

Professor Ian Walker
Department of Economics
University of Warwick,
Coventry CV4 7AL

Email i.walker@warwick.ac.uk
Tel (01203) 523054
Fax (01203) 538218

Dr Colm Harmon
Department of Economics
University College Dublin
Belfield, Dublin 4

Email colm.harmon@ucd.ie
Tel 00 3531 706 8505
Fax 00 3531 283 0068

Education and Earnings in Northern Ireland

*A Research Project to Analyse the Economic
Returns to Education in Northern Ireland*

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Final Report

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A Research Project to Analyse the Economic Returns to Education in Northern Ireland

1. Project Summary

- 1.1 Post-compulsory education in general and higher education in particular contributes to wealth creation in the economy in many ways. For example, technology transfer, direct links between education and research institutions with business and industry, improving the capacity of the economy to appropriate the benefits of technological advances made elsewhere, and input to programmes such as Technology Foresight, all serve to enhance both the economic well being and social cohesion of a region.
- 1.2 Some, perhaps much, of these benefits are appropriated by the individuals who make the investments in their own “human capital” that generate this wealth creation, in the form of higher wages¹. The “rate of return” to education derived from the relationship between education and economic success is central to most of education policy. The larger this rate of return (relative to the return on other investments) the more likely it is that individuals are *failing* to respond to economic incentives to invest in education. That is, paradoxically, a high rate of return to education is evidence that individuals are investing too little in education – if only they invested more the greater would be the supply of educated workers and, for given demand, the lower would be the wage of such workers.
- 1.3 There is some evidence to suggest that participation rates in post compulsory education is higher in Northern Ireland (NI) than in Great Britain (GB) and yet the availability of places in higher education is lower than in GB so that a disproportionate number of students pursue higher education in GB rather than NI. However, it is difficult to infer this from looking simply at participation rates since this may be limited by capacity and the preparedness of individuals to study elsewhere.
- 1.4 Nevertheless, the disparity has been noted in the recent *Dearing Report (Higher Education in the Learning Society, Report of the National Committee)* as well as in DENI’s own *Strategic Plan*

¹ Kruger and Lindahl (1999) look at the correlation between earnings growth and changes in schooling over many countries and finds that the “social” return to education is around 18% - an additional year of schooling, on average across the country, would raise GNP by 18%.

(Strategic Plan for Education 1996-2000,1996). A major question that Dearing has raised is the extent to which the high level of demand relative to supply in post-compulsory education in NI relative to the GB is evidence that indicates that further capacity is needed in NI.

1.5 However, it is not obviously the case that higher NI demand for Higher Education (HE) than NI supply justifies expansion of NI capacity. It could be that a “small” region benefits from having a disproportionate number of their young people educated outside of that region and that excess demand is a reflection of those benefits. While this is a plausible argument the absence of hard estimates to substantiate it suggests a need for additional research². What is required is research that estimates the return to education obtained outside NI relative to that obtained within NI.

1.6 The first stage of this project provides estimates of the returns to education in NI and GB separately. The research takes particular care in establishing the causality between education and labour market outcomes rather than simply the correlation between them. In addition to providing estimates of the returns to years of education we explore the returns to particular types of qualifications: for example, level of qualification including vocational training, and the returns to degrees broken down by broad subject area of degree. Moreover, we explore the effects of education on the earnings of individuals with different levels of ability to see if a “Bell Curve” phenomenon (which asserts that education does little to redress the effects of the underlying differences in ability across individuals) is apparent in the UK.

1.7 The second stage aims to estimate the returns to education in NI allowing for the complications associated with having a high proportion of young people moving to GB (or the Republic of Ireland (RoI)) for their higher education, some of who may not return. Those that move and return, and those that move and do not return, are likely to be different in both observable and unobservable ways from those that stay. That is, using samples of people who are currently resident in NI and GB to provide estimates may yield biased estimates because current residence will not be identical to where education took place, and those that move are not representative. Thus, we go on to consider data where both current residence and residence while in education are recorded and attempt to model the decision to move for education or not, and the decision to return or not having moved.

² A recent Northern Ireland Higher Education Council (NIHEC) report on access to higher education concluded that a number of young people, particularly those with lower grades at A level, were “reluctant leavers”. That is, they were unable to find a place at a NI institution because the limits on the number of places available were leading to higher entry levels but that they could, however, find places in GB. There is some evidence that suggests that the majority of leavers do not return to Northern Ireland once their higher education is completed.

2. The Methodology

- 2.1 The proposed research is based on the microeconomic analysis of conventional “human capital” theory with special attention to the distinctive issues that relate to NI – especially the question of excess demand and the possibility of pursuing HE outside NI, and the possibility that such individuals do not return.
- 2.2 This empirical investigation uses existing large-scale datasets to identify the relationship between education and earnings in NI. Education in NI is quite distinctive (probably more so than in Scotland) and yet there is little research that focuses on the specific issues in NI. The focus of the modelling is on: participation in post-compulsory education and the role of the capacity in NI, GB and the RoI; post A-level participation, future employment, and future earnings; participation in higher education outside NI and the earnings of returnees vs. non-returnees; the choice between HE and FE; the incentives to participate in HE outside NI and the incentive to return to NI.
- 2.3 While each of these topics are interesting in their own right and have relevance to specific issues, the overall objective is to provide the analysis to facilitate an evaluation of post A-level education provision in NI.
- 2.4 The existence of externalities in education that make the social return to it exceed the private returns has been long established and has been a feature of recent theories that attempt to explain the rate of growth of economies. However, it is extremely difficult to establish precisely the size of the social returns. Here the focus is on the private rate of return, which *can* be measured and will provide a lower bound to the social returns. If it can be established that the private returns are high (and exceed those elsewhere in the UK) then there is a strong case for expanding capacity in NI (perhaps at the expense of elsewhere).
- 2.5 There are a number of datasets that tell us about earnings and employment and the previous educational experiences of individuals. The methodology uses microeconomic methods to “explain” differences in earnings across individuals in terms of differences in observable characteristics (like gender and age) and differences in factors such as education and location. That is, we use multivariate regression methods to control for the effects of other variables, such as gender and age, on wage rates so that we identify the effects of education on wages purged of the correlation between education and those other factors.
- 2.6 The estimated relationships are of the form:

$$\log w_i = \mathbf{X}_i \beta + \delta S_i + e_i$$

where w_i is the wage rate (measured as earnings divided by hours worked) of individual i , \mathbf{X}_i is a vector of variables that also determine wage rates (such as age) and S_i is the individual’s duration of schooling,

and e_i is a “residual” which captures the effects of all unobserved determinants of wages. This specification is universally adopted in research into “human capital” and has been subjected to extensive testing (see Card (1999) for a review) that has vindicated its use. In particular, the linearity in the relationship between log wages and schooling has generally found to be supported as a sound approximation by the available evidence. The “semi-log” form of the model allows us to interpret β as the private financial “rate of return” on education³.

- 2.7 The estimation method that has been most commonly used in UK work has been standard “ordinary least squares” which will produce unbiased estimates of the coefficients of the model when S and e are uncorrelated. If this is true then S is randomly distributed across individuals and the coefficient β then gives the effect of adding one more year of S on wages.
- 2.8 The principal novelty of our project is that we show that this assumption is not warranted and that the bias that is induced in OLS is large. Here we infer the rate of return to education from the observed differences in education but rather than treat education as an exogenous characteristic of individuals (such as age and gender) we treat it as an endogenous variable over which individuals make decisions. That is we allow a correlation between S and e – which arises because individuals who are particularly able for unobserved reasons (and so have a high value of e) may have systematically more (or less) S than those with a low value of e .
- 2.9 That is we seek to explain why one individual’s schooling is different from another. There are good reasons for believing that one cannot infer the return to education from inspecting how earnings differ with education: in particular both earnings and education might be correlated with some other characteristic such as ability, access to credit markets, or motivation. If this is the case then, since we cannot readily observe these differences in characteristics, it is not possible to say whether the observed correlation between education and earnings is really due to differences in ability, etc. rather than the effect of education *per se*.
- 2.10 The difficulty in controlling for this potentially “spurious” element of the correlation between education and earnings is that we need to be able to model the determinants of education using (at least some) variables that are uncorrelated with earnings. In Harmon and Walker (1995) we use compulsory school changes to isolate the effect of education *per se* on earnings, while in Harmon and Walker (1999) we experiment with a variety of institutional changes such as the real level of student grants. In this project we focus these methodological developments specifically on NI and we now include women as well as men.

³ This is true providing that the direct tuition costs of education are small.

- 2.11 A second novelty is that we are interested in the impact of education on those individuals who choose to study outside NI for their higher education. Of course, studying outside NI is not a randomly assigned characteristic – those that choose to study outside NI are not a *randomly selected* subset of all NI students. Thus, we need to be able to explain why some individuals choose to study in GB (and the RoI) and others do not. It seems likely that the extent of NI unrest may be a useful variable, as well as the relative availability of HE places and differences in labour market conditions in NI relative to GB, to help explain the extent of study outside the region, and this may be different for individuals from different religious denominations.
- 2.12 Thus we estimate how wages are affected by education and whether that education was obtained elsewhere. The aim is to exploit the fact that changes in, say, unrest, the availability of places and in other variables, affect education decisions in order to address the impact of education on wages.
- 2.13 Our analysis proceeds in two broad stages. In the first stage we use GB data from GHS/FES and NI data from the NIFES/CHS datasets to model the impact of education on wages. This analysis will distinguish between men and women, and (within NI) between religions. Further work shows the effects of qualifications and degree type rather than just years of education received. The purpose of this first stage is to obtain some simple results that are based on the presumption that location is exogenous.
- 2.14 Results as presented in the main body of the report are largely in summary format. Full details on the methodology, the statistical details on the samples of data used and other points of information or clarification can be addressed to either of the authors of this study

The Economic Returns to Education: NI and GB

3. The Data

- 3.1 The Stage 1 analysis here is based largely on two widely explored data sources: the General Household Surveys (GHS), the Family Expenditure Surveys (FES). Both of the GB FES and GHS surveys have corresponding NI counterparts in the Continuous Household Survey (CHS) and the NIFES (observations from which are added to the GB FES to form the UK FES). The GHS/CHS and FES/NIFES contain earnings, hours, employment, characteristics, and educational backgrounds in varying detail. The advantage of GHS/CHS and FES/NIFES datasets is that they are available for each of a large number of years so that we construct very large samples for analysis.
- 3.2 The GHS/CHS contains data on qualifications as well as years of education, while FES/NIFES contains just years of education. The GHS/CHS and FES/NIFES have similar earnings and hours of work

data and the GHS/CHS also contains some information on parental family background that is useful. Gender is recorded in all datasets, but religion is only available for CHS and NIFES not GHS or FES.

