Economics Department

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ECO No. 99/2

EUI WORKING PAPERS

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EUROPEAN UNIVERSITY INSTITUTE, FLORENCE

ECONOMICS DEPARTMENT

EUI Working Paper ECO No. 99/2

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Printed in Italy in February 1999
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Abstract:

This paper considers industry earnings differentials in Ireland between 1987 and 1994. Earnings equations are estimated using data from 2 cross-section surveys. Industry differentials are calculated and their stability over time and the importance of industry in determining earnings assessed. Finally, the causes of the differentials found are explored.

* I am grateful to Brian Nolan for access to the datasets used in this paper and to Andrea Ichino and Robert Waldmann for helpful comments and suggestions. All remaining errors are my own

Section 1: Introduction

This paper considers industry earnings differentials in Ireland between 1987 and 1994. If such differentials exist, they are a sign of deviations from competitive theory. In perfectly competitive labour theory, earnings should depend only on employees' abilities and not on employer or firm characteristics, i.e., not dependent on the industry of employment. If industry earnings differentials exist, they are a sign that either firms do not profit maximise or that some firms find it profitable to pay earnings above the going rate. This is the basis of efficiency earnings theory. Among the reasons proposed for the existence of efficiency earnings theory are to raise effort level, promote loyalty to the employer, minimize turnover costs and for selection reasons to attract higher quality applicants. It is possible that if industry earnings differentials exist, they may reflect unmeasured human capital or non-pecuniary compensation or transitory demand factors. Outside of efficiency earnings theory, other reasons proposed for the existence of earnings differentials include compensating differentials (see, e.g., Rosen, 1986) or the insider-outsider model (Lindbeck and Snower, 1986).

O'Donnell (1998) considered the reasons for increased earnings inequality in Ireland between 1987 and 1994 and found that within industry changes drove movements in the employment structure while earnings inequality increased between industries. How could these results be expected to influence industry differentials? The increasing between-industry inequality should be reflected in increasing industry differentials but the within industry changes may have had offsetting or neutral effects on industry differentials.

Section 2 describes the data used, Section 3 how the industry differentials are calculated, Section 4 the earnings equations on which the differentials are based and Section 5 the results. Section 6 explores the causes of industry differentials while Section 7 concludes.

Section 2: Data

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 second, 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.

Section 3: Measurement of Industry Differentials

Write the cross-section earnings equation as

$$(1) \quad \ln W_{it} = \alpha_{it} + \beta X_{it} + \varphi D_{it} + \varepsilon_{it}$$

where D_{it} is a vector of industry dummy variables. The industries are (1) Agriculture, forestry and fishing (2) Building and Construction (3) Other Production (4) Wholesaling (5) Retailing (6) Insurance (7) Transport (8) Professional Services (9) Teaching (10) Health (11) Public Administration (12) Personal Services and (13) Other. The vector X_{it} consists of human capital, demographic and occupational variables and should control for individual-specific factors which can vary between industries and thus influence the mean industry earnings level. If individual specific differences are perfectly controlled for, the estimated φs represent the earnings premia in each industry with respect to the omitted industry which in this case is 'Other Production,' as it is the largest category. These are normalised into deviations from the mean differential by calculating the employment-weighted average for all industries. The industry differentials then reported in Section 5 are the difference between the estimated coefficient and the weighted mean differential as follows

$$(2) \quad \varphi_k^{*} = \hat{\varphi}_k - \sum_{j=1}^{K} v_j \hat{\varphi}_j$$

where K is the number of industries in the sample and v_j is the share of employees employed in industry *j*. For the omitted industry, the employment-weighted average is the negative sum of the employment weighted coefficients

$$(3) \quad \varphi_K^{*} = -\sum_{j=1}^{K} v_j \hat{\varphi}_j$$

The overall variability in industry earnings is summarised by the standard deviation of the industry earnings differentials, following Kreuger and Summers (1988). For each industry, $i=1..K$, the estimated earnings differential $\hat{\varphi}_i$ is an unbiased estimate of the true differential but the standard deviation of $\hat{\varphi}_i$ is an upwardly biased estimate of the standard deviation of $\hat{\varphi}_i$. The bias occurs because $\hat{\varphi}_i$ is the sum of $\varphi_i + \hat{\varepsilon}_i$ where $\hat{\varepsilon}_i$ is a least squares sampling error.

The standard deviation of $\hat{\varphi}$ is adjusted by using the formula

$$(4) \quad ASD = \left(\mathrm{var}(\hat{\varphi}) - \sum_{i=1}^{K} \hat{\sigma}_i^{2} / K\right)^{1/2}$$

where $\hat{\sigma}_i$ is the standard error of $\hat{\varphi}_i$. As this adjustment neglects the covariances among the ε_i, it slightly underestimates the standard deviation of φ. This adjusted standard deviation gives equal weight to each industry category, regardless of their employment share.

Section 4: Estimation of Earnings Equations

This section describes the earnings equations from which the industry differentials will be estimated. Firstly, human capital earnings equations are estimated, for males and females separately. These human capital variables are years spent out of the labour force, years of experience and the square of each of these variables. 4 educational level dummies are included and a dummy if an individual has an apprenticeship qualification or not. The baseline educational dummy is education below group/junior/intermediate certificate, i.e., education below the middle of the secondary cycle. The other education dummies are education to group/junior/intermediate certificate ('some secondary'), completed secondary education ('secondary'), a non-University diploma or certificate at post second level ('diploma') and a University degree ('University'). A dummy if the individual is married is also included.

Then the analysis is broadened to consider occupational dummies and a dummy for union membership. It should be noted that female self-selection is not accounted for and that this problem may have changed over the period due to rising female participation in the labour force from 30.9% in 1986 to 34.9% in 1993. Ideally, to study industry differentials, one would also have information on working conditions such as whether or not employees had to face irregular hours or health hazards. In all the regressions described below, the data were weighted with sampling weights containing the inverse of the probability that the observation is included due to the sampling strategy. All regression results are reported in the Appendix.

