacturing employment in total employment remained constant at around 21% over the period.

Large scale restructuring took place in the Irish manufacturing sector in the 1970s and 1980s. Incentives to foreign investors saw the dominant position of indigenous-owned, low-skill intensive traditional industries transferred to foreign-owned, high-technology industries, primarily in the electronics and pharmaceutical sectors. Employment in manufacturing began to increase after 1987 and importantly there were employment increases in the indigenous sector, which has become more skill intensive.

Thus, it seems that explanations of rising inequality which focus on poor trade performance and a resulting switch from manufacturing to services have little relevance for Ireland.

What is likely to have been extremely important is the large flows of foreign direct investment (FDI) into Ireland in the 1990s, much of which was in high-technology, skill-intensive sectors. While early foreign investors were attracted by tax-breaks and financial incentives, the availability of highly-skilled labour in Ireland is increasingly an important factor in investment decisions. Given the openness of the Irish labour market with a large pool of Irish emigrants abroad, especially in the UK, labour supply can respond quickly to improved demand opportunities.

Furthermore, skilled labour costs in Ireland are relatively low by international standards. In 1988, labour costs in Ireland in the computer sector were the lowest in the EU with the exception of Luxembourg. For the manufacturing sector as a whole, in 1991, hourly labour costs in Ireland were about the same as the UK, but below those of the original EC 6 and Denmark (Bradley *et al*, 1997).

The main sectors of foreign investment have been pharmaceuticals, office and data processing machinery, electrical engineering, instrument engineering and soft-drink concentrates. O'Malley and Scott (1994) report that in the early 1980s, these sectors accounted for 86 per cent of profits of foreign-owned manufacturing firms and that in the period up to 1981, this dominance was maintained.

The next section reviews relevant previous work.

Section 6: Previous Work

Kearney (1997) presents an analysis using a panel of 72 manufacturing sectors between 1979 and 1990. In the data over this period, there was a trend towards employment of relatively more skilled workers. However, the skilled/unskilled wage gap did not increase in proportion with the increase in relative employment. Indeed, in the 12 sectors with the highest growth rates, the relative wage gap narrowed over the period. Most of the increase in skilled employment was within sectors but sectoral growth was highest in skill-intensive sectors. There was significant restructuring in the manufacturing sector in the 1980s, as mentioned above, with the emerging dominance of high-growth foreign-owned, skill intensive sectors. These sectors account for most of the increase in demand for skilled labour. An increase in the employment and wages of the Clerical group of workers is taken as evidence for an outward shift in the demand curve for this group of workers which is interpreted as a sign of an information technology shock raising the productivity of workers with computer skills.

The Irish manufacturing sector is found to be extremely heterogeneous in terms of output, employment and wage growth. The data are divided into 3 stylised groups, high, medium and declining, on the basis of their output growth performance. The high-growth sector is dominated by foreign-owned firms. Relative skilled wages were highest in this group and this is the group where employment of skilled workers increased sharply.

The increase in skilled employment is decomposed into between and within sector effects for skilled, unskilled and clerical workers, for high, medium and

declining sectors and for the sub-periods 1979-1987 and 1987-1990, following (Berman *et al*, (1994), Machin, (1995)). The between-sector effect is hypothesised to be the result of changes in international trade patterns with the movement of low-skilled production to low-wage emerging economies. The within-sector effect is hypothesised to be the result of technological change which favours high-skilled workers.

It is found that most of the increase in skilled employment took place in the period until 1987. This increase in skill intensity may have been a big factor in the improved growth performance after 1987.

The within-sector component dominated for all time periods, all sectoral groups and all categories of employment. The high growth group had the largest increase in the proportion of skilled employment while the medium growth and declining sectors recorded below average growth. The study concludes that there is evidence of a trade effect in the decline in importance of sectors traditionally exposed to competition from low-wage countries. Evidence of a technology effect is also clear - there was an increase in skill-intensity in high-growth sectors, where relative skilled wages are highest. About half of this increase was due to a general increase in employment in these industries and most of the remainder due to an increase in skill intensity. Thus, part of the increase in earnings inequality found by Nolan and Hughes (1997) must be due to the increased skill intensity in high-paying sectors.

