CHAPTER 8

Wages and Human Capital: Evidence from the Irish Data

Kevin Denny*

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Colm Harmon**

&

Sandra Redmond***

* University College Dublin and Institute for
Fiscal Studies, Ireland
Kevin.Denny@ucd.ie

** University College Dublin and CEPR, Ireland
Colm.Harmon@ucd.ie

*** University College Dublin, Ireland
Sandra.Redmond@ucd.ie

1   Introduction

The object of this study is to compare results on the determinants of earnings across a spectrum of studies. Previous research solely focused on the topic has been scarce up to the 1990s, but the recent emergence of a number of comprehensive data sets has allowed a relative rebirth of the topic.

The studies reviewed differ in their objectives. For example, Denny et al. (1999) explore the effects of cognitive skills on labour market earnings, Callan and Wren (1994) examine the differential in male and female earnings and Callan and Harmon (1998) investigate alternative wage specifications, such as instrumental variables. Despite the different objectives the above studies estimate the return to a year's education at around 8 per cent. Similarly, Denny and Harmon (1998), Barrett et al. (1999) and Callan and Harmon (1998) provide evidence that the marginal effect of higher qualifications is increasing in the level of those qualifications. This might appear at first glance to imply a form of increasing returns. However, as it does not take into account the number of years it takes to finish these qualifications, it does not imply increasing returns to years of education.

The following papers, unfortunately, do not give us a comparison across worker groups, for instance private versus public employees or tenure induced wage effects, but some studies allow us to differentiate between males and females. In such cases, we find that females in general, enjoy a larger income increment at higher levels of education. However, the returns to experience are not quite so well determined, due to the different proxies used for experience.

The data sets and the estimation procedures are explained in Sections 2 and 3. Section 4 gives a detailed description of the results and Section 5 examines our conclusions.

2   Data sets

The following section and Table A1 of the Appendix describe the data sets used in the surveys.

Walsh and Whelan (1976) use cross-sectional data from the Department of Labour's redundancy section. This data set provides the authors with workers who were entitled to redundancy payments during the first 3 months of 1972. With this survey, the person must have worked for two years with the same employer in order to qualify for redundancy payments. Thus females are likely to be under-represented in the sample, as women tend to switch jobs more often than males because of family commitments. Also, policies in some companies also prevented a woman from regaining her job following marriage.

Denny and Harmon (1998) and Breen et al. (1995) use the *School Leavers Survey* (SLS). This survey also has a narrow focus, concentrating on school leavers who are interviewed 10 months after leaving secondary school. For example, school leavers who had responded to the questionnaire in May 1994 had left school in June 1993. So, the survey does not allow the authors to gauge other labour market attributes such as experience and tenure. However the data set is quite useful in that it contains detailed information on performance in the state examinations for second level students.

Hannan et al. (1998) use a follow up survey from the 1985/86 school leavers to their analyses. These school leavers are interviewed again in late 1992. Consequently, the data set has some measure of experience along with a general measure of performance in exams.

The International Adult Literacy Survey (IALS) used by Denny et al. (1999) is especially interesting in that it contains a general measure of cognitive ability rather than actual performance in an exam. The IALS was administered by thirteen governments in conjunction with the European Union, the OECD, and UNESCO between 1994 and 1996. The survey encompasses a broad range of skills used in the context of working, schooling and home duties; for example, a respondent may be asked to read the dosage on a medicine label, or calculate the total return from a compound interest table on a certain amount. The IALS also has information on the amount of schooling and earnings, so the calculation of the wage equation was possible.

The 1987 ESRI Survey of Income Distribution, Poverty and Usage of State Services (SIDPSS) is the focus of Callan and Wren (1994) and Callan and Harmon (1998). This survey along with the *ESRI Living in*

Ireland Survey (LIIS), 1994, are used by Barrett et al. (1999). Denny and Harmon (1998) also use the LIIS, to provide a comparison with the SLS. These surveys are rich with regard to labour market experience, providing the authors with a measure of actual experience along with a very comprehensive list of current gross earnings, deductions and net earnings.