Human Capital Specification without industry dummies

Table A1 presents the results for the human capital model for females in 1987 and 1994. Each extra year out of the labour force brings a penalty of 2% in 1987 worsening to 4% by 1994. The experience coefficients have the expected sign. An extra year of experience brings a premium of around 7% in each year. Earnings are maximised at 26 years of experience in each year. Being married has an effect insignificantly different from zero in 1987 which becomes a significant premium of 8% by 1994. There is evidence of a fall in the returns to all educational qualifications by 1994. Having an apprenticeship qualification brings a penalty of 16% in 1987 which becomes insignificant by 1994.

The results for men appear in Table A2. A year out of the labour force brings a penalty of 6% in 1987 falling to 4% by 1994. Earnings are maximised at 33 years of experience in both years. The marriage premium is much higher than that for females, at 20% in 1987 and 22% in 1994. There is evidence of increasing returns to university education over the period.

Occupational Specification

Results for the occupational specification for women appear in Table A3 below. Earnings are now maximised at 26 years of experience in both years. The returns to education have fallen a lot between 1987 and 1994 and are much lower compared to the human capital model for each year, as expected, because of collinearity with the occupational variables. The return to union membership falls slightly from a 20% premium in 1987 to 17% in 1994. Among the occupational dummies, the big change was a large fall in the premium to the 'Clerical' category over the period and an increase in the premia to the other category. The discussion of the industry premia will be left until the following section.

Table A4 shows the results for the occupational specification for men. The marriage premium rises slightly from 15% in 1987 to 19% in 1994. The penalty for years out of the labour force falls from 5% in 1987 to 3% in 1994. The returns to experience change little. Again, the return to a University qualification increases, from 60% to 66%. As expected, the returns to education are generally lower than for the human capital model. The returns to the various occupations generally worsened between the 2 years, with the exceptions of the 'Professional' category where the premium was constant and the 'Other' category where the premium increased. The premium to union membership fell from 17% in 1987 to 13% in 1994. The industry premia are discussed in the following section.

F-tests that the industry coefficients jointly equal zero were rejected for each year and for each gender group but many of the industry dummies are not individually statistically significant.

Table A5 shows the results when we pool the female and male samples, including a female dummy. The penalty to being female rises slightly from around 15% in 1987 to around 17% in 1994. The marriage premium increases from 9% to 14%. The returns to experience and years out of the labour force change little. There is evidence of a fall in returns to educational qualifications at all levels and a slight fall in the returns to having an apprenticeship qualification, though this category was insignificant in 1987. Considering occupations, there is a fall in the return to a Clerical occupation from 12% to 7%. The return to being in a Professional occupation falls slightly from 26% to 24%. The return to being in the 'Other' category increases from 26% to 34%. The premium for trade union membership falls from 17% to 15%. Industry differentials are discussed below.

Pooled human capital model

To assess the significance of these changes, data for both years were pooled and the differential effect of each variable in 1994 as compared to 1987 assessed. Results are in Table A6 below.

For females, it is clear that the increase in the marriage premium is insignificant. Evidence of an increase in the returns to experience is also clear. A significant increase in the returns to all levels of education is found as is a significant increase in the returns to having an apprenticeship qualification.

For males, there is evidence of a significant increase in the returns to experience. There is again evidence of an increase in the returns to all levels of education and to an apprenticeship qualification.

Pooled occupational model

Including industry and occupational dummies, (Table A7), for females, again there is evidence of an increase in the returns to experience. There is an increase in the returns to all levels of education. There are significant increases in the returns to all of the occupational dummies and to union membership.

For men, again an increase in the returns to experience and all levels of education is evident. The return to an apprenticeship qualification is again significant. As with women, there are increases in the returns to all the occupational dummies and to union membership.

Section 5: Results on Industry differentials

The analysis of industry differentials, calculated as in Equation 2, is based on the occupational model, i.e., Tables A3 and A4 above. Table 1 shows the results for females in each year.

Table 1: Industry Differentials for females, 1987 and 1994

Industry Category	1987	Unadjusted OLS s.e.	1994	Unadjusted OLS s.e.
Agri.	-0.019	0.0671	-0.008	0.048
Building and Construction	-0.229	0.2515	0.194	0.1244
Wholesaling	0.002	0.0925	0.027	0.0503
Retailing	-0.111	0.1000	-0.124	0.0615
Insurance	0.193	0.0699	0.166	0.055
Transport	0.015	0.0766	0.060	0.063
Professional Services	-0.021	0.1162	-0.053	0.0887
Teaching	0.013	0.0935	0.035	0.0576
Health	0.044	0.064	0.054	0.0506
Public Administration	-0.042	0.0643	-0.024	0.057
Personal Services	-0.290	0.0935	-0.181	0.0623
Other	-0.162	0.1498	-0.114	0.0535
Other Production, baseline	0.113	baseline	0.063	baseline
Adjusted standard deviation of differentials (ASD)	0.073		0.087	

Due to the high number of industry categories (13) relative to the sample size, many of the industry categories in the earnings equations were insignificant but were jointly statistically significant. In 1987, females in the insurance category get the highest earning premia, on average 20% above the earnings in all industries, followed by the Other Production Category at 11%. However, the insurance category was insignificant in the earnings equation. Employees in personal services were worst off, suffering a penalty of 29% relative to the average in all industries. The coefficient on this category was significant in the earnings equation. Seven industries had negative premia. By 1994, employees in the Building and Construction category were best off with a premium of 19% relative to the average, followed by workers in the insurance category with a premia of 16.6%. Neither of these categories were significant in the earnings equation. Again, worst off were those in personal services but the size of their penalty had fallen by 11 percentage points but remained significant. The premia in the Other Production baseline category had fallen to 6%. Six industries now had negative premia.

For those categories significant in both years, i.e., retailing, personal services and 'other' (borderline significance in 1987), the change in the differential is large for the personal services category of the magnitude of 10 percentage points, half that for the 'other' category and minimal for the retailing category. Total variability was slightly higher in 1994 compared to 1987 with an ASD, calculated as in Equation 4, in the later year of 0.087 compared to 0.073. This is as we would have expected given the increased earnings inequality over the period.