Considering the relationship between the growth of the education profile of employees, as mentioned above and increased earnings dispersion, Barrett, Callan and Nolan (1997a,b) find that the growth in median earnings showed the greatest percentage increase at the top and bottom levels of educational attainment. Looking at dispersion within educational categories as measured by the ratio of the top to bottom decile, dispersion in the top and bottom educational categories rose rapidly between 1987 and 1994, albeit from a low base compared to the other educational categories. Results for the bottom category can be partly explained by the fact that it was decreasing in size, as described above. Considering men only, the pattern of increase in median earnings was similar to that for all employees, but the changes in dispersion in the top and bottom educational categories were less. For men aged between 25-39, there was little difference across categories in the rise in median earnings with the overall increase in dispersion less for this age group than for all men. Dispersion had increased within most education groups.

For workers under 30 years of age, the biggest percentage increases in median earnings were again at the top and bottom levels of educational attainment while

there was actually a fall in median earnings for those with a post secondary diploma or certificate.

Results of estimating various specifications of human-capital wage equations for all employees and for men separately finds a general picture of increased or constant returns to university education, despite a large increase in the supply of graduates.
The same is true for employees under 30 but for this group, there is actually a bigger increase to the returns to junior cycle qualifications.

Wage differentials between 1987 and 1994 are then decomposed to assess to what extent the change in returns to the factors included in the wage equation had affected wage dispersion. The data were re-weighted to reflect the change in the age-education profile of employees. The change in the age-education profile and higher returns to education account for much of the observed increase in dispersion, precisely how much depending on the specification of the wage equation and the decomposition methodology. Thus, a similar picture to that painted by Kearney (1997) and described above arises, of increased skill intensity in employment and higher prices for those skills.

Section 7: Data and Results

This section aims to shed light on why earnings inequality has increased in Ireland. The data used are 2 cross-section, household surveys for 1987 and 1994 collected by the Economic and Social Research Institute (ESRI) in Dublin. The first, the Survey of Income Distribution, Poverty and Usage of State Services has been extensively used for poverty and labour market research (see Callan, Nolan *et al* (1989) for a description of the survey and Callan and Nolan (1994) for an overview of the research). The 1994 Living in Ireland Survey forms the Irish module of the European Community Household Panel (see Callan, Nolan *et al* (1996) for a description of the survey and a study of household poverty). The sampling frame for both surveys was the Electoral Register and both have been re-weighted to correspond with the Labour Force Survey for key household characteristics. The response rate for the 1987 survey was 64% and 62.5% in 1994, corresponding to 3,294 and 4,048 households respectively. Earnings data and labour market characteristics were obtained from around 2,700 employees in 1987 and around 3,000 in 1994. The focus here is on usual gross weekly earnings from full-time employment (defined as working 30+ hours per week). This leaves a sample for analysis of 2,426 in 1987 and 2,768 in 1994, after discarding observations with missing information.

The approach taken was to calculate Theil Mean Log Deviation (MLD) indices to attribute inequality to between and within group components for the variables of interest. The index can be written as follows

$$T_{MLD} = \frac{1}{n} \sum_{i=1}^{n} \ln(\frac{\mu}{y_i})$$

where n is the sample size, μ the sample mean and y_i the earnings of individual i.