Some checks have been applied to the data sets to assess their reliability. For instance Walsh and Whelan (1976) find that their earnings data is somewhat unrepresentative, in that the figures for men are lower and for females are higher, than what we would expect from other data. A comparison of the ESRI Survey data and the Census of Population shows that the data is representative of the population, in terms of its age structure and other demographic characteristics. Also, the earnings data closely corresponds to that of figures by the Central Statistics Office. Given that the ESRI data is representative of the population, Denny et al. (1999) compare the IALS with this survey. They find that the IALS working sample tends to have a higher average age and fewer years of schooling than the 1994 Living in Ireland Survey, but point out that the higher average age may be the cause of the lower schooling level of the sample, as the older age cohorts tend to have less schooling.

3   Estimation procedure

Variables included in the earnings functions vary depending on the data set used and the purpose of each study. Table A2 of the Appendix summarises the equation specifications.

Walsh and Whelan (1976) conducted the first detailed analysis of earnings in Ireland. The estimation procedure used was OLS with the natural logarithm of weekly earnings as the dependent variable and the wage regression run separately for males and females and for both sexes together. The difference in male and female earnings is also explored in Callan and Wren (1994). Firstly standard Mincer (1970) equations are run separately for males and females to uncover gender-specific returns to personal characteristics such as age and experience. They then do the standard Oaxaca–Blinder decomposition of the wage gap, into that which can be explained

by differences in characteristics and that which can be explained by differences in returns, usually interpreted as discrimination.

Denny and Harmon (1998) endeavour to find the effects of education on the probability of obtaining employment and the actual return to education and vocational training. Multinomial logit estimation is used to determine the effects of various factors on three labour market outcomes after leaving school – further education, employment and unemployment. Two labour market alternatives are only considered in Breen et al. (1995), thus a binary probit model is applied to establish what determines the chances of being in employment rather than unemployment.

When looking at the wage function we are obviously looking only at the working population, thus the data is non-randomly selected. Denny and Harmon (1998) deal with the non-randomness of the data by including the inverse of Mills' ratio (λ) as an additional term in their regression; λ then measures the effect of truncating the sample on the outcome. The problem is more pronounced for females, as the majority of males work whereas this is not true for females, so Callan and Harmon (1998) and Denny et al. (1999) only look at the male population.

Callan and Harmon (1998) also attempt to solve the endogenity of schooling problem. The problem lies in the fact that individuals with higher ability tend to choose more education. The disturbance term will pick up this unobserved ability. Thus, the education measure is correlated with the disturbance term resulting in downward bias estimates in OLS estimation. The instrumental variable approach may solve this problem by using another variable that is correlated with schooling but one that is uncorrelated with the disturbance term. Callan and Harmon (1998) apply this approach. Following tests of instrument validity, parental background is found to be an appropriate instrument.

Denny et al. (1999), Denny and Harmon (1998) and Breen et al. (1995) enter some measure of ability in their wage function to take account of the above mentioned unobservables. The IALS contains a range of measures of literacy, broadly defined. Denny et al. (1999) use principal components to construct from these a composite measure of cognitive ability. Denny and Harmon (1998) and Breen et al. (1995) control for results in the Leaving Certificate.

The growing preoccupation with 'credentials' and the rising return to qualifications brings Barrett et al. (1999) to examine the earnings dispersion between 1987 and 1994. A decomposition technique is employed to determine whether the inequality in earnings is due to education or other factors. Along the same lines, Hannan et al. (1998) analyse the match between education level attained and occupational status in order to find evidence of 'qualification inflation'. In doing this they run the usual wage equation with dummy variables for being 'overqualified' and 'underqualified'. An individual is 'overqualified' when in an occupational class that is more characteristic of an individual with a lower education level. For example, a person with a degree is overqualified if he/she is in an occupational class at or below the median of an occupational class that is more characteristic of a person with a sub-degree qualification.