Table 2: Industry Differentials for males, 1987 and 1994

Industry Category	1987	Unadjusted OLS s.e.	1994	Unadjusted OLS s.e.
Agri.	-0.068	0.0764	-0.317	0.0642
Building and Construction	-0.051	0.053	0.000	0.0334
Wholesaling	-0.029	0.0711	0.019	0.0349
Retailing	-0.164	0.0507	-0.147	0.0483
Insurance	0.284	0.0614	0.139	0.0499
Transport	0.036	0.0304	0.097	0.0294
Professional Services	0.045	0.1252	-0.281	0.1486
Teaching	-0.078	0.072	-0.099	0.0467
Health	-0.066	0.048	0.013	0.0517
Public Administration	-0.014	0.034	0.006	0.0317
Personal Services	-0.18	0.0704	-0.053	0.0541
Other	0.007	0.0779	-0.064	0.0609

Other Production, baseline	0.045	baseline	0.050	baseline
Adjusted standard deviation of differentials (ASD)	0.0948		0.1207	

For males, the same problem of insignificance of industry categories arises in the earnings equations but again the industry variables were jointly statistically significant. For males in 1987, again those in the insurance category were best off with a premium of 28% relative to the average and this category was significant in the earnings equation. Worst off were those in personal services (significant), followed closely by those in retailing (significant). 8 categories had negative premia. By 1994, again those in the Insurance category were best off but their premium had fallen to 14% and was insignificant. Worst off were those in agriculture (significant), strangely followed by those in Professional Services (significant). However, this is a very small category, accounting for just 1.5% of male employment in 1987 and under 1% by 1994 respectively. This category has lower relative earnings, given the level of human capital and demographic variables among employees there. The premium for those in the Other Production baseline category had increased slightly. 6 categories now had negative premia. The penalty for the personal services category had fallen a lot.

Of those categories significant or borderline significant in both years, the fall in the penalty attached to the retailing category fell slightly while the premium attached to the insurance category fell by more than half. There was a slight increase in the penalty attached to the teaching category and a large fall in the penalty attached to being in the personal services category. As with the female differentials, total variability was higher in 1994 with an ASD of 0.1207 compared to 0.0948, again as expected.

Female and Male differentials compared

Of those categories significant for both females and males in 1987, females in the retailing category were 11% worse off than the average female employee while males in this category were 16% worse off than the average male. The relative penalty attached to the public administration category was higher for females than males at 4% versus 1.5%. Females in the personal services category were 30% worse off than the average female employee while males in this category experienced a relative penalty of almost 20%. The relative premium attached to the baseline of Other Production was much higher for females than males at 11% compared to 4.5%.

In 1994, the relative penalty attached to the retailing category was slightly lower for females and males. In Insurance, females had a slightly higher relative premia. In Personal Services, females were almost four times more worse off than males and were almost twice as worse off in the 'Other' category. Females had a slight relative advantage in the Other Production baseline category.

In both years, the male earnings differentials showed greater variability than the female differentials. This is not surprising given the greater within group inequality for men noted in O'Donnell (1998).

Pooling females and males

Given the problems of insignificance, we pooled the male and female samples and included a dummy for females in the earnings equations, the results of which can be seen in Table A5. The resulting industry differentials are in Table 3 below.

Table 3: Industry Differentials for males and females together, 1987 and 1994

Industry Category	1987	Unadjusted OLS s.e.	1994	Unadjusted OLS s.e.
Agri.	-0.090	0.0710	-0.306	0.0633
Building and Construction	-0.072	0.0509	0.013	0.0324
Wholesaling	-0.018	0.0588	0.024	0.0302
Retailing	-0.180	0.0453	-0.154	0.0381
Insurance	0.237	0.0451	0.163	0.0357
Transport	0.027	0.0285	0.093	0.0261
Professional Services	-0.015	0.0847	-0.192	0.1057
Teaching	-0.063	0.0573	-0.049	0.0354
Health	-0.011	0.0379	0.027	0.0334
Public Administration	-0.026	0.0305	0.006	0.0292
Personal Services	0.027	0.0596	-0.128	0.0421
Other	-0.048	0.0708	-0.086	0.0411
Other Production, baseline	0.059	baseline	0.061	baseline
Adjusted standard deviation of differentials	0.0803		0.1204	

(ASD)

Pooling males and females, in 1987, employees in the insurance category were best off in both years and this category was significant in both earnings equations. The premium for this category was almost 24% in 1987 and had fallen to 16% in 1994. The worst off category in 1987 was retailing (significant) and in 1994, agriculture (significant) which had worsened drastically since 1987. The penalty to retailing had fallen slightly by 1994. 9 categories had negative premia in 1987 and 6 in 1994. The premium for the baseline category of Other Production was more or less constant between the two years. An F-test that the industry coefficients in the pooled earnings equation equaled zero was rejected.

For those categories significant or borderline significant in both years, the penalty for the agriculture category relative to the average had increased massively from 9% to 30%. The relative penalty for the retailing category had fallen slightly from 18% to 15%. For the insurance category, the relative premium had fallen from 26% by ten percentage points to 16%. In teaching, the relative penalty had fallen from 6% to 5% while in public administration, a 2.5% penalty had become a 0.6% premium. There was little change in the Other Production baseline. As with females and males, separately, there was greater variability in 1994 than in 1987, as would have been expected.

Stability over time

The industry differentials do not appear highly correlated over time. The correlation coefficient between the female differentials in the 2 years is 0.516, between the male 0.437 and for the sample as a whole 0.654. The fact that many of the industry coefficients in the earnings equations are individually insignificant and change a lot between the two years will impact on the level of stability. Also, the significance of the correlation coefficient is sensitive to the number of industry categories, in this case just 13. The statistical significance of the correlation coefficients are tested as per Kendall and Stuart (1977) (See Zanchi, 1997)[1]. The t-transformation for the female sample is 1.9979 and for the male sample 1.6114, compared to the 1% critical value of 2.718. Thus, for the male

[1] In testing the null hypothesis that the population correlation coefficient $\rho = 0$, the sample correlation coefficient can be reduced to a Student's t-distribution. We test the null hypothesis that $\rho = 0$ against the alternative hypothesis $\rho > 0$, i.e., stability of the industry wage structure. The t-transformation is $t = \{(n-2)r^2 / (1-r^2)\}^{1/2}$ where r is the sample correlation coefficient and n the number of industries.

and female samples separately, we can not reject the null hypothesis that the correlation coefficient equals zero.