This index is chosen because it is additively decomposable, i.e., can be decomposed into within and between-group components. The decomposition weights in this index are the population share of each group and the decomposition can be written as follows (Shorrocks, 1980).

$$T_{MLD} = \sum_{i=1}^{G} (\frac{n_g}{n}) T_{MLD_G} + \sum_{g=1}^{G} (\frac{n_g}{n}) \ln[(\frac{n_g}{n}) / (\frac{n_g}{n} \frac{\mu_g}{\mu})]$$

The first term is the within-group component and the second the between-group component. The between-group component can be thought of as that proportion of inequality that would exist if everyone earned the mean income of their group so that there was no within-group inequality. The between-group component can be thought of as the explained proportion of inequality and the within-group the unexplained. Thus, we see how much inequality can be explained by the variables on which we have information. Individuals have been defined along the single dimensions of gender, age, occupation, industry, experience and trade-union membership and by age and education together and experience and education together, to study interaction effects. For definitions of the groups and cell sizes used, see Appendix 1. The index increased from 0.13115 in 1987 to 0.1501 in 1994, an increase of 14.5%.

Table 4: Contribution of certain variables to earnings inequality, 1987 and 1994, as measured by Theil MLD index

1987

	Within Group Component	%	Between Group Component	%	Total
gender	0.1192	90.87	0.0119	9.12	0.13115
age	0.0928	70.75	0.0383	29.24	0.13115
education	0.1124	85.72	0.0187	14.28	0.13115
occupation	0.1077	82.15	0.0234	17.85	0.13115
industry	0.1152	87.88	0.0159	12.12	0.13115
experience	0.0984	76.97	0.0294	23.03	0.1278
trade-union member	0.1239	96.95	0.0039	3.05	0.1278
age*education	0.085	64.84	0.04611	35.16	0.13115
experience* education	0.0771	60.35	0.0507	39.65	0.1278

1994

	Within Group Component	%	Between Group Component	%	Total
gender	0.1397	93.10	0.0103	6.89	0.1501
age	0.1022	68.10	0.0479	31.89	0.1501
education	0.1216	81.00	0.0285	19.00	0.1501
occupation	0.1103	73.5	0.0398	26.5	0.1501
industry	0.1241	82.72	0.0259	17.28	0.1501
experience	0.1085	72.29	0.0416	27.71	0.1501
trade-union member	0.1449	96.53	0.0052	3.46	0.1501
age*education	0.0907	60.45	0.0593	39.54	0.1501
experience* education	0.0817	54.43	0.0684	45.57	0.1501

Note: in 1987, the experience and union membership questions were not answered by the whole sample, resulting in a different index value for these variables.

It is clear from Table 4 above that most inequality is within-group, i.e., unexplained. For 1994, defining individuals along just one dimension, the importance of between group inequality ranges from just approximately 3.5% for the union-membership variable to 32% for age. Gender accounts for about 7% of inequality. For those factors over which individuals may have some choice, as opposed to age and gender, education explains 19% of inequality and occupation 26.5%. Industry explains 17%. Years of experience can explain 28% of inequality. Trade union membership can explain just 3% of inequality.

Compared to 1987, the proportion of inequality explained by gender had fallen slightly from 9% suggesting that the male-female wage differential had narrowed over the period. This is indeed the case. The ratio of average female to male wages stood at 71% in 1987 compared to 73% in 1994.

The proportion explained by age had increased from 29% to 32% suggesting increased returns to age and labour market experience. Indeed, the contribution of experience increased from 23% to 28%.

Education increased its power as an explanation of inequality from 14% to 19%, even while the supply of highly educated labour was growing. The occupation variable increased its contribution from 18% to 26.5% while that of industry rose from 12% to 17%. There was no change in the proportion accounted for by the union membership variable.

Considering interaction effects for age and education together and experience and education together, the proportion of inequality that can be explained increases to 35% and 40% respectively in 1987, as we consider more than one characteristic. There is also an increase in the explanatory power of these interaction effects between 1987 and 1994 with the proportion of inequality explained by age and education together rising to 39% and that of experience and education to 46%.