3.3 Both GHS/CHS and FES/NIFES datasets contain some variables that are potential “instrumental variables” that we feel may be justifiably excluded from our model of wage rate determination, but which enter our model of the determination of education.

4a. Stylised Facts FES/NIFES

4.1 The NIFES/FES analysis is conducted on a sample drawn from the April 1986 to March 1995 surveys. The observations relate to "prime" age individuals (21-64 for men and 21-59 for women). Much of the analysis is concerned with employed individuals (i.e. those with positive recorded normal hours and earnings working as employees). The data has been constructed by merging the GB households from the FES with the households in NIFES.

4.2 Figures 1 and 2 show the distribution of real (log) hourly wage rates in the data. Since these are log wages the difference in the heights of the blocks are a measure of the percentage wage differences. The overall differences between NI and GB in the raw data are illustrated in Figure 3 and in Table 1. The gender differential is larger in GB than NI (or, equivalently, the regional difference is smaller for women than men).

4.3 Figure 4 shows the raw correlation between education and wages by gender in NI and GB separately. Figures 5 and 6 show the education leaving age distribution in GB and NI for men and women respectively.

Figure 1 Male Real Log Wages by Region
Pooled FES/NIFES 1985/6-1994/5

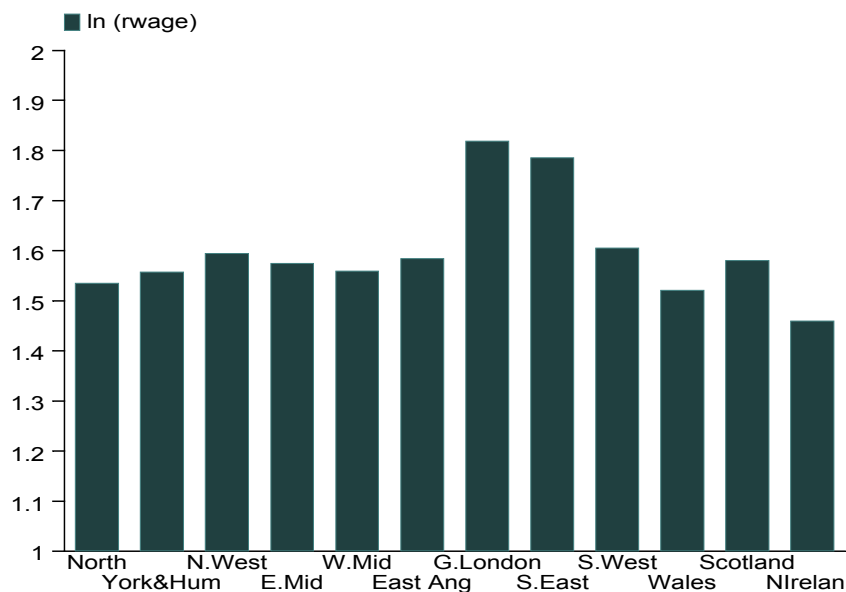


Figure 2 Female Real Log Wages by Region
Pooled FES/NIFES 1985/6-1994/5

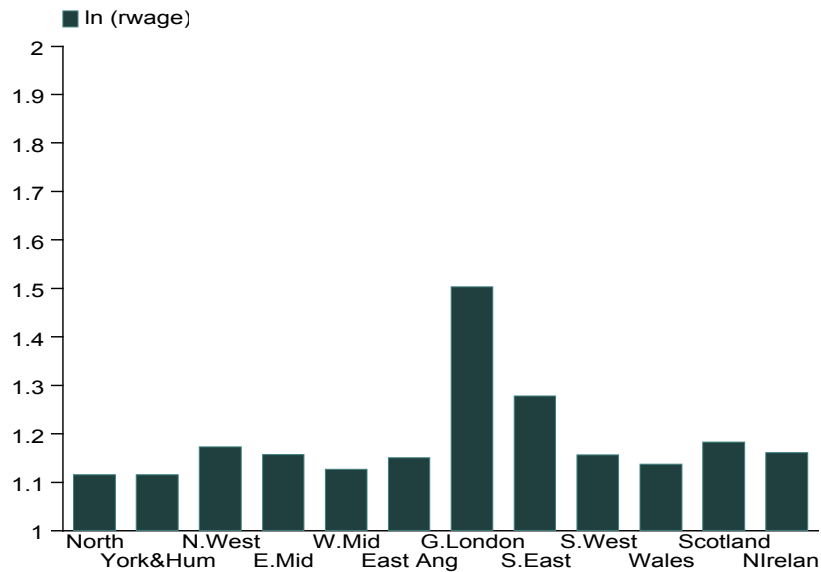


Table 1 Male and Female Log Wages by Gender
Pooled FES/NIFES 1985/6-1994/5

	Men	Women	Gender Differential
GB	1.641	1.214	0.427
NI	1.459	1.161	0.298
Regional differential	0.182	0.053	

4.4 The sample sizes in each for NI are rather small but there is some tendency over time for the regional difference to close for men but little for women.

4.5 The education earnings profiles are steeper for women than men since the gender differential is larger at lower levels of education. This suggests that the returns to education are higher for women than men. However, there is little apparent difference between the slopes of the NI and GB profiles. Note that the dip in the profiles at 19/20 corresponds to a very small proportion of the data - few people leave at these ages.

4.6 The education distributions are quite different between NI and GB for both men and women. The proportion on individuals whose age of leaving education is 21 or above is give in Table 2. The GB/NI differential is large and positive for men and small and positive for women. Table 3 gives the average lengths of education by gender and region. The average lengths are very similar and the differences between Tables 2 and 3 suggest that NI has a higher proportion stopping education at 17/18 than in GB. Figures 5 and 6 bear this out, especially for women. Table 4 and Figure 7 shows that there are differences in the proportion leaving education beyond 20 within NI with Protestants, women in particular, having slightly lower participation rates than

Catholics. However, average durations of education by religion and by gender are little different within NI.

Figure 3 *Real Log Wages by Gender and Year for GB and NI Pooled FES/NIFES 1985/6-1994/5*

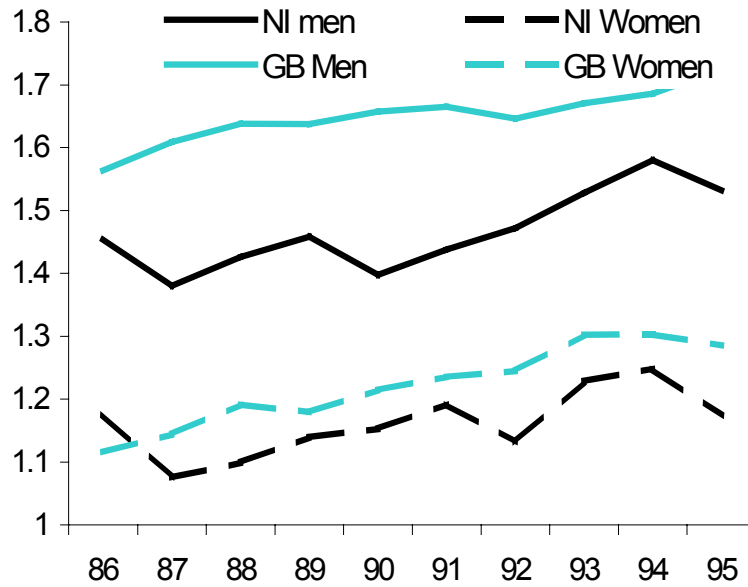


Figure 4 *Education and Wages by Gender for GB and NI Pooled FES/NIFES 1985/6-1994/5*