But even for the pooled sample, where the majority of the industry coefficients in each year are significant, the correlation coefficient is not terribly high at 0.654. With a t-transformation value of 2.8672, this is significant at a 1% level. Thus, it is possible that transitory demand factors or short-run labour immobility are relevant factors in explaining these differentials. However, the high number of industry categories relative to the sample size impacts on the significance and stability of the estimated coefficients and thus the significance and stability of the correlations.

Changes in measures of fit

The importance of industry affiliation can be assessed by looking at the increases in the R^2 when different variables are added to the earnings equations. In this case, we use the human capital and union membership variables as control variables. From Table 4, it is clear that for both men and women in each year, human capital variables are more important as explanations of the earning structure than industry affiliation. The baseline model regressors are a dummy for married, 8 occupational dummies and years out of the labour force and its square. The human capital variables are the 4 educational level dummies, a dummy for apprenticeship and years of experience and its square. The industry categories are the 12 dummies previously used and the union membership dummy is as before.

In 1987, the human capital variables increase the R^2 by 53.6% for women and for men by a much lower value of 37%. The industry dummies increase the R^2 by 26% for women and 17% for men. The union membership variable increases the R^2 by 25% for women and 14% for men. Thus for both men and women, industry affiliation is just slightly more important than union membership in explaining earnings.

In 1994, the importance of the human capital variables have fallen somewhat for both men and women, causing an increase in the R^2 of 42% for women and 30.5% for men. The importance of the industry dummies falls also, causing a 16% increase in the R^2 for women and a 7.6% increase for men. The importance of the union membership variable also falls to 14.6% for women and 5% for men. Again, the gap between the union membership and industry dummies is very small. But the industry variables are certainly not trivial in explaining earnings.

It is interesting that each of the three types of variable considered is always more important in explaining earnings for women than for men, suggesting that either unobservables or the occupational and demographic variables are more important for men.

Table 4: Effect on R^2 of adding human capital and industry variables

	1987		1994	
	Women	**Men**	**Women**	**Men**
baseline	0.3302	0.3685	0.4134	0.4586
R^2 with human capital variables (% increase)	0.5071 (53.57)	0.504 (36.77)	0.5867 (41.92)	0.5986 (30.53)
R^2 with union variable (% increase)	0.413 (25.07)	0.4203 (14.05)	0.4741 (14.68)	0.4835 (5.43)
R^2 with industry dummies (% increase)	0.417 (26.29)	0.4316 (17.12)	0.4789 (15.84)	0.4935 (7.61)

The effect on the R^2 of each of the sets of human capital, union membership and industry variables falls between 1987 and 1994 for both men and women, perhaps suggesting that the role of unobservables becomes more important. Of course, it could be the case that other variables such as the demographic or occupational variables increase in importance between the two years.

Section 6: Exploring the Causes of Industry Differentials

The industry differentials we have found could be due to differences in unmeasured aspects of labour quality across industries. The effect of alternative degrees of control for human capital is examined in Table 5. If industry differentials are due to observed or unobserved differences in labour quality across industries, there should be a fall in the dispersion of industry earnings once we control for measured human capital.

Table 5: Alternative degrees of control for human capital

	1987		1994	
	ASD of industry earning differentials			
Controls	Female	Male	Female	Male
(1) none	0.119	0.1104	0.115	0.1275
(2) dummies for 4	0.108	0.0917	0.112	0.1144

educational levels and apprenticeship				
(3) as (2) with years of experience and its square	0.073	0.0948	0.087	0.1207

From Table 5, it is clear that the ASD does fall but not to a very large extent. The biggest fall of almost 40% is for females in 1987. The ASD of the male earning differentials actually increase if controls for experience are added to the earnings equation. Thus, unless differences in unmeasured human capital are much more important than differences in measured education and experience, it is unlikely that these differences in unmeasured human capital are what is causing the industry earnings differentials.

The small sample size limits the extent to which we can test for the causes of industry differentials by comparing differentials by sub-groups. However, we do estimate industry differentials by union and non-union employees to check if the differentials could be the result of varying degrees of union power. We would expect to find less variation in non-union earnings if the differentials resulted from strong unions which could raise their earnings in certain industries without suffering employment losses.

Table 6 shows the ASD of industry differentials by unionised and non-unionised employees. An F-test of the hypothesis that the industry coefficients in the earnings equation were jointly insignificant was rejected.

Table 6: Differences in industry differentials by unionised and non-unionised employees

	1987	1994
	ASD of industry earnings differentials	
(1) non-unionised	0.1218	0.1069
(2) unionised	0.1101	0.0829
correlation of (1) and (2)	0.15	0.85
t-transformation	0.5032	5.3516
reject $H_0: \rho = 0$ at 1% significance level	no	yes

The variation in non-union earnings differentials is actually slightly higher than in unionised earnings differentials in each year and this is what would be expected, given previous studies of union membership. This gives little credence to the union power argument.

The correlation of union and non-union earnings is extremely low in 1987 at 0.15 but increases dramatically to 0.85 by 1994. However, the null hypothesis that the correlation coefficient equals zero can not be rejected in 1987.

Table 7 presents results on industry earning differentials by age, comparing those aged under 30 and those aged 30 plus and Table 8 by years of experience, comparing those with under 20 years of experience and those with 20 plus years. Again, F-tests that the industry coefficients in the earnings equation were jointly zero were rejected.

Table 7: Differences in industry differentials by age

	1987	1994
	ASD of industry earnings differentials	
(1) aged under 30	0.1104	0.0473
(2) aged 30 +	0.098	0.1385
correlation of (1) and (2)	0.503	0.694
t-transformation	1.9302	3.1969
reject $H_0: \rho = 0$ at 1% significance level	no	yes

The ASD shows little difference between older and younger workers in 1987 but the correlation coefficient is quite low. By 1994, the dispersion among younger workers is much lower than among older workers and the correlation coefficient has increased to 0.694. Thus, there is some evidence that the age structure or seniority has a part to play in determining industry differentials. However, as in the previous table, we can not reject the null hypothesis that the correlation coefficient equals zero in 1987.