Decomposition of changes over time

We can decompose the changes in the Theil index over time to get a more accurate picture of why the increase has taken place. The decomposition quantifies the impact of changes in within group inequality, between group inequality and changes in the employment shares of each group (Mookherjee and Shorrocks, (1982)). The latter has implications for both within and between group contributions, depending on the level of inequality within the group whose population changes and whether the average income of the group whose population changes is close or far apart from the rest of the distribution. Term 1 in the formula below captures changes in within-group inequality, terms 2 and 3 the impact of changes in employment share and term 4 changes in between group inequality.

$$\Delta T_{MLD} = \sum_{g=1}^{G} \frac{\overline{n_g}}{n} \Delta T_{MLD_G} + \sum_{g=1}^{G} \overline{T_{MLD_G}} \Delta \frac{n_g}{n} - \sum_{g=1}^{G} \ln(\frac{\overline{\mu_g}}{\mu}) \Delta \frac{n_g}{n} - \sum_{g=1}^{G} \frac{\overline{n_g}}{n} \Delta \ln(\frac{\mu_g}{\mu})$$

Table 5: Decomposition of Theil MLD index over time

	Term 1 within group	Term 2 employment share	Term 3	Term 4 between group	Total
gender	0.020729	-0.00015	0.0067	-0.008322	0.01895
	109.38%	-0.81%	35.37%	-43.9153	100
age	0.00639	0.003036	-0.061876	0.0714	0.01895
	33.72%	16.02%	-326.52%	376.77%	100
education	0.003897	0.005264	-0.05343	0.06322	0.01895
	20.56%	27.78%	-281.95%	333.611%	100
industry	0.006712	0.002203	-0.004703	0.01474	0.01895
	35.42%	11.62%	-24.82%	77.78%	100
occupation	0.001125	0.001459	-0.023899	0.04027	0.01895
	5.93%	7.7%	-126.115%	212.486%	100
experience	0.08817	0.001313	0.00565	0.00651	0.022287
	39.55	5.89	25.34	29.22	100
union member	0.010322	0.01066	0.01882	-0.01751	0.022287
	46.30%	47.82%	84.41%	-78.56%	100
age*education	0.00478	0.00092	-0.09177	0.10502	0.01895
	25.23%	4.88%	-484.27%	554.17%	100
experience* education	0.00409	0.000469	-0.080658	0.09838	0.022287
	18.38%	2.1%	-361.85%	441.37%	100

Note: in 1987, the experience and union membership questions were not answered by the whole sample, resulting in a different index value.

Table 5 shows that for the gender variable, the increased female participation[2] would have had an unequalising effect on earnings inequality, other things equal. But increasing **within** group inequality - especially among men contributed most strongly to increasing inequality. The narrowing male-female differential is reflected in the between-group component which caused decreased inequality.[3]

The effect of age was dominated by increasing **between** group inequality. Within group inequality also rose but the effect of changes in the employment shares of the agegroups which saw fewer younger workers was to reduce inequality. The share of workers aged under 25 fell from 32% to 24%, as participation in education increased. The share of workers aged 25 - 34 remained more or less stable at 29%. The increases took place in the 35-44 and 45-54 groups, groups

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[2] From 33% to 35% of the sample.

[3] The average male wage in the sample increased by 20.75% compared to an increase of 24.42% for women.

where the average wage was higher and where the increases were higher than in the younger age groups and where internal inequality was also higher.

The effect of education was dominated by increasing **between** group inequality. Within group inequality also increased but to a much smaller extent. The effect of changing employment shares which led to an upgrading of the educational quality of the workforce was to reduce inequality as the share of very poorly educated groups fell. The groups which increased their share were those with the highest average wages. Barrett, Callan and Nolan (1997a) show that for median earnings by education category, the greatest percentage increases were for the bottom and top levels of educational attainment. The groups which increased their share were also the groups with the highest internal inequality.

For the experience variable, all three terms were positive and **within**-group inequality had the largest impact. Increasing between group inequality accounted for 29% of the increase. Changes in employment shares which were minimal accounted for 31% of the increase.