Denny et al. (1999) depart from the above mentioned studies, in that maximum likelihood estimation techniques are employed to estimate the wage function due to the grouped nature of the dependent variable. IALS wage data is constructed on the basis of assigning individuals to the appropriate quintile of the wage distribution, providing a 5-category banded income variable. Stewart (1983) shows that better estimates are available by exploiting a distributional assumption for the continuous but unobserved variable with a maximum likelihood estimator than ad hoc procedures such as using the midpoints of the wage bands. The estimator is a natural generalisation of estimation of the censored normal, which is in turn a generalisation of the well-known Tobit estimator. It provides consistent estimation if wages are lognormal distributed.

Where not stated the dependent variable is the natural logarithm of gross hourly earnings.

4   Results

The results from returns to various labour market attributes show surprising homogeneity across studies. This is unexpected given the different data sets used and the divergent objectives of the studies surveyed. Another surprising element to the results is the

complete absence from the wage equation of any distinction between public and private sector employees or tenure-induced wage effects. Tables 1–3 summarise the results from variables that explain most of the variation in earnings, which are analysed below along with other variables.[1]

4.1   Education

The Irish education system consists of three levels: Primary education, attended by children aged 5–12; Secondary and Vocational schools attended by children aged 12–18; and the Third Level. Pupils who have 3 years of post-primary education sit a State exam called the Junior Certificate. Students who continue on for a further two or three years sit another State exam called the Leaving Certificate. Prior to 1992, students who had experienced three years of Vocational schools sat a State exam called the Group Certificate. From 1992 the two junior cycle exams (Intermediate and Group) were consolidated into one exam called the Junior Certificate. The third level sector consists of non-university and university courses. The non-university or Institutes of Technology (IT) sector consists of degree and non-degree programmes, whereas the majority of university programmes are for a degree.

The use of educational levels rather than years of education is the preferred option in the studies surveyed here the reason being the absorption with the credentialist model, which requires the use of educational levels rather than years of education, to show the rising returns to qualifications. A review of the returns to education (Tables 1–3) shows the expected positive correlation between earnings and education, the higher the level of education the higher one's earnings.

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[1]   Sexton, Whelan and Williams (1988) also study the effects on earnings using a specially collected data set which examines the transition from education to working life and early labour market experience in Ireland. However, this paper is not included in this review due to different econometric specifications which do not allow comparison with other studies, specifically the dependent variable is the level not the logarithm.

Table 1.   Returns to a year's education

	Year	All	Male	Female
Walsh and Whelan (1976) **Secondary Education**	1972	0.029	0.026	Not sig.
Walsh and Whelan (1976) **Vocational Education**	1972	0.012	0.018	Not sig.
Callan and Harmon (1998)	1987		0.083 All 0.092 Age 18-32 0.085 Age 33-49 0.88 Age 50-64	
Denny et al. (1999)	1994		0.082	
Denny et al. (1999) **Controlling for ability**	1994		0.070	

Table 1 shows findings for returns to years of education. Callan and Harmon (1998), Hannan et al. (1998) and Callan and Wren (1994) find an estimated return of 8 per cent for each additional year of schooling, which is consistent with Denny et al. (1999), despite using different estimation procedures. Callan and Harmon (1998) also find that there is a slight increased return to the younger age group. However, Walsh and Whelan (1976) find somewhat lower estimates in the returns to vocational school and secondary school, which is not surprising given the narrow sample of population covered.

The fact that the education measure may include some measure of ability, which may produce biased estimates of the returns to education, has been much discussed. Denny et al. (1999) control for this fact by including a measure of cognitive skills, which results in a lowering of the effect of education on earnings, indicating that education does indeed include some measure of innate ability.

Tables 2 and 3 show findings from educational levels. Callan and Harmon (1998), Callan and Wren (1994) and Barrett et al. (1999) provide very similar estimates of the returns to education for men. This is not surprising since the estimated year is the same (1987). Having the Intermediate Certificate increases earnings by 19% above that for a person with no qualification and a degree increases earnings by a further 60%.