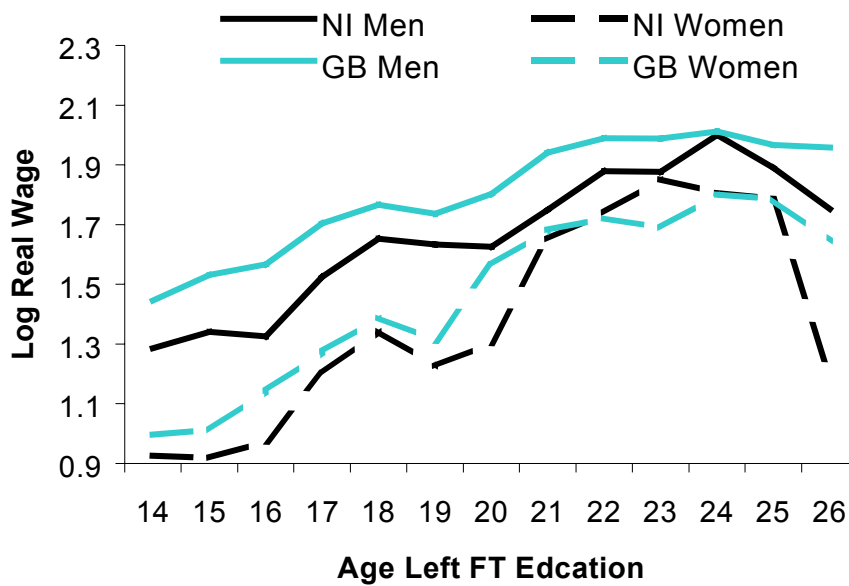


Figure 5 Male Education Distribution, GB and NI
Pooled FES/NIFES 1985/6-1994/5

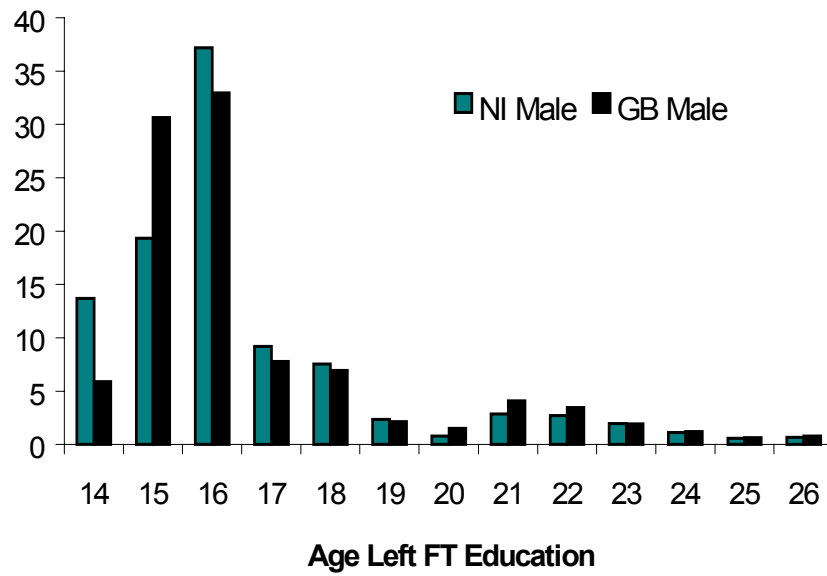


Figure 6 Female Education Distribution, GB and NI
Pooled FES/NIFES 1985/6-1994/5

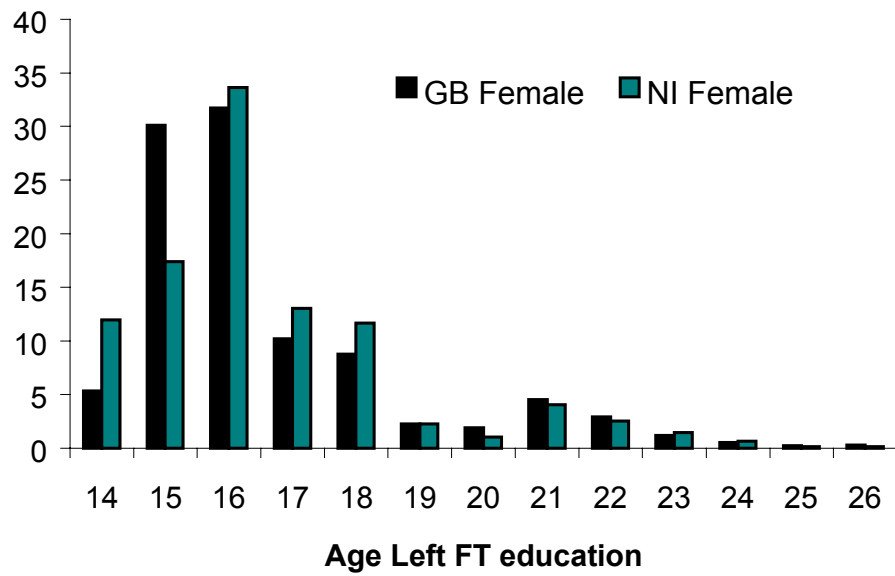


Figure 7 Education Years Distribution within NI:
Pooled NIFES 1985/6-1994/5

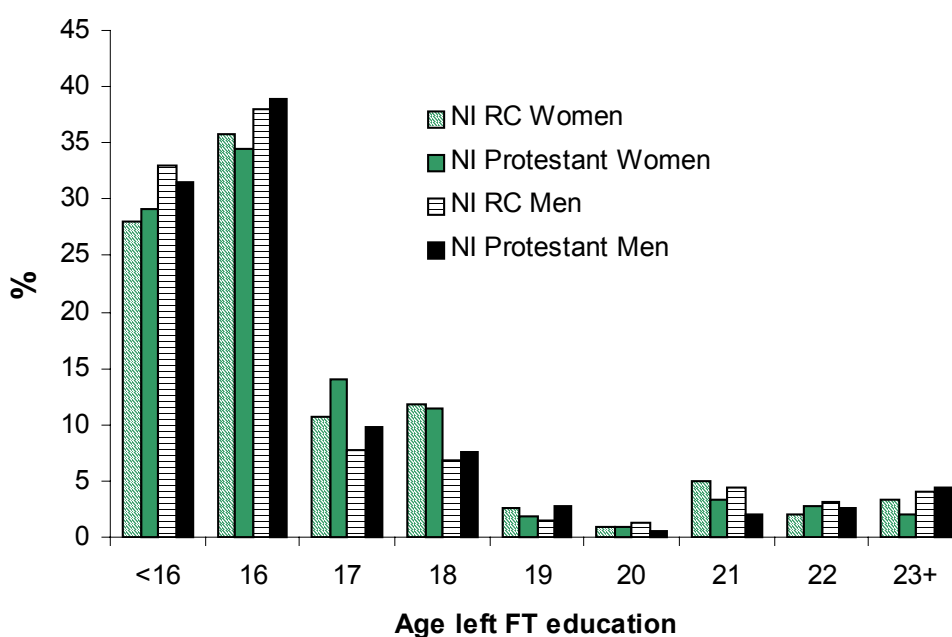


Table 2 Percentage with Education Leaving Ages Exceeding 20
Pooled FES/NIFES 1985/6-1994/5

	Men	Women	Gender Differential
GB	12.1	9.7	2.4
NI	9.9	9.0	0.9
Regional differential	2.2	0.7	

Table 3 Average Duration of Education (Years)
Pooled FES/NIFES 1985/6-1994/5

	Men Years	Women Years	Gender Differential
GB	11.7	11.6	0.1
NI	11.5	11.6	-0.1
Regional differential	0.2	0.0	

Table 4 Percentage with Education Leaving Age > 20 in Northern Ireland by Religion: Pooled FES/NIFES 1985/6-1994/5

	No religion	Protestant	Catholic	Protestant - Catholic Differential
Male	9.7	9.0	11.6	-2.6
Female	9.3	8.0	10.2	-2.2
Gender differential	0.4	1.0	1.4	

- 4.7 The Continuous Household Survey is an annual survey of approximately 4000 households analogous to the General Household Survey conducted in Great Britain. For the purpose of our analysis we will focus on the employed individuals from a pooled sample of CHS for the years 1985/6-1993/4, 1995/6⁴. The total usable sample, applying the same selection criteria as before, is 17887, comprising 8435 men and 9452 women⁵. We select GHS data for the corresponding years and obtain a sample of 27587 GB working men and 25352 GB working women without missing values for the variables of interest.
- 4.8 There is an important deficiency in the CHS - earnings is only recorded as annual earnings and is only provided on a banded or grouped basis, unlike GHS in GB which reports actual weekly earnings.
- 4.9 This presents two difficulties. First we need to use an appropriate estimation method to deal with the banded nature of the data on earnings. Secondly we need to adjust the earnings data for variations in hours worked per week and make some assumption about the weeks worked per year.
- 4.10 The second is straightforward – we simply divide the bands by annual hours of work. For example, if an individual is coded as having earnings between, say £10,000 and £15,000 and records 40 hours of work we infer that their hourly wage rate would be between £4.81 (i.e a (natural) log wage of 1.57) and £7.21 (i.e a log wage of 1.98) assuming that they work for 52 weeks of the year⁶. Thus for each observation we know that the (log) wage rate lies within a band (although the wage band definition itself now differs across individuals, whereas the earnings band was the same for all, this makes no difference to the estimation methodology).
- 4.11 When dealing with banded data one might be tempted to replace the bands by the midpoint of the range – so, in the case in the previous paragraph use a log wage of 1.78 as the midpoint of the range 1.57 to 1.98. In fact, because log wages are (approximately) Normally distributed this is generally an inappropriate procedure since the mean of the data within the band will be above the midpoint if the range lies below the overall mean of the data while the band mean will be below the band midpoint when the band lies above the overall mean of the

⁴ Our analysis omits 1994 since we have been unable to recover income data for that year from the survey data. More recent CHS data is not yet available at the ESRC Data Archive.

⁵ Missing income data appears to be a much larger problem for the CHS data than the GHS. Our attempts to correct for potential selection bias associated with using a sample with no missing values did not suggest any bias, and we report below only simple estimates that do not attempt to correct for any possible bias.

⁶ Assuming some other value would simply affect the estimated constant terms in our models, but not the estimate of the rate of return.

data. Stewart (1983) shows how, by exploiting the Normality of the log wage distribution one can improve on the use of the midpoint by the use of Maximum Likelihood estimation methods. It is this method that we use here – we refer to it as Interval Regression (IntReg). The method is exactly comparable to OLS and allows the same interpretation to the parameters. OLS is likely to be biased (since the use of the midpoint would only be appropriate if the wage distribution were Uniform rather than Normal) and we should expect the parameters to be less precisely determined because the data is less informative when its is grouped into bands. In practice, when IntReg and OLS are compared, we find the bias is small and the loss in precision is minor.

4.12 Since the CHS wage data is recorded only in intervals we do not present any stylised wage facts from GHS/CHS that would correspond to Figures 1 to 4 for FES/NIFES above.