Table 8: Differences in industry differentials by years of experience

	1987	1994
	ASD of industry earnings differentials	
(1) under 20 years of experience	0.1015	0.1102
(2) 20 + years of experience	0.1266	0.1223
correlation of (1) and (2)	0.5778	0.7305
t-transformation	2.3479	3.5477
reject $H_0: \rho = 0$ at 1%	no	yes

significance level

The structure of industry differentials by years of experience is remarkably stable. In each year, there is slightly less variation in differentials for workers with less than 20 years of experience. As with the previous two tables, we can not reject the null hypothesis that the correlation coefficient equals zero in 1987.

Thus, in general, we find that the industry earnings structure is quite stable. Exceptions to this fact are the low correlation between union and non-union workers in 1987. By 1994, the correlation is much higher. This can possibly be explained by the introduction of centralised bargaining agreements in 1987, after which point many more employees were covered by negotiated agreements than previously. Another puzzling factor is the very low ASD of workers aged under 30 in 1994. The share of this group in total employment fell between 1987 and 1994 as participation in education increased. The results in Table 7 give some slight evidence that seniority has a role to play in determining industry earnings differentials.

Table 9: Differences in industry differentials by manual/non-manual occupation

	1987	1994
	ASD of Industry earnings differentials	
(1) manual occupations	0.1288	0.1731
(2) non-manual occupations	0.1014	0.1318
correlation of (1) and (2)	0.859	-0.1456
t-transformation	5.5647	0.4881
reject $H_0: \rho = 0$ at 1% significance level	yes	no

Table 9 shows differences in industry differentials by manual/non-manual occupation. As the occupational 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 of defined as non-manual workers.

In 1987, the variation in manual earnings was slightly higher than in non-manual earnings and the correlation between the two groups was high at 0.859 and significant. In 1994, again the variation in manual earnings was higher than in non-manual earnings but the correlation between the two groups was now negative and not statistically different from zero. Thus, there seems to have been a huge divergence in the earnings structure of these two groups of workers in the seven year period. By 1994, it is not the case that industries that tend to pay workers in one occupational group above the average tend to pay workers in other occupational groups above the average as well. This is some evidence on favour of an unmeasured labour quality explanation of industry earnings differentials as it is unlikely that workers in different occupations within an industry have the same levels of unmeasured ability. It also gives some strength to arguments based on monitoring as monitoring costs are likely to vary by occupation. However, it is more likely that this instability in the earnings structure in 1994 reflects the impact of the forces for increased earnings inequality described in O'Donnell (1998). This divergence of the manual and non-manual wage structure is consistent with the argument that technology change has increased the productivity of more skilled workers.

Section 7: Conclusions

Pooling males and females, employees in the Insurance category were best off in each year but the relative premium in this category fell from 26% to 16% in the seven year period. Worst off were those in the retailing category in 1987 and in agriculture in 1994. The penalty to the agriculture category increased dramatically between 1987 and 1994. For the sample as a whole, the correlation coefficient between the industry differentials over the two years of data was 0.654, not terribly high. Thus, transitory demand shocks or short-run labour immobility may be relevant factors in explaining these differentials. The instability of the estimated coefficients may be evidence against the compensating differentials hypothesis as, over a seven year period, sharp changes in working conditions which would warrant changing returns are unlikely. But, as stated previously, the high number of industry categories relative to the sample size impacts on the significance and stability of the estimated coefficients and thus on that of the correlations.

Human capital variables are a stronger explanation of earnings than industry variables which in turn are marginally stronger than union membership. In testing for the causes of industry earnings differentials, we find that neither unmeasured human capital nor union power seem to be the answer. However, there is some evidence that the wage structure or seniority has a role to play. The correlation between union and non-union earnings increases dramatically between 1987 and 1994. This could be explained by the introduction of centralised bargaining agreements in 1987 after which point many more employees were covered by

negotiated agreements than previously. When considering earnings differentials by manual/non-manual groups, we find that the earnings structure for these 2 groups seems to have diverged significantly between 1987 and 1994.

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Appendix: Results of Earnings Equations

Table A1: Human capital model, females

1987				1994		
N	600			976		
R^2	0.4333			0.4775		
Variable	Coefficient	Robust Standard Error	t-ratio	Coefficient	Robust Standard Error	t-ratio
Married	0.01777	0.0433	0.410	0.0816	0.0315	2.59
Years out of labour force	-0.02588	0.011	-2.356	-0.0309	0.0071	-4.361
Years out squared	0.0006	0.0005	1.162	0.0009	0.0003	3.354
Years of Experience	0.0769	0.0092	8.341	0.0645	0.0051	12.485
Experience squared	-0.0014	0.0003	-5.138	-0.0012	0.0001	-7.517
Education						
Some secondary	0.1042	0.0627	1.661	0.0329	0.0677	0.486
Secondary	0.3922	0.0537	7.305	0.2532	0.0585	4.323
Diploma	0.5733	0.0733	7.818	0.3481	0.0627	5.546
University	0.8089	0.079	10.232	0.7606	0.0659	11.54
Apprenticeship	-0.1593	0.0776	-2.051	0.0647	0.0804	0.805
Constant	0.4578	0.068	6.732	4.355	0.0594	73.33

Table A2: Human capital model, Males

1987				1994		
N	1182			1792		
R^2	0.4799			0.5427		
Variable	**Coefficient**	**Robust Standard Error**	**t-ratio**	**Coefficient**	**Robust Standard Error**	**t-ratio**
Married	0.199	0.0336	5.923	0.2262	0.0312	7.237
Years out of labour force	-0.0572	0.0121	-4.72	-0.0384	0.0103	-3.702
Years out squared	0.0021	0.0006	3.459	0.0019	0.0004	5.076
Years of Experience	0.0464	0.0041	11.235	0.0542	0.0035	15.395
Experience squared	-0.0007	0.0001	-8.456	-0.0008	0.0001	-11.254
Education						
Some secondary	0.1659	0.0323	5.139	0.1749	0.0286	6.103
Secondary	0.3996	0.0353	11.315	0.3732	0.031	12.013
Diploma	0.5102	0.0472	10.81	0.5005	0.0463	10.816
University	0.7794	0.0521	14.94	0.8381	0.0373	22.458
Apprenticeship	-0.0252	0.0244	-1.031	0.0684	0.0289	2.367
Constant	0.671	0.0477	14.07	4.357	0.0365	119.2