Table 2.   **Levels of education**

	Year	Men				
		Intermedi-ate/Junior certificate	Group certificate	Leaving certificate	Diploma/ 3rd level	Uni-versity
Callan and Wren (1994)	1987	0.19	0.15	0.38	0.54	0.81
Callan and Harmon (1997)	1987	0.195	0.162	0.374	0.505	0.794
Barrett et al. (1999) Spec 1	1987	0.17		0.37	0.58	0.86
Barrett et al. (1999) Spec 3	1987	0.12		0.36	0.59	0.79
Barrett et al. (1999) Spec 4	1987	0.11		0.34	0.56	0.85
Breen et al. (1995)	1988-1991	0.376		0.239		
Denny and Harmon (1998) SLS	1990-1995	0.1016		0.2455		
Denny and Harmon (1998) LIIS	1994	0.376 0.296	0.289	0.464	0.609	0.940
Barrett et al. (1999) Spec 1	1994	0.22		0.41	0.54	1.01
Barrett et al. (1999) Spec 3	1994	0.18		0.36	0.53	0.95
Barrett et al. (1999) Spec 4	1994	0.17		0.34	0.51	0.98

Note: Where results for the Group Certificate are not shown, it has been clas-sified with the Intermediate/Junior Certificate.

Comparing the male and female results, Callan and Wren (1994) find that females enjoy a lower wage premium at the lower levels of education and a higher wage premium at higher levels of education. However, Breen et al. (1995) find that women enjoy the higher pre-mium to the Leaving Certificate. It has to be pointed out that Breen et al. (1995) control for performance in exams. Nevertheless, Denny and Harmon (1998) also take account for performance in exams and discover that men experience higher returns to the Leaving Certificate than women. The difference in the two opposing results can be ex-plained in the actual measure of exam achievement. Breen et al. (1995) take account of the actual grades in the exams, whereas Denny and Harmon (1998) take account of the number of papers taken at higher and lower levels. A plausible explanation for this is that actual grades make a difference for girls in the labour market, as they tend to enter into clerical or secretarial positions following secondary school, which need proof of some numeric or written ability. Whereas, males

Table 2.   **(cont.)**

	Year	Women				
		Intermedi-ate/Junior certificate	Group certificate	Leaving certificate	Diploma/ 3rd level	Uni-versity
Callan and Wren (1994)	1987	0.17	0.15	0.44	0.74	1.10
Callan and Harmon (1997)	1987					
Barrett et al. (1999) Spec 1	1987					
Barrett et al. (1999) Spec 3	1987					
Barrett et al. (1999) Spec 4	1987					
Breen et al. (1995)	1988-1991					
Denny and Harmon (1998) SLS	1990-1995	-		0.1406		
Denny and Harmon (1998) LIIS	1994	0.332 0.308	0.291	0.477	0.609	1.04
Barrett et al. (1999) Spec 1	1994					
Barrett et al. (1999) Spec 3	1994					
Barrett et al. (1999) Spec 4	1994					

Note: Where results for the Group Certificate are not shown, it has been clas-
sified with the Intermediate/Junior Certificate.

who leave after secondary school enter into manual labour and actual results are not important to obtaining these jobs.

When Callan and Harmon (1998) and Barrett et al. (1999) break their sample into specific age cohorts, a general picture emerges whereby returns to education increase with age. This suggests that the older age cohorts enjoy a wage premium because qualifications were relatively scarce while they were attending school in the 1940s.

In addition, Barrett et al. (1999) find that returns are consistently increasing from 1987–1994. This, it could be argued, is a reflection of a society that is growing preoccupied with qualifications, a phenomenon which Collins (1979) coined as 'credentialism'. This term refers to the hypothesis that employers expect their employees to have more qualifications in the face of the rising standard of the education level of the population (Hannan, 1986). However, it is not clear that this is