4.13 However, we can inspect the education distribution in CHS/GHS and Tables 5, 6 and 7 show that this data is broadly comparable with the NIFES/FES data.

*Table 5 Percentage with Education Leaving Ages Exceeding 20
CHS/GHS 1985/6-1993/4, 1995/6*

	Men	Women	Gender Differential
GB	12.1	11.2	0.9
NI	11.2	10.3	0.9
Regional differential	0.9	0.9	

*Table 6 Average Duration of Education (Years)
CHS/GHS 1985/6-1993/4, 1995/6*

	Men Years	Women Years	Gender Differential
GB	12.3	12.5	-0.2
NI	11.9	12.3	-0.4
Regional differential	0.4	0.2	

*Table 7 Percentage with Education Leaving Age > 20 in Northern
Ireland by Religion
CHS/GHS 1985/6-1993/4, 1995/6*

	Protestant	Catholic	Protestant - Catholic Differential
Male	11.2	12.6	-1.4
Female	9.4	11.6	-1.8
Gender differential	0.8	1.0	

5. Econometric Estimates of Education Returns

5.1 A summary of the OLS FES/NIFES results is in Table 8, the CHS/GHS OLS estimates are in Table 9, and the IV estimates are in Table 10. The main methodological deficiency in the analysis is that we do not correct for the bias associated with using samples of individuals with reported wage rates - that is, individuals who are labour market participants. In fact the existing literature does not point to any significant bias is using a selected sample of working individuals alone (see Dearden (1999)). We investigate whether this is also likely to be true in the present data in a later table.

5.2 In Table 8 we find that the OLS return to education is 8% when we pool all the FES data but when we estimate separate returns for men and women we find significantly higher returns for women (at 10%) than men (at 6%). On average we find that women earn 41% less than men in the pooled data regression and that the NI/GB differential is -12.6%. But when we disaggregate the data by sex we find that the regional wage differential is -8% for women and -18% for men. When we estimate separate equations for men in GB and men in NI we find that the returns to education is somewhat higher in NI (7.5%) than in GB (6.3%). Similarly we find that, for women, the return to education is higher in NI (11.7%) than in GB (9.9%). When we look at the NI only we can control for religion (which is not available in the GB data) and we find that the gender differential is similar to the UK differential at approximately -40%. When we control for religion we find that the returns to education are approximately as before (7.6% and 11.8%) and that Catholic men earn 11.1% (9.5+1.6) less than Protestant men, and that Catholic women earn 4.9% (6.2-1.3) less than Protestant women⁷.

5.3 Table 9 records some similar results for the GHS/CHS data. The GHS estimates use OLS and the CHS use interval regression, the pooled UK results use interval regression (where, because the GB wage records wages exactly, we code the upper and lower bounds as both equal to the recorded wage, while the NI data records only the income band that each individual belongs to so we set the upper and lower bounds for each individual as those that correspond to the income band that the individual reports - this allows us to pool the NI and GB data in the same estimations). The same patterns emerge although the estimates of the returns to education for the GB are slightly smaller than the NIFES/FES results. Since all four data sets are independent random samples of the same underlying populations it is not surprising that they yield very similar results. However, differences in definitions caution us against pooling the CHS with NIFES and GHS with FES.

⁷ The omitted category of religion here is "No response". Thus NI Protestant women earn 1.3% less than women who refuse the religion question and NI Catholic women earn 6.2% less than non-respondents. Hence the Protestant/Catholic differential is 4.9% for women, and 11.1% for men.

Table 8 OLS Estimated Returns to Education: FES/NIFES

Sample	N	Educ	NI	Female	Pro	Cath
UK All	57174	0.080	-0.126	-0.411	-	-
UK Women	27419	0.100	-0.079	-	-	-
UK Men	29755	0.064	-0.177	-	-	-
GB Men	27587	0.063	-	-	-	-
NI Men	2168	0.075	-	-	-	-
GB Women	25352	0.099	-	-	-	-
NI Women	2067	0.117	-	-	-	-
NI All	4235	0.094	-	-0.398	-0.000	-0.076
NI Men	2168	0.076	-	-	0.016	-0.095
NI Women	2067	0.118	-	-	-0.013	-0.062

Note: Estimating equations include a quadratic in age, a monthly time trend, and region and gender dummies as appropriate. Bold indicates statistical significance.

Table 9 Returns to Education: Interval Regression on CHS and OLS on GHS

Sample	N	Educ	NI	Female	Protestant	Other/no religion
UK All	73836	0.071	-0.102	-0.371	-	-
UK Women	34804	0.077	-0.111	-	-	-
UK Men	36022	0.059	-0.105	-	-	-
GB All	52949	0.059	-	-0.415	-	-
GB Men	27587	0.054	-	-	-	-
GB Women	25352	0.068	-	-	-	-
NI All	17887	0.111	-	-0.392	-0.021	-0.092
NI Men	8435	0.099	-	-	-0.023	-0.113
NI Women	9452	0.123	-	-	-0.045	-0.054

Note: Estimating equations include a quadratic in age, a monthly time trend, and region and gender dummies as appropriate. Bold indicates statistical significance.

5.4 Estimating the model allowing for the potential endogeneity of education is difficult in the case when the dependent variable is grouped so we use only the FES/NIFES data to investigate this issue.

5.5 The main features of the results are reported in Table 10 and show that: IV returns are consistently higher than OLS; returns for women are higher for men; and the returns in NI are higher than in GB. Other results are stable across methods and indicate a large negative female/male differential and a large negative NI/GB differential. The results are typically well determined (although the NI sample sizes are small). Thus, our IV estimates suggest much higher returns than the OLS results (and the integer regressions), consistent with the GB results in Harmon and Walker (1995, 1999) and much of the non-UK literature (see Card (1999) for a review).

Table 10 *IV Estimated Returns to Education: NIFES/FES*

Sample	N	Educ	NI	Female	Pro	Cath
All	57174	0.147	-0.134	-0.404	-	-
Women	27419	0.219	-0.103	-	-	-
Men	29755	0.102	-0.179	-	-	-
GB Men	27587	0.103	-	-	-	-
NI Men	2168	0.147	-	-	-	-
GB Women	25352	0.194	-	-	-	-
NI Women	2067	0.242	-	-	-	-
NI All	4235	0.162	-	-0.301	0.057	-0.047
NI Men	2168	0.139	-	-	0.062	-0.071
NI Women	2067	0.241	-	-	0.089	-0.014

Note: Estimating equations include a quadratic in age, a monthly time trend, and region and gender dummies as appropriate. The instrument set includes whether the individual smokes, youth wage when 16, dummy variables indicating which minimum school leaving age individuals faced, real student grant level, and the ratio of UK student population to population of 18-21 year olds. Bold indicates statistical significance.

- 5.6 The large returns to education in NI merit closer examination. Thus in Tables 11 and 12 we report on separately estimated equations for those who declare No religion, Catholics and Protestants. The notable feature about these results is that the returns to Protestant women seem a great deal larger than for Catholic women, but the returns for Catholic men are higher than for Protestant men (although not statistically significantly so).
- 5.7 The disaggregated NIFES results in Table 11 continue to suggest that returns in NI are higher than the earlier GB results. The IV results suggest that for Protestant women the return is very high (27% in the IV case). Note that one would have not picked this up in the OLS results where the returns are approximately the same for all groups of NI women (at around 12%). Our analysis cannot tell us why returns for this group are so high but the suggestion is that Protestant women faced the greatest hurdles in attending college - perhaps because there was peer or parental pressure on them to remain in NI (relative to Catholic women or Protestant men) rather than leave for college in GB?
- 5.8 In Table 12 we use the CHS data, where the dependent variable is grouped into ranges and hence requires that we use interval regression methods rather than OLS, and confirm the OLS findings in Table 11 that uses OLS on NIFES: the return (given by the coefficient on education in the regression results) to women is higher than for men, and the return to Catholics is slightly higher than to Protestants. However, this later difference is typically not statistically significant.

Table 11 *Estimated Returns to Education in NI by Religion: NIFES*

Sample	N	Method	Educ	Female	Pro	Cath
All	4235	OLS	0.094	-0.398	-0.00	-0.076
No religion	1003	OLS	0.088	-0.279	-	-
Catholic	1133	OLS	0.103	-0.243	-	-
Protestant	2099	OLS	0.091	-0.335	-	-
All	4235	IV	0.162	-0.301	0.057	-0.047
No religion	1003	IV	0.145	-0.284	-	-
Catholic	1133	IV	0.198	-0.255	-	-
Protestant	2099	IV	0.158	-0.335	-	-
No religion men	522	OLS	0.067	-	-	-
Catholic Men	553	OLS	0.087	-	-	-
Protestant Men	1093	OLS	0.075	-	-	-
No religion men	522	IV	0.113	-	-	-
Catholic Men	553	IV	0.186	-	-	-
Protestant Men	1093	IV	0.142	-	-	-
No religion Women	481	OLS	0.119	-	-	-
Catholic Women	580	OLS	0.122	-	-	-
Protestant Women	1006	OLS	0.113	-	-	-
No religion Women	481	IV	0.166	-	-	-
Protestant Women	1006	IV	0.265	-	-	-
Catholic Women	580	IV	0.094	-	-	-

Note: Estimating equations include a quadratic in age, a monthly time trend, and gender and religion dummies as appropriate. The instrument set includes youth wage when 16, dummy variables indicating which minimum school leaving age individuals faced, real student grant level, and the ratio of UK student population to population of 18-21 year olds. Bold indicates statistical significance.