For industry, the **between** group effect was dominant accounting for 78% of the change. Thus, there seems to be evidence of a trade effect. The within group effect also caused an increase in inequality. Changes in industry structure which were not very large, the biggest percentage point change being a 4.5% fall for the retailing sector, contributed to a fall in inequality.

Between group effects were again dominant for the occupation variable where the within group effect was now surprisingly small. The effect of changing occupational shares which were minor apart from a 4% fall in the share of producers and a 5% increase in the share of professionals would have had a negative impact on inequality, *ceteris paribus*.

The **employment share effect** was dominant for the union membership variable. The share of unionised workers fell from 51.79% in 1987 to 41.68% in 1994. This caused increased inequality, other things equal. Unionised workers have higher wages and lower internal inequality. The non-union/union differential widened slightly from 84% in 1987 to 81% in 1994 but the between-group component worked to reduce inequality. The within-group component contributed positively to increased inequality.

Within group inequality increased for the age and education and experience and education interaction variables. For both these variables, changes in employment share would on their own have reduced inequality as the share of younger

workers and those with low levels of education fell. The **between-group** term was dominant for both these interaction variables.

So to summarise, the between group component was the most important for age, education, industry, occupation and the interacted variables of age and education and experience and education. In all these cases, the between-group term caused inequality to increase. However, there was little change in the industrial and occupational structures as defined in the surveys. Along the dimensions of age and particularly education, it was the groups with the highest average wages which increased their share.

The within-group component was the most important for the gender and experience variables with the population share effect dominating for union membership.

The fact that industrial and occupational structure has changed little (see Table 6) seems to cast doubt on the importance of trade effects even though we find that between-group effects are dominant for age and education, indeed for industry and occupation also, but more disaggregated data would be desirable to test this hypothesis. For example, these categories do not allow us make a distinction between indigenous and foreign-owned industry. Indeed, for men the industry categories which increased their share were agriculture, building, wholesaling and personal services, which are not the industries with a high concentration of highly educated workers. For women, the industries which increased share were the health and *other* category.

Table 6: Changes in employment shares, 1987 - 1994

Industry	1987	1994	percentage point changes
Agriculture, Forestry & Fishing	2.31	3.61	+1.3
Building and Construction	4.58	6.79	+2.21
Other Production	33.22	28.68	-4.54
Wholesaling	2.84	5.38	+2.54
Retailing	11.5	6.9	-4.6
Insurance	4.7	5.88	+1.18
Transport	8.57	7.51	-1.06
Professional Services	2.27	0.94	-1.33
Teaching	3.71	5.06	+1.35
Health	6.68	8.27	+1.59
Public Administration	12.12	9.25	-2.87
Personal Services	5.56	6.00	+0.44

| Others | 1.94 | 5.71 | +3.77 |

Occupation	1987	1994	percentage point changes
Agricultural Workers	2.43	3.32	+0.89
Producers	30.34	26.12	-4.22
Labourers and unskilled	5.69	5.56	-0.13
Transport & Communication workers	8.78	7.19	-1.59
Clerical	14.51	14.67	+0.16
Commerce, Insurance & Finance	10.92	9.5	-1.42
Service Workers	9.31	10.44	1.13
Professional Workers	11.29	15.93	+4.64
Others	6.72	7.26	+0.54

We now turn to explicitly decompose changes in employment structure, defined along schooling, occupation and gender groups, into between and within industry components using the following formula (Berman *at al,* (1994), Machin (1995))

$$\Delta P_n = \sum_i \Delta S_i \, \overline{P_{ni}} + \sum_i \Delta P_{ni} \, \overline{S_i}$$

where i refers to industry, n to categories of workers defined according to gender/schooling/broad occupational group and P_n to the share of category n in total employment. $P_{ni} = E_{ni} / E_i$ is the share of employment of category n in industry i and $S_i = E_i / E$ is the share of industry i in total industry

This is similar to the analysis carried out by Kearney (1997) and described above but covers the economy and labour force as a whole, rather than just the manufacturing sector. It is of interest to see what this analysis yields for the period 1987-94 as we know that earnings inequality in the economy as a whole increased sharply over this period. Also, this more recent timeframe captures the entire period of centralised bargaining, booming trade performance and flows of foreign direct investment.