Table 3.   **Levels of education by age cohorts–men only**

	Age Cohort	Year	Inter/ Junior Certificate	Group Certificate	Leaving Certificate	Diploma/ 3rd level	Uni- versity
Callan and Harmon (1998)	18-32	1987	Not sig	Not sig.	0.193	0.395	0.847
Barrett et al. (1999) Spec 2	15-32	1987	0.08		0.23	0.39	0.73
Barrett et al. (1999) Spec 5	15-32	1987	0.05		0.26	0.46	0.86
Callan and Harmon (1998)	33-49	1987	0.144	0.107	0.385	0.450	0.710
Barrett et al. (1999) Spec 2	33-49	1987	0.18		0.42	0.56	0.90
Barrett et al. (1999) Spec 5	33-49	1987	0.12		0.38	0.54	0.88
Callan and Harmon (1998)	50-64	1987	0.151	0.221	0.573	0.573	0.736
Barrett et al. (1999) Spec 2	50-64	1987	0.14		0.49	0.87	0.94
Barrett et al. (1999) Spec 5	50-64	1987	0.16		0.45	0.79	0.78
Barrett et al. (1999) Spec 2	15-32	1994	0.11		0.21	0.26	0.73
Barrett et al. (1999) Spec 5	15-32	1994	0.14		0.26	0.39	0.91
Barrett et al. (1999) Spec 2	33-49	1994	0.24		0.52	0.67	1.13
Barrett et al. (1999) Spec 5	33-49	1994	0.18		0.42	0.60	1.06
Barrett et al. (1999) Spec 2	50-64	1994	0.14		0.35	0.71	1.04
Barrett et al. (1999) Spec 5	50-64	1994	0.13		0.34	0.63	0.95

the only or indeed the best explanation. The rate of return may have simply increased because of market forces.

In addition, Table 3 shows that those having a qualification other than a degree do not seem to have experienced the same in-

creased returns. In fact there is a slight tendency for decreased returns in non-university third level qualifications. Furthermore, Tables 2 and 3 indicate that the earnings function appears not to be very sensitive to its specification, in that returns to education do not differ greatly across alternative methods of expressing the wage function. Returns tend to be remarkably similar at lower levels of education, however there tends to be a slight difference at the upper level of education. Where standard errors are reported in the studies, we find that the differences in the returns are not statistically significant from each other.

4.2   Vocational education/training

Sitting the Group Certificate exam has a positive effect on earnings but less than the Intermediate Certificate. For example, Callan and Wren (1994) find that taking the Group Certificate will add 15% to earnings for men and women against individuals who have no qualifications, whereas this figure for the Intermediate Certificate is 19% and 17% for males and females, respectively. However, Callan and Harmon (1998) find that sitting the Group Certificate is not statistically significant for men for the younger age cohort, indicating the growing need for the younger generation to equip themselves with higher qualifications.

Denny and Harmon (1998) analyse the effect of post Intermediate and Leaving Certificate Vocational training. They find that Post-Intermediate Certificate training has no significant effect for girls but has a positive significant effect for boys. In addition Post Leaving Certificate Vocational training (PLVT) has a positive significant effect on both sexes with a slightly larger impact for boys. However, this effect for girls drops dramatically once selection bias is taken into account, as the working female population will not opt for PLVT, whereas the non-working population will. Controlling for this fact reduces the effect PLVT has on the female population. Also, the marginal effect for boys from PLVT to diploma courses is small in comparison to the marginal effect for females. This may be due, as the authors point out, to the high degree of substitution between this vocational training and sub-degree courses for males.

4.3   Experience

The School Leavers Survey focuses on individuals one year after the end of the secondary school cycle, so information on experience is non-existent in surveys that use this data set.

Table 4.   Estimated coefficient: experience

		Males		Females		All	
		Expe-rience	Expe-rience^2	Expe-rience	Expe-rience^2	Expe-rience	Expe-rience^2
Walsh and Whelan (1976)	1972	0.012	-0.000	not sig.	not sig.	0.009	-0.000
Callan and Wren (1994)	1987	0.63	-0.98	0.71	-1.32	-	-
Callan and Harmon (1998) All	1987	0.459	-0.726				
Callan and Harmon (1998) 18-32	1987	1.211	-4.365				
Callan and Harmon (1998) 33-49	1987	0.549	-0.860				
Callan and Harmon (1998) 50-64	1987	0.851	-1.119				
Denny and Harmon (1998)	1994	0.785	-0.099	0.568	-0.071		
Denny at al. (1999)	1995	0.645	-0.059				