Table 12 *Estimated Returns to Education in NI by Religion: CHS*

Sample	N	Method	Educ	Female	Pro	Cath
All	17887	IntReg	0.111	-0.389	-0.038	-0.097
Catholic	6511	IntReg	0.112	-0.308	-	-
Protestant	11376	IntReg	0.103	-0.495	-	-
All Men	8435	IntReg	0.099	-	-0.014	-0.135
Catholic Men	2615	IntReg	0.102	-	-	-
Protestant Men	5820	IntReg	0.093	-	-	-
All Women	9452	IntReg	0.123	-	-0.047	-0.059
Catholic Women	3896	IntReg	0.124	-	-	-
Protestant Women	5556	IntReg	0.116	-	-	-

Note: Estimating equations include a quadratic in age, a monthly time trend, and gender and religion dummies as appropriate. Bold indicates statistical significance.

5.9 It might be argued that the recent expansion in HE would have increased the supply of graduates and driven down the rate of return to education. In Figure 8 we present the results derived from estimating a parsimonious model, using the standard least squares method,

containing just education, gender, age and age squared for each year for GB and NI data and for men and women separately to see if the increased supply of graduates has outstripped the demand and forced down the return.

5.10 The estimated returns appear to be surprisingly stable at around the mean values for the pooled samples reported earlier. The earlier results are substantiated with NI returns above GB and female returns above male. The NI returns are more volatile because of the smaller sample sizes and no statistical significance can be attached to any of the year on year changes, for example there is noticeable, but statistically insignificant, dip in 1994 in NI returns.

Figure 8 *Estimated Returns by Year for NI and GB Men and Women NIFES/FES*

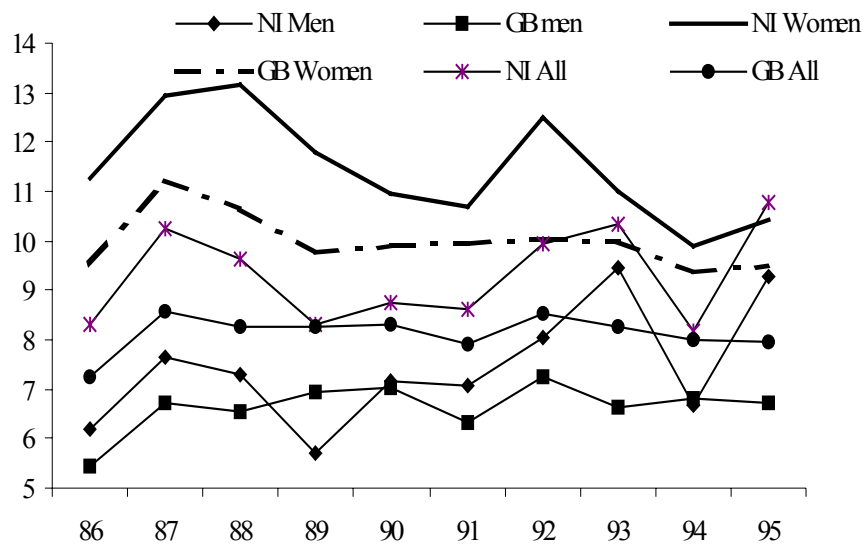
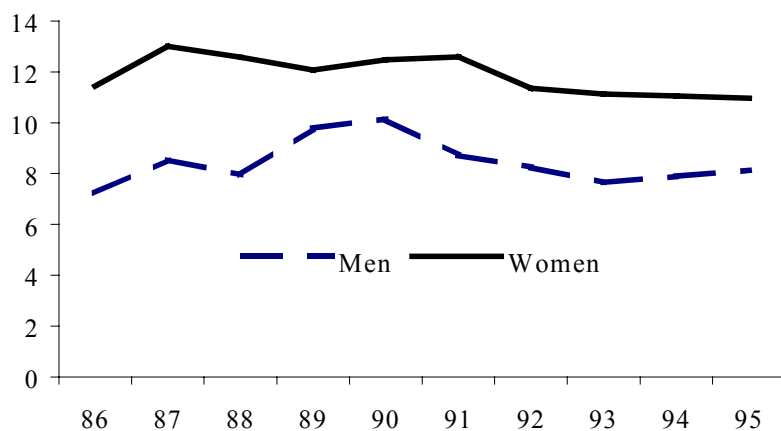


Figure 9 *Estimated Returns by Year for NI Men and Women: CHS only.*



- 5.12 We can investigate the robustness of this result – that the returns are relatively stable over time – by replicating the NIFES analysis with the CHS data. A simple specification that controls for age effects and religion shows that the profile of returns is relatively flat over the period 1986 to 1995. These results are illustrated in Figure 9 above: the return for women averages 12% while that for men averages about 8%. We also find in these results that the Protestant-Catholic differential is relatively stable (at approximately 14% for men and 10% for women as too is the Male-Female differential (at approximately 33%).
- 5.13 The next issue that we wish to address is the extent to which the estimates of returns to education are biased from using a self-selected sample of working individuals. This has typically thought not to be such an issue for men as for women since voluntary non-participation is thought to be much less common for men than women. However, now that participation rates for men and women are much closer than they were this is an issue for both.
- 5.14 The essence of our methodology is to compare OLS estimates with estimates of "median" regressions. Bias in OLS arises because if individuals with low wages tend to predominate amongst non-participants. Thus, using a selected sample of workers is to truncate the bottom of the wage distribution and hence raise the mean of the distribution over what it would otherwise be if no selection took place. Since OLS passes through the mean of the estimating sample it will be affected by the truncation in the data. However, the median of the data is unaffected by the truncation so there should be no bias in median regressions.

Table 13 *Estimated Returns to Education by Gender in NIFES/FES*

	Region	OLS	Median regression
Male	GB	6.73	6.71
Female	GB	9.98	11.23
Male	NI	7.39	8.23
Female	NI	11.52	12.81

Note: Estimating equations include a quadratic in age, marital status, and a monthly time trend. Bold indicates statistical significance.

- 5.15 Table 13 above shows that the parameter estimates for both men and women for OLS and median regression. The results for men show no change suggesting that there is no selection bias from using a sample of workers only. The results for women show slightly higher returns under the median regression method and while statistically significant the differences are small in absolute value. Importantly, our overall conclusions from the earlier analysis seem to be robust: the returns to women are higher than for men and higher in NI than GB.
- 5.16 The next issue that we wish to address is the extent to which the estimates of returns to education reflect not just the productivity enhancing effect of education but an effect on earnings of the underlying ability that education *signals*. This idea stems from work by

Spence (1970). There is a fundamental difficulty in unravelling the extent to which education is a signal of existing productivity as opposed to enhancing productivity: both theories are observationally equivalent – they both suggest that there is a positive correlation between earnings and education, but for very different reasons.

5.17 There are two approaches to finessing this problem. One could attempt to control for ability and see if education still has as strong an effect on earnings – any difference could be attributed to the signalling value of education; or one could look at the education/earnings relationship for the self-employed - where education has no value as signal since individuals know their own productivity and have no need to signal it to themselves by acquiring more education. Thus the difference between the returns to education for employees *vs* the self-employed or between returns that control for ability and those that don't is the value of education as a signal. DfEE's evidence in the Dearing Report referred to this as $(1-\alpha)$ and thought that the observed returns to education ought to be discounted by an α -factor of between 0 and 0.4. However, this was not based on any particular evidence and there is, indeed, precious little evidence available in the literature. Of course, there are difficulties with both approaches and the paucity of the literature is testament to the difficulty of the problem.

5.18 The main problem with the self-employed/employee distinction is that self-employment is not random - individuals with specific (and typically unobservable) characteristics choose to be self-employed). Unfortunately there is no data that records the income of the self-employed available for NI. In Table 14 we use Family Resources and British Household Panel Survey data for GB only. The FRS data does not allow us to correct for the non-random nature of self-employment but the BHPS contains information on whether one's parents were self-employed and on housing equity both of which are likely to be associated with self-employment (but are not likely to be well correlated with wages). The results here suggest quite comparable rates of return and imply that the signalling component is quite small.

5.19 The main problem with the ability controls methods is that the ability measures need to be uncontaminated by the effects of education else they will pick up the productivity enhancing effects of education. However, the ability measures need to indicate ability to make money rather than ability in an IQ sense. It seems unlikely that any ability measure would be able to satisfy both of these requirements exactly and we pursue the issue here with two specialised datasets: the GB National Child Development Survey (NCDS) is a cohort study of all individuals born in GB in a particular week in 1958 whose early development was followed closely and whose subsequent careers have been recorded including earnings; and the International Adult Literacy Survey (IALS) datasets for GB, NI and RoI which record earnings and ability.

5.20 In Table 15 we provide estimates from NCDS, which ought to be a good guide for NI as well as GB, and estimates from IALS data

that control for a variety of ability variables for GB, NI and RoI separately. In NCDS, we use the results of Maths and English ability tests at age 7 as controls and show the estimated rates of returns for men and women separately. We compare these results with using controls at age 11 and at age 16. As we expect, using ability controls at later ages confounds the effects on education on ability scores and the apparent bias appears to be larger. Thus, the results at age 7 are probably an upper bound on the extent to which education is picking up innate ability.

Table 14 BHPS and FRS for GB Only: the Signalling Value of Education

	Employees Return	Self-employed Return	Signalling value Return
FRS - OLS			
Men	0.0786 (0.001)	0.0679 (0.005)	0.0107 (0.007)
Women	0.1082 (0.015)	0.0831 (0.010)	0.0351 (0.030)
BHPS - OLS			
Men	0.0641 (0.002)	0.0514 (0.008)	0.0131 (0.012)
Women	0.1027 (0.002)	0.0763 (0.015)	0.0264 (0.019)
BHPS - Heckman			
Men	0.0691 (0.003)	0.0552 (0.022)	0.0139 (0.025)
Women	0.1032 (0.002)	0.0784 (0.066)	0.0248 (0.070)

Note: Standard errors in parentheses. Estimating equations include a quadratic in age, and a monthly time trend. Bold indicates statistical significance.