Table 7 presents the results when employees are defined only by industry and education group, Table 8 when defined by industry, education and manual/non-manual occupation and Table 9 when defined by industry, education, manual/non-manual group and gender.

Table 7: Decomposition of changes in employment structure

Education Group	Total Change, Percentage points	Between %	Within %
< 2nd level	-13.55	1.17	98.82
2nd level	2.39	-44.81	144.81
diploma/cert.	5.7	6.19	93.8
university	5.44	16.14	83.85

Table 8: Decomposition of changes in employment structure

Manual or non-Manual	Education Group	Total Change, percentage points	Between %	Within %
manual	< 2nd level	-9.19	-6.46	106.46
non-manual	< 2nd level	-4.36	17.28	82.71
manual	2nd level	2.87	-4.03	104.03
non-manual	2nd level	-0.47	202.66	-102.66
manual	diploma/cert.	0.95	-12.66	112.66
non-manual	diploma/cert.	4.75	9.97	90.03
manual	university	0.33	18.37	81.62
non-manual	university	5.11	16.00	84.00

Table 9: Decomposition of changes in employment structure

Men

Manual or non-Manual	Education Group	Total Change, percentage points	Between %	Within %
manual	< 2nd level	-7.39	-13.25	113.25
non-manual	< 2nd level	-1.52	38.73	61.26
manual	2nd level	2.5	5.3	94.7
non-manual	2nd level	-1.5	57.1	42.9
manual	diploma/cert.	0.45	-14.55	114.55
non-manual	diploma/cert.	2.59	4.2	95.8
manual	university	0.114	68.17	31.83
non-manual	university	2.54	14.04	85.96

Women

manual	< 2nd level	-1.8	21.47	78.52
non-manual	< 2nd level	-2.84	5.8	94.18
manual	2nd level	0.37	-66.97	166.97
non-manual	2nd level	1.01	-10.58	110.58
manual	diploma/cert.	0.5	-10.96	110.96
non-manual	diploma/cert.	2.16	16.89	83.1
manual	university	0.21	-7.91	107.91
non-manual	university	2.57	17.94	82.03

It should be noted that as the occupation categories were very broadly defined, the distinction between manual and non-manual occupations is likely to be quite inaccurate. The occupational groups of agricultural workers, producers, labourers and unskilled workers and transport and communication workers were defined as manual workers with the remaining categories (see Table 6) defined as non-manual workers. Furthermore, some very small cell sizes result as we define the sample along the dimensions of gender, occupation, industry and education. By this classification, the share of manual workers in employment fell from 47% in 1987 to 42% in 1994.

From Table 7, the proportion of workers with less than a 2nd level qualification decreased, while the other educational categories increased their share in employment. The within industry component is always dominant, in explaining these changes. For workers with a 2nd level qualification as their highest qualification, between industry changes would have reduced their share.

From Table 8, where workers are defined along the dimensions of industry, education and manual/non-manual occupation, within industry changes are again always dominant. Between-industry changes resulted in declining employment share for manual workers at all educational levels apart from University, this category amounting to just 1 - 2% of all manual workers.

From Table 9, for men, there was also a slight fall in the share of non-manual workers with a 2nd level qualification. For women, the within industry component is always dominant, the smallest value it takes being 78%. For men, the within-industry component is nearly always dominant also, the exception being for non-manual workers with a 2nd level qualification and for manual workers with a university degree. For women, between industry shifts caused a decline in employment share for nearly all categories but the within-industry changes counteracted this and caused an increase in employment shares, apart from the lowest 2 categories. For men, between industry shifts on their own would have caused a slight increase in the share of manual workers with the lowest education levels and a decrease in the share of non-manual workers with a diploma or certificate, beyond secondary education. The other between-industry changes for men and all the within-industry changes worked in the same direction as the total changes. Thus, it does indeed seem that within-industry changes are driving the increased demand for more educated and non-manual workers.