Walsh and Whelan (1976) measure experience as the present age minus the age when an individual left school. Experience and experience squared exhibit the expected non-linear pattern, i.e. earnings increase with experience but at a diminishing rate (see Table 4). Callan and Wren (1994) find, using actual experience, that for women the earnings/experience profile is more peaked, i.e. female earnings increase faster than males with experience but also diminish at a quicker rate. Also, Callan and Wren (1994) find that the return to on-the-job experience is greater for females, a fact that Denny and Harmon (1998), using age as a proxy for experience, do not find. The difference lies in the fact that Callan and Wren (1994) take account of interruptions in the female labour market, thus providing a more accurate measure of experience.

Callan and Harmon (1998) break the sample into age cohorts. They find that experience has a greater influence on earnings when a person is young and a lesser and more diminishing effect as the individuals grow older. Over time and across the different studies we find no trend and quite varied estimates for the returns to experience. This brings us to the understanding, that the definition of experience is important in trying to assess the sensitivity of the wage equation with respect to experience. Barrett et al. (1999) unfortunately do not give estimates for the returns to experience.

4.4   Occupation/Social Class

A male individual, whose father is from an unskilled background, experiences a 10% drop in earnings compared to another male from a professional background. This figure for females is 16% (Breen et al., 1995). Another important finding is that if one's father has a job, this increases greatly the chances of the respondent having a job one year after leaving school, as opposed to being unemployed. Denny and Harmon (1998) find that individuals from worse off backgrounds are also less likely to pursue higher education. In addition, reinforcing Breen et al. (1995) above, Denny and Harmon (1998) find that having a father who has a job, increases the probability of being either in higher education or in employment compared to unemployment.

4.5   Selection bias

The only study that addresses the issue of selection bias (see Section 3) is Denny and Harmon (1998). Using the Heckman two-step method Denny and Harmon (1998) discover that the inverse Mills' ratio is insignificant for men and significant for females. This implies that there is a problem of selection bias in the regression results for females but not for males, that is, the estimates from the OLS female equation are inconsistent.

In addition, controlling for selection bias results in a notable effect from exam performance; taking higher level papers in the Intermediate and Leaving Certificate is now significant for females. This indicates that performance in exams is important in signalling women's general literacy to employers, in the job market, more so than for males. Again, as mentioned above, the reason lies in the

type of jobs females tend to enter into when they leave school. Correcting for selection bias also lowers, by half, the effect that vocational training has on earnings, which indicates that the unobserved characteristics, such as motivation and ability, are different across the working and non-working population.

5   Conclusion

A survey of the literature on the returns to education brings us to the conclusion that the specification of the wage equation and the use of different data sets do not have a dramatic effect on earnings. For example, the returns to educational levels do not vary much and the differences across years and studies are not significantly different. When years of education is used, the returns are around 8 per cent per year with the exception of Walsh and Whelan (1976). The return to experience varies a lot between the studies surveyed, which is due to the different proxies for experience used, i.e. age, potential or actual experience. Again, with Walsh and Whelan's (1976) study producing some peculiarities.

Thus, this review has also brought to light the importance of reliable data sets. Walsh and Whelan (1976) use earnings from a data set that is unrepresentative of the population distribution of wages, hence produces estimates that can be classified as 'outliers' in comparison to other studies.

However, we cannot be fully confident of these results until more estimates have been replicated, especially in terms of robustness of results to different data sets. There is a remarkable scarcity of research on returns to labour market attributes in Ireland, which is attributed to the lack of comprehensive micro-data; in the 9 papers surveyed there is only 5 different data sets used, which does not allow us to be fully confident of our results.

Further research is also warranted to explore the correct wage specification and some peculiarities especially in relation to the female wage equation. Particularly, the impact of performance in exams on success in the female labour market.

Also, as can be seen from Table A1 of the Appendix it is difficult to infer anything about the trend in the rate of return because

of the timing of the data sets. While one study argues for increasing returns to credentials, there is no obvious increase (or decrease) in the return to years of education.

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