Table 15 Estimated Returns to Education by Gender in NCDS and IALS: Ability Controls

		Without ability controls	With ability controls
NCDS - GB	Women	0.107 (0.007)	0.100 (0.008)
Controls at age 7	Men	0.061 (0.006)	0.051 (0.006)
NCDS - GB	Women	0.107 (0.007)	0.081 (0.009)
Controls at age 11	Men	0.061 (0.006)	0.036 (0.007)
NCDS - GB	Women	0.107 (0.007)	0.071 (0.009)
Controls at age 16	Men	0.061 (0.006)	0.026 (0.007)
IALS - GB	Women	0.106 (0.014)	0.077 (0.013)
Current age controls	Men	0.089 (0.009)	0.057 (0.009)
IALS - NI	Women	0.103 (0.012)	0.084 (0.012)
Current age controls	Men	0.062 (0.010)	0.046 (0.010)
IALS - RoI	Women	0.084 (0.015)	0.060 (0.015)
Current age controls	Men	0.082 (0.012)	0.070 (0.013)

Note: Standard errors in parentheses. Estimating equations include a quadratic in age, and a monthly time trend. Ability controls in the NCDS equations are English and Maths test scores in quartiles; while in IALS they are based on standardised tests in numeracy and literacy (prose and document formation). Bold indicates statistical significance.

5.21 Thus, the ability control approach agrees with the method that uses the self-employed: the signalling value of education is rather small - probably of the order of 1% so that the productivity effect is the dominant factor in the education/earnings relationship. The results seem to suggest that α -factor is rather small and certainly at the smaller end of the range that DfEE in Dearing was using.

5.22 A further development of the research into the stability of rates of return over time is to look at the returns to types of degree. GHS and CHS data both allow us to distinguish between degree types but the small numbers on many particular degrees force us to aggregate into Arts, Social Science/Business, Science and Engineering including Maths, and other (mainly vocational subjects such as medicine, law, etc.) We drop the (relatively) small number of individuals with joint degrees.

5.23 The GHS results, in table 16a, show significantly rising returns to Arts/Humanities and Science/Engineering for women, and rising returns to Science and Engineering for men during the 1980's. Note that these estimates are **relative to A levels**. The results do suggest that (except for Social Science/Business) the returns have dropped a little in the 1990's. The higher returns in science/engineering and social/business relative to arts/humanities may suggest that there are too few of the former relative to the latter. Note that these are private returns since they reflect only the opportunity costs of the time spent studying not the tuition costs, which are larger for science and engineering.

5.24 The CHS data is too small to reliably disaggregate by year but the average returns, in Table 16b, over the pooled data from 1985/86 to 95/6 (excluding 1994/5). All observations have a degree and the omitted category here is Arts degree. Although the level of subject aggregation is, of necessity, quite high, and the precision of the estimates are low, taken at face value the results suggests that there is no shortage of NI capacity in any particular subject area except for Engineering where the returns to men is a large and significant 21% higher than for an Arts degree.

Table 16a Returns to Degrees (Relative to A Levels): GHS (GB)

	80/82	84/86	89/91	93/95
Men				
Arts/Human	0.021 (0.032)	0.043 (0.035)	0.019 (0.036)	0.049 (0.045)
Science/Eng	0.120 (0.023)	0.176 (0.024)	0.243 (0.023)	0.177 (0.027)
SocSci/Business	0.166 (0.026)	0.197 (0.026)	0.248 (0.026)	0.221 (0.031)
Other	0.223 (0.031)	0.252 (0.031)	0.263 (0.035)	0.165 (0.040)
Women				
Arts/Human	0.109 (0.037)	0.192 (0.036)	0.193 (0.034)	0.267 (0.049)
Science/Eng	0.243 (0.048)	0.314 (0.043)	0.319 (0.034)	0.366 (0.042)
SocSci/Business	0.223 (0.041)	0.220 (0.037)	0.263 (0.030)	0.203 (0.039)
Other	0.278 (0.041)	0.343 (0.037)	0.234 (0.036)	0.202 (0.044)

Note: Standard errors in parentheses. Samples contain only individuals with at least A-levels as highest qualification. Bold indicates statistical significance

Table 16b Returns to Qualifications: CHS (NI)

	Men		Women	
Science	0.131	(0.078)	0.011	(0.079)
Engineering	0.212	(0.081)	-0.021	(0.082)
SocSci/Business	0.163	(0.077)	-0.011	(0.071)
Other	0.082	(0.070)	0.065	(0.066)

Note: Standard errors in parentheses. Samples contain all individuals with degrees. Omitted category is Arts degree. Bold indicates statistical significance

- 5.25 A further disaggregation that is of interest is the distinction between HE and Further Education (FE). In Table 17 we estimate wage equations for NI and GB separately for men and women and estimate the effect of education level, including the higher vocational training that is usually associated with Further Education. The breakdown of the NI sample for 1986 to 1995 (except 1994) are as follows: university degree 5.6%, teaching qualification 1.6%, higher vocational 1.3%, Nursing 2.5%, A level 4.6%, GCSE 12.6%, apprentice 4.2%, and 9.3% with commercial vocational. The remainder are none or CSE only. Note that this is a stock sample and this distribution will differ from the current flow proportions.
- 5.26 The return to CSEs (relative to no qualifications) and GCSE's (relative to no qualifications) is much larger than in GB for both men and women. The returns to moving from GCSE to A Level are also different between NI (about 16%) and GB (about 11%). For women the marginal return to moving from A Level to Degree is large but not significantly different between GB and NI at around 40% in each. In contrast the marginal return to moving from A Level to Degree for men is significantly larger in GB (28%) than NI (17%).
- 5.27 The returns to vocational qualifications also broadly similar between NI and GB with the exception of teaching, higher vocational and commercial qualifications, where the returns in NI are all higher for men than in GB relative to no qualification. For women teaching is the only area with a significant premium for NI.
- 5.28 While there is variation in the returns to different qualifications over time these differences between years are not statistically significant. Moreover, the important difference noted above, the premium of degree over A-level is stable.
- 5.29 As a general rule it is inappropriate to include as regressors choice variables that are themselves correlated with education choices. In particular, including occupational variables as regressors will certainly result in the coefficient on educational variables being reduced since it would pick up the effect of education on wages *within an occupation* and would not pick up the effect of education on occupational achievement. However, there is a distinctive difference between the proportions of public sector jobs in NI compared to GB and there may be a case for controlling for sector of employment.
- 5.30 The difficulty here is that, unlike race, sector of work is unlikely to be randomly assigned. In particular, there may be a correlation between the fixed effect in wages and sector of work. For

example, risk averse individuals may be more likely to choose the public sector and are also likely to have lower wages. This is particularly acute when one bears in mind that certain occupations are associated with certain sectors almost exclusively: medics and teachers are almost invariably public sector workers. Thus, even ignoring the endogeneity of sector, it is difficult to disentangle sector effects from occupational ones. A second difficulty is that neither GHS/CHS nor FES/NIFES make a distinction between public and private sector employment explicitly in the data.

Table 17 Returns to Qualifications: GHS and CHS

	Male		Female	
	CHS-NI	GHS-GB	CHS-NI	GHS-GB
CSE	0.245 (0.019)	0.082 (0.134)	0.167 (0.018)	0.097 (0.019)
GCSE Level	0.332 (0.015)	0.219 (0.010)	0.278 (0.015)	0.235 (0.019)
A Level	0.492 (0.020)	0.323 (0.043)	0.435 (0.020)	0.366 (0.016)
Degree	0.662 (0.015)	0.598 (0.012)	0.860 (0.018)	0.770 (0.014)
Apprentice	0.109 (0.017)	0.093 (0.013)	0.047 (0.062)	-0.050 (0.028)
Commercial	0.240 (0.156)	0.111 (0.059)	0.176 (0.015)	0.160 (0.011)
Higher Vocational	0.574 (0.030)	0.413 (0.011)	0.554 (0.037)	0.591 (0.023)
Nursing	0.338 (0.015)	0.296 (0.042)	0.587 (0.017)	0.548 (0.016)
Teaching	0.687 (0.040)	0.429 (0.027)	0.947 (0.021)	0.760 (0.020)
R ²	0.43	0.39	0.37	0.41
Sample size	8435	18746	9452	17924

Note: All equations include a set of year dummies, dummies for commercial qualification, foreign qualification, nursing and apprentice, a quadratic in age, and region dummies (just East and West in the case of NI, standard regions in the case of GB). Omitted category is A level qualification, 1992 for GB and 91 for NI, and West Midland for the GB data and Belfast for the NI data. Figures in parentheses are standard errors. Bold indicates statistical significance

5.30 Thus, here we use BHPS GB data, where sector is explicitly recorded, and simply enter sector into a least squares model. The extent to which this is informative is unclear, and we include sector here for comparability with other studies and to see if it could be responsible for the large NI - GB differences we find in our estimates. The results in Table 18 suggest: a 9% public sector wage differential for men and a 21% one for women; but no difference in returns to education for women and just 1% lower for men in the public sector.