As an attempt to isolate the effects of foreign direct investment, the analyses of changes in employment structure are carried out excluding the Other Production category, which includes the areas where such investment has been most heavily

concentrated. The results (see Appendix 2) change little. The dominance of the within-industry effect remains, at all levels of partitioning, pointing to the importance of the technology change effect.

Section 8: Conclusions

Earnings inequality increased sharply between 1987 and 1994. Over this time-period, the Irish economy experienced an upgrading in the quality of its labour force - the educational profile of the workforce improved enormously. This upgrading was accompanied by rising returns to education for the better educated groups whose supply was rising, which suggests that shifts in demand for labour were biased towards the better educated. To the extent that increased returns to education may signal shortages of skilled labour, this has policy implications. Between-group inequality also increased along the dimensions of age, occupation, industry and experience. The introduction of centralised bargaining in 1987 could not counteract the forces causing increased inequality.

The industrial structure which changed little over the period in our data could hardly be responsible for the increase in inequality and increased employment of skilled workers. *Within*-industry changes seem to have been responsible. What could have been causing these within industry changes? Technology change is normally the prime candidate. However, our data do not allow us to explicitly test this hypothesis. Such tests would take the form of the Berman *et al* test applied at a more disaggregated level or a direct test by regressing changes in the share of non-manual labour on indicators of technological change.

However, it is possible that our data are too highly aggregated to capture *between*-industry changes which may have been taking place, e.g., we can not distinguish between foreign-owned and indigenous industries, which in the manufacturing sector have been exhibiting different behaviour (Kearney, 1997).

Indeed, the role of foreign direct investment in this period needs to be thoroughly investigated. Feenstra and Hanson (1995) study the impact of US investment in Mexico in the 1980s. They argue that this investment has reduced the relative wage of unskilled workers in both countries because the activities transferred are less skill intensive than the average in the US and more skill intensive than the average in Mexico. It would be interesting to see if this argument can be applied to Ireland. However, it is unlikely that foreign investment would show up in *within*-industry changes, as it tends to be concentrated in particular areas, e.g., pharmaceuticals, electronics. Again, the industry data used are probably too highly aggregated to be informative about this issue.

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As an attempt to isolate the effects of foreign direct investment, the analyses of changes in employment structure were carried out excluding the Other Production category, which includes the areas where such investment has been most heavily concentrated. The dominance of within-industry changes is still evident, pointing to the importance of the technology change effect.

Further research will proceed to analyse how industry differentials have changed - inequality has been increasing between industries while within industry changes have been driving changes in employment structure.

Appendix 1
Table A1: Groups and Cell sizes for Theil MLD indices

Variable		1987	1994
Gender	Male	1624	1792
	Female	802	976
Age	<20	202	99
	20-24	586	567
	25-29	406	452
	30-34	296	365
	35-39	223	329
	40-44	179	274
	45-49	184	255
	50-54	151	207
	55-59	124	132
	60+	75	88
Education	less than Primary	217	100
	Primary	217	142
	Some Second	230	193
	Group Cert.	223	215
	Inter/Junior Cert.	419	465
	2nd level	778	954
	Diploma/Cert.	163	344
	University	179	355
Occupation	Agricultural Workers	59	92
	Producers	736	723
	Labourers and unskilled	138	154
	Transport & Communication workers	213	199
	Clerical	352	406
	Commerce, Insurance & Finance	265	263
	Service Workers	226	289
	Professional Workers	274	441
	Others	163	201
Industry	Agriculture, Forestry & Fishing	56	100
	Building and Construction	111	188
	Other Production	806	794
	Wholesaling	69	149
	Retailing	279	191