Table A3: Occupational Model, Females

1987		1994
N	600	976
R^2	0.5846	0.6401

Variable	Coefficient	Robust Standard Error	t-ratio	Coefficient	Robust Standard Error	t-ratio
Married	-0.0003	0.0375	-0.007	0.0427	0`.027	1.577
Years out of labour force	-0.0105	0.00980	-1.069	-0.0267	0.0057	-4.695
Years out squared	-0.0001	0.0004	-0.059	0.0008	0.0002	3.802
Years of Experience	0.0579	0.007	8.230	0.0482	0.0048	10.059
Experience squared	-0.0011	0.0002	-5.656	-0.0009	0.0001	-6.693
Education						
Some secondary	0.0782	0.0526	1.487	-0.0128	0.0495	-0.258
Secondary	0.2221	0.0516	4.301	0.0986	0.0471	2.094
Diploma	0.2996	0.0714	4.197	0.1823	0.0554	3.289
University	0.4821	0.0944	5.107	0.44	0.0621	7.079
Apprenticeship	0.0125	0.0745	0.168	0.1311	0.0536	2.444
Agri.	-0.1318	0.0671	-1.965	-0.0702	0.048	-1.463
Building & Construction	-0.3417	0.2515	-1.359	0.1316	0.1244	1.058
Wholesaling	-0.1111	0.0925	-1.201	-0.0355	0.0503	-0.707
Retailing	-0.2245	0.10005	-2.243	-0.1871	0.0615	-3.044
Insurance	0.0795	0.0699	1.137	0.1037	0.055	1.883
Transport	-0.0981	0.0766	-1.281	-0.0026	0.063	-0.042
Professional Services	-0.1344	0.1162	-1.157	-0.1157	0.0887	-1.305
Teaching	-0.0997	0.0935	-1.067	-0.0273	0.0578	-0.474
Health	-0.0685	0.064	-1.070	-0.0088	0.0506	-0.175
Public Admin.	-0.1552	0.0643	-2.414	-0.0867	0.057	-1.521
Personal Services	-0.4029	0.0935	-4.309	-0.2434	0.0623	-3.903
Other	-0.2746	0.1498	-1.832	-0.1771	0.0535	-3.307
Agri. workers	no obs.			-1.932	0.682	-2.834
Labourers	0.0921	0.1401	0.657	0.0776	0.0701	1.107
Transport & Communication Workers	0.0842	0.0665	1.266	0.0836	0.0675	1.237
Clerical	0.2167	0.0582	3.726	0.1362	0.0481	2.832
Commerce, Insurance & Finance	-0.0071	0.1152	-0.062	-0.0075	0.0632	-0.118
Service Workers	0.01	0.0756	0.132	-0.0383	0.052	-0.736
Professional Workers	0.3286	0.0739	4.446	0.3097	0.0538	5.76
Others	0.3908	0.1113	3.511	0.5163	0.0842	6.13
Union member	0.2030	0.0361	5.627	0.1724	0.0244	7.057
constant	0.5645	0.0638	8.850	4.51	0.0575	78.397

F-test on industry coefficients

F(12,569)=3.53 F(12,944)=5.17

Prob>F=0.00 Prob>F=0.00

Table A4: Occupational Model, Males

1987				**1994**		
N	**1182**			**1792**		
R^2	**0.5673**			**0.631**		
Variable	**Coefficient**	**Robust Standard Error**	**t-ratio**	**Coefficient**	**Robust Standard Error**	**t-ratio**
Married	0.1514	0.0296	5.109	0.1909	0.0259	7.361

Years out of labour force	-0.0471	0.0109	-4.325	-0.0283	0.0088	-3.195
Years out squared	0.0018	0.0005	3.366	0.0014	0.0004	3.639
Years of Experience	0.0398	0.0038	10.469	0.0447	0.0031	14.313
Experience squared	-0.0006	0.0001	-8.116	-0.0007	0.0001	-10.509
Education						
Some secondary	0.1335	0.0284	4.692	0.1271	0.0265	4.787
Secondary	0.2822	0.0321	8.774	0.2708	0.0297	9.113
Diploma	0.3866	0.0457	8.462	0.3638	0.0442	8.231
University	0.5941	0.0637	9.322	0.6574	0.0418	15.706
Apprenticeship	0.0053	0.0262	0.202	0.0749	0.0282	2.656
Agri.	-0.1134	0.0764	-1.484	-0.3668	0.0642	-5.707
Building & Construction	-0.0964	0.053	-1.82	-0.0507	0.0334	-1.516
Wholesaling	-0.074	0.0711	-1.041	-0.0312	0.0349	-0.895
Retailing	-0.2088	0.0507	-4.119	-0.1967	0.0483	-4.071
Insurance	0.2386	0.0614	3.888	0.0883	0.0499	1.769
Transport	-0.0092	0.0304	-0.303	0.0471	0.0294	1.602
Professional Services	0.0012	0.1252	0.01	-0.3311	0.1487	-2.227
Teaching	-0.1231	0.072	-1.711	-0.1488	0.0467	-3.187
Health	-0.1114	0.048	-2.319	-0.0371	0.0517	-0.717
Public Admin.	-0.0585	0.034	-1.718	-0.0437	0.0317	-1.38
Personal Services	-0.2251	0.0704	-3.198	-0.1028	0.0541	-1.898
Other	-0.0383	0.0779	-0.492	-0.1145	0.0609	-1.879
Agri. workers	-0.0894	0.0693	-1.29	-0.136	0.0745	-1.825
Labourers	-0.1013	0.0437	-2.316	-0.0991	0.0333	-2.971
Transport & Communication Workers	-0.0687	0.0342	-2.011	-0.0873	0.031	-2.811
Clerical	0.0702	0.0478	1.467	0.0325	0.0361	0.900
Commerce, Insurance & Finance	0.117	0.0558	2.096	0.0109	0.0406	0.269
Service Workers	0.0797	0.044	1.813	0.0139	0.0403	0.344
Professional Workers	0.2215	0.0525	4.219	0.196	0.0415	4.73
Others	0.2359	0.048	4.928	0.2984	0.0352	8.463
Union member	0.1675	0.0234	7.165	0.128	0.0194	6.585
constant	0.734	0.0443	16.55	4.499	0.0376	119.50