5.31 A further topic of interest is the implications of the results for the net returns to education. That is, net of taxes and income tested welfare transfer payments. In Figure 10 we plot the **marginal** returns net of taxes and transfers from estimates of the relationship between

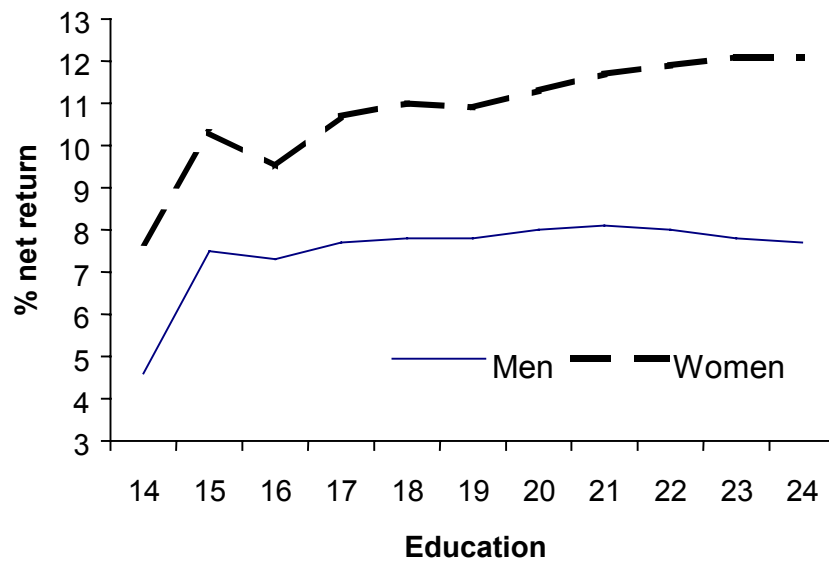
education, wages rates, labour force participation and hours of work estimated on FRS GB data (FRS is a better vehicle for this kind of analysis because of its large size and detailed information on welfare payments - there seems little reason to imagine that the message would not apply to NI. Indeed, it might have particular relevance for NI given the lower incomes in the Province).

Table 18 BHPS: the Returns to Education in the Public and Private Sectors

	Men	Women
Public/Private wage differential	0.090 (0.003)	0.209 (0.010)
Public Sector Return	0.065 (0.003)	0.093 (0.003)
Private - Public Return	-0.011 (0.004)	-0.0008 (0.004)
Sample sizes	8284	8987

Note: Figures in parentheses are robust standard errors. The models include year dummies, marital status, the number of children in three age ranges, region dummies, and regional unemployment rates. Bold indicates statistical significance

Figure 10 FRS: Net Returns to Education.



5.32 The notable feature of the figure is the low NET returns from education for those that leave at low ages even though the underlying gross returns in the figure are constant. That is the figure shows that the return to each **additional** year of schooling is approximately constant for school leavers after 16. This suggests that *educational maintenance allowances* may be effective in encouraging individuals who would have otherwise have left school at the earliest opportunity. Such individuals are more likely to come from lower income households than other children and hence there is a good case for making such allowances means tested against parental income.

5.33 Note that the corollary of the low net returns to some individuals is that there is a corresponding larger return to the

government from promoting later school leaving. In other words, the difference between the net of tax/benefits return in Figure 10 and the estimated gross returns (of 8.7% for men and 9.1% for women using a simple OLS model on the FRS data) is the return to the government in the form of reduced benefit expenditure and additional tax revenue. Thus, educational maintenance allowances, with means testing, may not turn out to be an expensive option for government since they can recoup some of the expenditure on these allowances in the form of high revenues or reduced expenditures.

Table 19 ISSP Data OLS Estimates: Various Years

	Male		Female	
Australia	0.0509	<i>0.0042</i>	0.0568	<i>0.0071</i>
West Germany	0.0353	<i>0.0020</i>	0.0441	<i>0.0036</i>
Great Britain	0.1299	<i>0.0057</i>	0.1466	<i>0.0069</i>
USA	0.0783	<i>0.0045</i>	0.0979	<i>0.0058</i>
Austria	0.0364	<i>0.0033</i>	0.0621	<i>0.0049</i>
Italy	0.0398	<i>0.0025</i>	0.0568	<i>0.0036</i>
Hungary	0.0699	<i>0.0053</i>	0.0716	<i>0.0051</i>
Switzerland	0.0427	<i>0.0065</i>	0.0523	<i>0.0143</i>
Poland	0.0737	<i>0.0044</i>	0.1025	<i>0.0046</i>
Netherlands	0.0331	<i>0.0025</i>	0.0181	<i>0.0050</i>
Rep of Ireland	0.1023	<i>0.0051</i>	0.1164	<i>0.0081</i>
Israel	0.0603	<i>0.0069</i>	0.0694	<i>0.0077</i>
Norway	0.0229	<i>0.0025</i>	0.0265	<i>0.0032</i>
N Ireland	0.1766	<i>0.0111</i>	0.1681	<i>0.0127</i>
East Germany	0.0265	<i>0.0032</i>	0.0450	<i>0.0041</i>
Philippines	0.1194	<i>0.0197</i>	0.2086	<i>0.0330</i>
New Zealand	0.0424	<i>0.0050</i>	0.0375	<i>0.0058</i>
Russia	0.0421	<i>0.0042</i>	0.0555	<i>0.0043</i>
Slovenia	0.0892	<i>0.0104</i>	0.1121	<i>0.0091</i>
Sweden	0.0367	<i>0.0047</i>	0.0416	<i>0.0047</i>
Bulgaria	0.0495	<i>0.0100</i>	0.0624	<i>0.0091</i>
Canada	0.0367	<i>0.0072</i>	0.0498	<i>0.0083</i>
Czech Rep	0.0291	<i>0.0069</i>	0.0454	<i>0.0077</i>
Japan	0.0746	<i>0.0066</i>	0.0917	<i>0.0151</i>
Spain	0.0518	<i>0.0071</i>	0.0468	<i>0.0099</i>
Latvia	0.0363	<i>0.0136</i>	0.0482	<i>0.0113</i>
Slovakia	0.0496	<i>0.0070</i>	0.0635	<i>0.0078</i>

Note: Figures in italics are standard errors. Bold indicates statistical significance.

5.34 In addition to accounting for the tax and social security system on returns we can also calculate the effects of tuition fees. Assuming fees for a degree of £1000 p.a. for three years, and that the fees have no affect on the gross wages paid in the labour market, we compute that a gross return of 10% would, after fees, be a net return of 9.6%. Thus, fees do decrease returns but are sufficiently modest to have no effect on our overall conclusions.

5.35 Finally we look briefly at evidence from other countries to substantiate our GB/NI/RoI estimates and to demonstrate that there is nothing inherent in the methodology that generates large returns. Table 19 gives results for several other countries where we apply exactly the

same estimation methods to data that has been constructed to be closely comparable across countries. The results show that GB/Ni/RoI do indeed have large returns relative to international standards - perhaps indicating the higher levels of skill elsewhere. Note that the Northern Ireland estimates have higher standard errors than typically the case because the sample sizes are quite small⁸.

6. Conclusions from Estimated Returns to Education in Section 5

6.1 The statistical work shows that:

- The return to education in NI is high and higher than in GB - conventional statistical analysis of the GB data suggests a return of 6% for men and 10% for women, while the NI data suggests higher figures of around 8% for men and 12% for women. These are dramatic differences that are statistically significant which suggest that NI born individuals find post compulsory education more expensive or difficult to acquire holding everything else constant. These estimates support the case for encouraging and facilitating higher levels of education participation in NI which could be based on straightforward financial criteria.
- Indeed, when looked at in detail by qualification we found the largest differences in returns between GB and NI to be the return to GCSE relative to no qualification – the differences in the marginal returns to qualifications beyond this were not significantly different between GB and NI. The policy implications of this are that attention should be given to encouraging higher levels of age participation in NI, and those in the workforce with no or lower levels of qualifications should be encouraged to acquire additional education.
- The estimates using more sophisticated methods that control for the fact that high levels of education may be chosen by individuals of a specific type (say the able, or motivated) suggests even higher rates of return. However the general pattern that returns are higher in NI than GB remains. For example, typical results suggest return of 15% for NI men compared to 10% for GB men, and 24% for NI women compared to 19% for GB women. These estimates are consistent with the earlier literature and support the case for greater NI post-compulsory education capacity. The high rates of return in both GB and NI suggest that any additional education capacity in NI should not be at the expense of that in GB.
- Within NI, the return to education seems to be higher for Catholic relative to Protestant men, and for Catholic women relative to Protestant women. However these differences are small (in the case

⁸ ISSP data has been underused in the economics literature so it is difficult to comment on the robustness of these results to additional testing.

of OLS) and are not statistically significant (in both OLS and IV results) and these disaggregated results would need to be borne out with larger datasets before it could be concluded that there is a significant difference between the returns to education for Catholics and Protestants.

- The higher age participation rates found in NI are consistent with the idea that there is a correlation between active participation in religion and investment in human capital: both require a low “discount rate” since both imply that individuals are prepared to make current sacrifices for future gains. This makes the above results all the more surprising: we would expect that individuals with low discount rates to invest in more human capital and for this to drive down the rate of return until it equalled the individual’s discount rate. Thus, the failure for this to happen in NI strengthens our view that there are significant market failures that prevent individuals who wish to invest in additional human capital, say through higher education. This might be of the form of higher costs, financial or otherwise, for NI residents to participate in HE and is consistent with the lower level of capacity in NI relative to demand than in GB.
- The data suggests that there has been no decrease in the returns to education over time. Thus, there does not seem to be any ground for believing that the increase in the supply of graduates has depressed the return to education. Indeed the evidence suggests that the increase in the demand for graduates has only just kept pace with the large increase in supply so keeping the return approximately constant over time and considerably above the Treasury Discount Rate.
- There is some evidence that the returns *to a degree* for women have risen over the 1980's and for science and engineering for men. The data also suggests that returns to a degree may have fallen back a little in the 1990's except for social science/business degrees.
- Our enquiry into the extent to which the returns represent the effect of education on productivity via the accumulation of human capital suggests that most of the returns are due to this effect and relatively little to signalling of innate productivity.
- The results seem to be robust not only over time but also robust to selection bias. We find that the estimated returns are very similar when using median regression methods that are thought to be robust to selection bias problems.
- Those findings, which could be replicated with other datasets, were found to be consistent with our main results. Thus we find similar results for our basic model with CHS/GHS as with FES/NIFES and more specialised work on other data (ISSP, IALS, etc) tell very similar stories.