	Insurance	114	163
	Transport	208	208
	Professional Services	55	26
	Teaching	90	140
	Health	162	229
	Public Administration	294	256
	Personal Services	135	166
	Others	47	158
Experience	less than 5 yr.s	352	583
	5-9	341	495
	10-14	248	384
	15-19	219	349
	20-24	171	284
	25-29	136	217
	30-34	116	188
	35-39	98	148
	40-44	64	78
	45+	37	42
Trade Union	Member	923	1154
Membership	Non-member	859	1614

Interaction Variables

Age	**Education**		
age<25	< than Inter/Junior Cert	149	75
	Inter/Junior Cert.	202	131
	2nd level	358	299
	Diploma/Cert	54	121
	University	25	40
age 25-54	< than Inter/Junior Cert	613	448
	Inter/Junior Cert.	201	320
	2nd level	390	626
	Diploma/Cert	99	209
	University	136	279
age 55+	< than Inter/Junior Cert	125	127
	Inter/Junior Cert.	16	14
	2nd level	30	29
	Diploma/Cert	10	14
	University	18	36

Experience (years)	Education		
less than 10	< than Inter/Junior Cert	132	108
	Inter/Junior Cert.	144	176
	2nd level	326	468
	Diploma/Cert	54	198
	University	37	128
10-19	< than Inter/Junior Cert	168	125
	Inter/Junior Cert.	84	145
	2nd level	130	292
	Diploma/Cert	36	76
	University	49	95
20-29	< than Inter/Junior Cert	174	142
	Inter/Junior Cert.	32	93
	2nd level	48	136
	Diploma/Cert	24	49
	University	29	81
30+	< than Inter/Junior Cert	212	275
	Inter/Junior Cert.	25	51
	2nd level	42	58
	Diploma/Cert	15	21
	University	21	51

Appendix 2

Table A2.1: Decomposition of changes in employment structure

Education Group	Total Change, Percentage points	Between %	Within %
< 2nd level	-12.31	-6.00	106.00
2nd level	1.002	-209.07	309.07
diploma/cert.	6.19	5.52	94.48
university	5.11	19.85	80.14

Table A2.2: Decomposition of changes in employment structure

Manual or non-Manual	Education Group	Total Change, percentage points	Between %	Within %
manual	< 2nd level	-5.43	-50.89	150.89
non-manual	< 2nd level	-6.88	29.41	70.58
manual	2nd level	2.02	31.41	68.56
non-manual	2nd level	-1.02	268.08	-168.09
manual	diploma/cert.	0.45	-2.58	102.58
non-manual	diploma/cert.	5.74	6.15	93.85
manual	university	-0.05	-252.8	352.8
non-manual	university	5.16	17.27	82.73

Table A2.3: Decomposition of changes in employment structure

Men

Manual or non-Manual	Education Group	Total Change, percentage points	Between %	Within %
manual	< 2nd level	-5.44	-48.78	148.78
non-manual	< 2nd level	-3.03	41.77	58.23
manual	2nd level	2.09	28.87	71.12
non-manual	2nd level	-1.7	99.91	0.09
manual	diploma/cert.	0.4	2.06	97.94
non-manual	diploma/cert.	2.89	3.37	96.62
manual	university	-0.05	-252.8	352.8
non-manual	university	2.37	17.34	82.66

Women

manual	< 2nd level	0.013	849.87	-749.87
non-manual	< 2nd level	-3.85	19.68	80.31
manual	2nd level	-0.07	-43.18	143.18
non-manual	2nd level	0.69	-149.41	249.41
manual	diploma/cert.	0.05	-38.99	138.99
non-manual	diploma/cert.	2.85	8.95	91.04

manual	university	-[1]	-	-
non-manual	university	2.79	17.21	82.79

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[1] Note: there were no females in this catgeory in either 1987 or 1994.

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