F-test on industry coefficients

F(12,1150)=5.11 F(12,1760)=6.88

Prob>F=0.00 Prob>F=0.00

Table A5: Occupational Model, Males and Females together

1987				**1994**		
N	**1782**			**2768**		
R^2	**0.5853**			**0.639**		
Variable	**Coefficient**	**Robust Standard Error**	**t-ratio**	**Coefficient**	**Robust Standard Error**	**t-ratio**
Female	-0.1489	0.0249	-5.972	-0.1675	0.0198	-8.449
Married	0.0916	0.0229	4.000	0.1418	0.0192	7.395
Years out of labour force	-0.0282	0.007	-4.003	-0.0297	0.0051	-5.857
Years out squared	0.0007	0.0003	2.296	0.001	0.0002	4.715
Years of Experience	0.0463	0.0032	14.427	0.0446	0.0025	17.834

Experience squared	-0.0007	0.0001	-11.127	-0.007	0.0001	-12.876
Education						
Some secondary	0.1302	0.0254	5.12	0.0875	0.0246	3.549
Secondary	0.2800	0.0272	10.296	0.2207	0.0253	8.699
Diploma	0.3799	0.0384	9.876	0.3073	0.0337	9.103
University	0.5716	0.053	10.79	0.5919	0.0348	16.975
Apprenticeship	0.0108	0.0251	0.432	0.0881	0.0259	3.402
Agri.	-0.1486	0.0710	-2.092	-0.367	0.0633	-5.799
Building & Construction	-0.1305	0.0508	-2.565	-0.0483	0.0324	-1.494
Wholesaling	-0.0772	0.0588	-1.314	-0.0375	0.0302	-1.244
Retailing	-0.2392	0.0453	-5.28	-0.2154	0.0381	-5.652
Insurance	0.1776	0.045	3.942	0.1017	0.0357	2.847
Transport	-0.032	0.0285	-1.121	0.0318	0.0261	1.215
Professional Services	-0.0739	0.0847	-0.872	-0.253	0.1057	-2.393
Teaching	-0.1224	0.0573	-2.134	-0.1096	0.0354	-3.09
Health	-0.0697	0.0379	-1.838	-0.034	0.0334	-1.018
Public Admin.	-0.0849	0.0305	-2.78	-0.0552	0.0292	-1.891
Personal Services	-0.322	0.0596	-5.397	-0.1889	0.0421	-4.487
Other	-0.1069	0.0708	-1.51	-0.1468	0.0411	-3.568
Agri. workers	-0.0725	0.0634	-1.144	-0.171	0.0805	-2.122
Labourers	-0.1008	0.0397	-2.54	-0.0773	0.0298	-2.594
Transport & Communication Workers	-0.0465	0.0311	-1.495	-0.0604	0.0286	-2.111
Clerical	0.1239	0.0346	3.582	0.0737	0.0271	2.718
Commerce, Insurance & Finance	0.0712	0.0508	1.402	0.0173	0.0353	0.489
Service Workers	0.0406	0.0393	1.033	-0.0073	0.0318	-0.231
Professional Workers	0.2628	0.0417	6.298	0.2374	0.0326	7.284
Others	0.2629	0.0439	5.987	0.3411	0.0319	10.684
Union member	0.1743	0.0197	8.826	0.1475	0.0156	9.463
constant	0.7183	0.038	18.881	4.569	0.0314	145.22

F-test on industry coefficients

F(12,1749)=8.35 F(12,2735)=11.2

Prob>F=0.00 Prob>F=0.00

Table A6: Pooled Human Capital Model, Females and Males separately

Females				Males		
N	1576			2974		
R^2	0.903			0.9157		
Variable	**Coefficient**	**Robust Standard Error**	**t-ratio**	**Coefficient**	**Robust Standard Error**	**t-ratio**
Married	0.1013	0.0671	1.509	0.2959	0.0565	5.235
Married 94	-0.0577	0.0925	-0.624	-0.1460	0.0749	-1.948
Years out of labour force	-0.0615	0.0162	-3.796	-0.2244	0.0182	-12.330
Years out of labour force 94	0.0977	0.0274	3.559	0.2915	0.0236	12.364
Years out squared	0.0015	0.0007	2.166	0.0109	0.0012	8.805
Years out squared 94	-0.0018	0.0011	-1.572	-0.0115	0.0016	-7.208
Years of Experience	-0.0354	0.0135	-2.622	-0.0723	0.007	-10.278
Years of Experience 94	0.1633	0.0158	10.3	0.1925	0.0081	23.832

Experience squared	0.001	0.0003	3.045	0.0012	0.0001	8.56
Experience squared 94	-0.0036	0.0004	-7.993	-0.0029	0.0002	-16.217
Education						
Some secondary	-0.8249	0.1111	-7.422	-0.5634	0.054	-10.433
Some secondary 94	2.301	0.1262	18.229	1.615	0.0649	24.877
Secondary	-0.7015	0.1068	-6.566	-0.4396	0.0563	-7.806
Secondary 94	2.593	0.0878	29.536	1.842	0.0624	29.502
Diploma	-0.4469	0.1192	-3.749	-0.2087	0.0749	-2.787
Diploma 94	2.503	0.1106	22.631	1.765	0.0927	19.042
University	-0.1769	0.146	-1.212	0.0878	0.0769	1.143
University 94	2.621	0.152	17.246	1.6989	0.0925	18.352
Apprenticeship	-0.3944	0.1904	-2.072	-0.1498	0.0385	-3.886
Apprenticeship 94	0.879	0.2801	3.138	0.3116	0.06	5.197
Constant	2.2	0.133	16.541	2.641	0.0702	37.639

Table A7: Pooled Occupational Model, Females and Males separately

Females				**Males**		
N	**1576**			**2974**		
R^2	**0.9315**			**0.9306**		
Variable	**Coefficient**	**Robust Standard Error**	**t-ratio**	**Coefficient**	**Robust Standard Error**	**t-ratio**
Married	0.0741	0.0569	1.302	0.1734	0.0487	3.557
Married 94	-0.0529	0.0794	-0.666	-0.0586	0.0669	-0.875
Years out of labour force	-0.0506	0.0158	-3.211	-0.1749	0.0177	-9.891
Years out of labour force 94	0.0802	0.0256	3.136	0.2251	0.0225	10.009
Years out squared	0.0013	0.0007	1.856	0.009	0.0010	8.398
Years out squared 94	-0.0016	0.0011	-1.537	-0.0095	0.0014	-6.82
Years of Experience	-0.0257	0.0113	-2.266	-0.0542	0.0064	-8.459
Years of Experience 94	0.1182	0.0138	8.527	0.1558	0.0074	21.03
Experience squared	0.0008	0.0003	2.907	0.0009	0.0001	7.546
Experience squared 94	-0.0026	0.0004	-6.925	-0.0023	0.0001	-14.893
Education						
Some secondary	-0.5743	0.0964	-5.957	-0.4572	0.0479	-9.532
Some secondary 94	1.584	0.1202	13.181	1.385	0.0617	22.427
Secondary	-0.5555	0.0978	-5.687	-0.4408	0.0548	-8.033
Secondary 94	1.854	0.1055	17.577	1.641	0.0662	24.795
Diploma	-0.4558	0.1111	-4.100	-0.2787	0.0722	-3.861
Diploma 94	1.900	0.1231	15.43	1.6184	0.092	17.583
University	-0.2755	0.1451	-1.898	-0.0677	0.0908	-0.746
University 94	2.045	0.1613	12.676	1.701	0.1083	15.700
Apprenticeship	-0.1613	0.1372	-1.176	-0.1685	0.0407	-4.141
Apprenticeship 94	0.5656	0.1765	3.204	0.3975	0.0608	6.541
Agri.	-0.5162	0.1000	-5.162	-0.3574	0.1523	-2.347
Agri. 94	0.8151	0.1259	6.471	0.1969	0.1968	1.000
Building & Construction	-0.3923	0.3302	-1.188	-0.3502	0.0649	-5.397
Building & Construction 94	0.6873	0.3578	1.921	0.6602	0.0799	8.262
Wholesaling	-0.1874	0.1563	-1.199	-0.2497	0.0889	-2.807
Wholesaling 94	0.4164	0.1889	2.205	0.5201	0.1044	4.979
Retailing	-0.2908	0.1366	-2.128	-0.4766	0.076	-6.267
Retailing 94	0.2360	0.1699	1.389	0.6585	0.1073	6.138

Insurance	0.2854	0.1058	2.698	0.1705	0.0836	2.039
Insurance 94	-0.1089	0.1295	-0.841	-0.0023	0.1068	-0.021
Transport	0.1849	0.1273	1.452	-0.0157	0.0489	-0.321
Transport 94	-0.1495	0.1568	-0.953	0.0918	0.0727	1.262
Professional Services	-0.213	0.1879	-1.134	-0.1226	0.2208	-0.555
Professional Services 94	-0.0532	0.2323	-0.229	-0.1777	0.2989	-0.595
Teaching	0.1302	0.1318	0.988	-0.1194	0.0964	-1.239
Teaching 94	-0.2861	0.1569	-1.823	-0.1998	0.1166	-1.713
Health	0.0972	0.0979	0.993	-0.1363	0.0686	-1.986
Health 94	-0.1221	0.1234	-0.989	0.2039	0.1108	1.841
Public Admin.	0.0666	0.1022	0.652	-0.0984	0.0519	-1.895
Public Admin. 94	-0.198	0.1275	-1.555	0.0961	0.0724	1.328
Personal Services	-0.4532	0.1399	-3.240	-0.6300	0.1367	-4.608
Personal Services 94	0.4688	0.1736	2.700	0.873	0.158	5.523
Other	-0.2692	0.2354	-1.143	-0.3719	0.1471	-2.528
Other 94	0.2037	0.2496	0.816	0.4962	0.1646	3.015
Agri. Workers	-1.381	0.4768	-2.897	-0.5026	0.1377	-3.649
Agri. Workers 94	dropped (0 obs. in 1987)			0.7105	0.1870	3.798
Labourers	-0.8569	0.1400	-6.121	-0.4182	0.0607	-6.891
Labourers 94	1.557	0.1705	9.131	0.721	0.0834	8.637
Transport & Communication Workers	-0.681	0.1363	-4.995	-0.2971	0.0571	-5.198
Transport & Communication Workers 94	1.452	0.2010	7.225	0.5377	0.077	6.982
Clerical	-0.4614	0.1124	-4.105	-0.0301	0.0747	-0.403
Clerical 94	0.9254	0.1295	7.146	0.2100	0.0957	2.194
Commerce, Insurance & Finance	-0.702	0.1684	-4.169	-0.5201	0.0799	-0.651
Commerce, Insurance & Finance 94	1.1768	0.1946	6.047	0.2884	0.1026	2.81
Service Workers	-0.8213	0.1401	-5.86	0.0575	0.0732	0.785
Service Workers 94	1.311	0.1589	8.25	0.1333	0.0937	1.423
Professional Workers	-0.2267	0.1295	-1.751	0.1968	0.0761	2.585
Professional Workers 94	0.8685	0.1532	5.667	0.1254	0.0962	1.303
Others	-0.2037	0.1743	-1.169	0.1836	0.0707	2.597
Others 94	1.0941	0.2092	5.229	0.2068	0.0891	2.322
Union member	-0.0689	0.0565	-1.22	-0.0345	0.0363	-0.949
Union member 94	0.4065	0.0681	5.971	0.30	0.0463	6.473
Constant	2.4642	0.1423	17.321	2.6525	0.0719	38.867

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