- While all of our evidence pre-dates the imposition of tuition fees it is possible to compute the effect of raising the costs of a degree by £3000 (through imposing fees) on the returns. We find the fees effect to be small – small enough for it to make no impact to our overall conclusions.

Education, Migration and Labour Market Returns

7. Background

7.1 A high level of mobility implies that returns ought to equalise across areas – if returns to education are higher in one area than another then we would expect educated workers, at the margin, to move from the low return area to the high return area. In the absence of any significant deterrence to mobility we should observe rates of return converging across regions.

7.2 Figure 11 shows the variation in returns to education, estimated by OLS, and there is a clear non-degenerate distribution of returns especially for women. NI is notable for having the highest return on education of all regions for both men and women. Thus returns are not being equalised, especially for women. This suggests that there are significant barriers to moving between North and South in the GB and, perhaps, between GB and NI. The smoother distribution for women suggests that their earnings may often be regarded as “secondary” – with wives being “tied stayers” or “tied movers”.

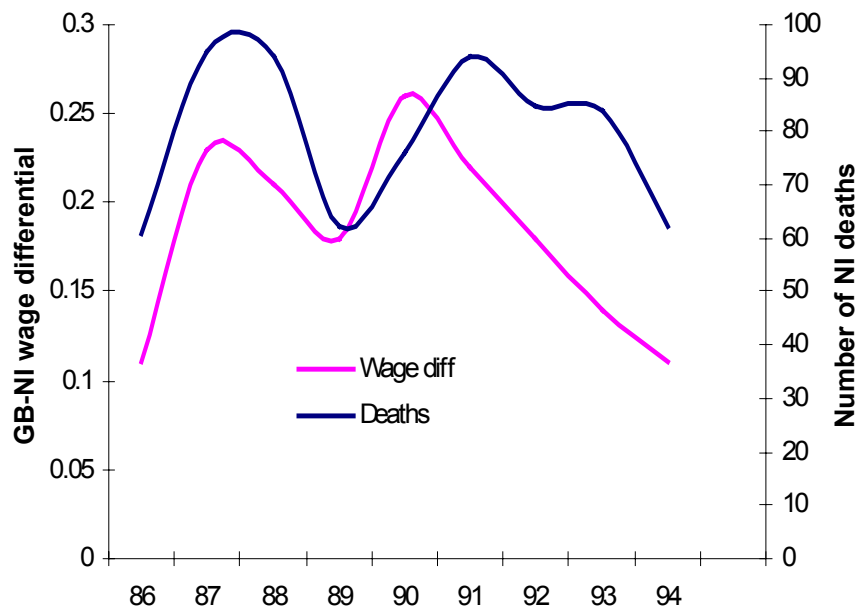
Figure 11 Returns to Education by Region and Gender: NIFES/FES



7.3 Note that the comments above do not deny that there may be compensating differentials associated with locating in an individual region. There are, indeed, quite marked differences in the levels of average wages across regions. However, these compensating differentials imply nothing for differences in rates of return. Rather these differences in rates of return are generated by disequilibria across regions in demand and supply of workers with different levels of education. Thus, NI has an excess supply of low educated workers and a excess demand for high educated relative to other areas, such as Greater London for example. In the absence of an inflow of educated workers, this forces down wages for those with low education and forces up wages for those with high education.

7.4 However the idea that wages vary to reflect the security situation seems tenable in our data. We find, in Figure 12, that while the wage differential between GB and NI averages about 15% real wages *fall* in NI relative to GB when the security-related death rate⁹ falls, which is what would be implied by the theory of compensating differentials.

Figure 12 GB-NI Wage Differentials: Men in NIFES/FES.



7.5 However, while average wages may reflect the security problem in NI it may also affect the relationship between wages and education in NI relative to that in GB. That is the effect of human

⁹ Data are “Number of deaths due to security situation” from the Northern Ireland Office website.

capital acquisition on productivity may be compounded by the reluctance of graduates to stay in NI, move back to NI after education in GB, or move to NI. Thus, there is the possibility that the observed relationship in cross section data may lead the return to education to be biased (upwards in this explanation).

7.6 The fact that educational returns are not equalised again suggests that there are some significant costs, psychic or otherwise, associated with mobility. Moreover the correlation between the NI terrorist activity and the GB/NI differential suggests that there would be a "peace dividend" in terms of lower earnings.

7.7 Thus, in the next sections we examine the relationship between migration and wages.

7a HENI Data

7.8 The conventional pooled cross section data used above is not well suited to addressing the extent to which there may be a bias induced in estimates of the returns to education by region when region is potentially endogenous because the data does not record region where education took place. At best (with GHS/CHS) the data records region of birth as well as current region of residence (NI in the case of CHS, GB in the case of GHS). Thus, the data that we rely on for much of our analysis of migration is the Higher Education Northern Ireland (HENI) cohort studies from which we extract 3435 individuals (1761 men, 1674 women) who have complete information on the relevant variables. Cormack *et al.* (1994) provides some analysis and description of this data. The most notable feature of the data is that it is made up entirely on NI born graduates and hence is quite different from NIFES or CHS so that it would be inappropriate to compare the samples directly.

7.9 The raw data in Table 20 suggests very large regional differentials between GB and NI annual earnings both for those who received their HE in GB and those that remained in NI for their HE. The differences in earnings according to place of HE are smaller but still sizeable: of those that work in NI those that received their HE in GB earn almost 14% more than those who were educated in NI.

Table 20 Annual Gross Earnings (£) of NI Born Graduates

	HE in NI	HE in GB	GB-NI differential %
Working in GB	15,852	16,649	5.03
Working in NI	11,036	12,531	13.55
GB-NI differential%	43.64	32.86	

7.10 Table 20 records just the means of the data yet individuals who chose to work in GB after education in NI are a selected sample

and we might expect that they earn more than they would otherwise do had they remained in NI. Comparing, for the 1979 cohort only, Figures 13a and 13b we see that the left tail of the earnings distribution in Figure 13b is thinner than in Figure 13a.

7.11 The raw HENI data, for example for the two HENI cohorts pooled together, in Figure 14 suggests that the probability of studying in GB rather than NI is slightly higher for women than men and somewhat higher for Protestants than Catholics.

7.12 Figure 15, for the pooled cohorts, suggests that the probability of returning to NI, conditional on having studied in GB, is larger for women than men and for RC than Protestant.

Figure 13a Working in NI and Educated in NI: HENI 1979 only

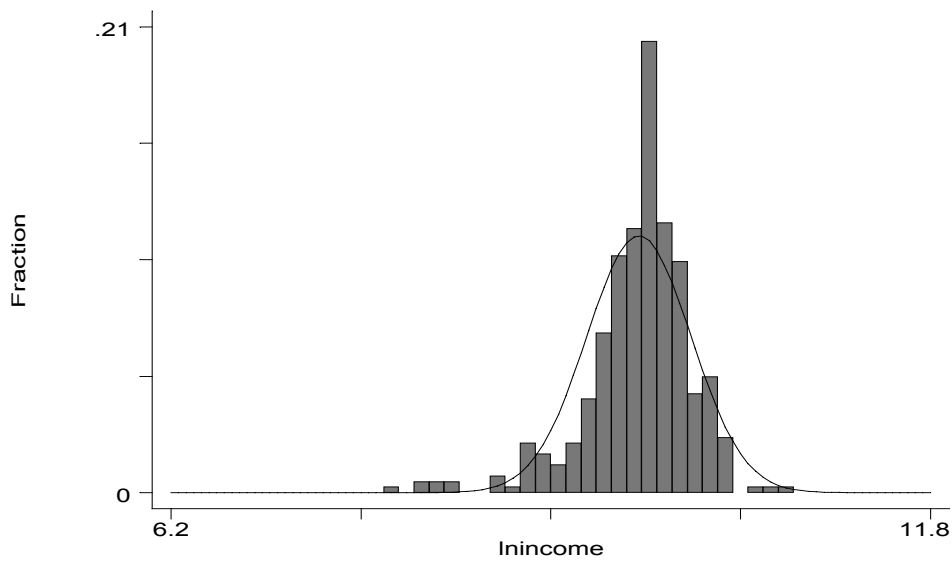


Figure 13b Working in GB, Educated in NI: HENI 1979 only

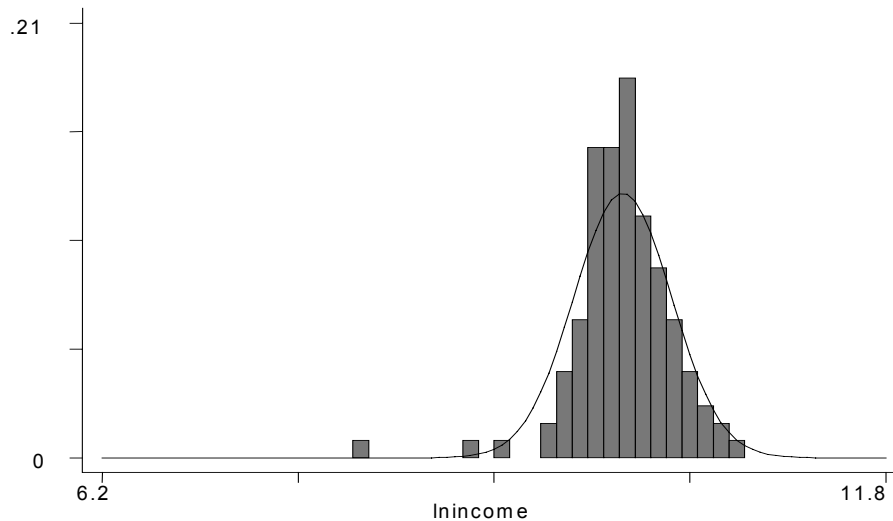


Figure 14 *Place of HE by Religion and Gender: HENI 1979 and 1985*

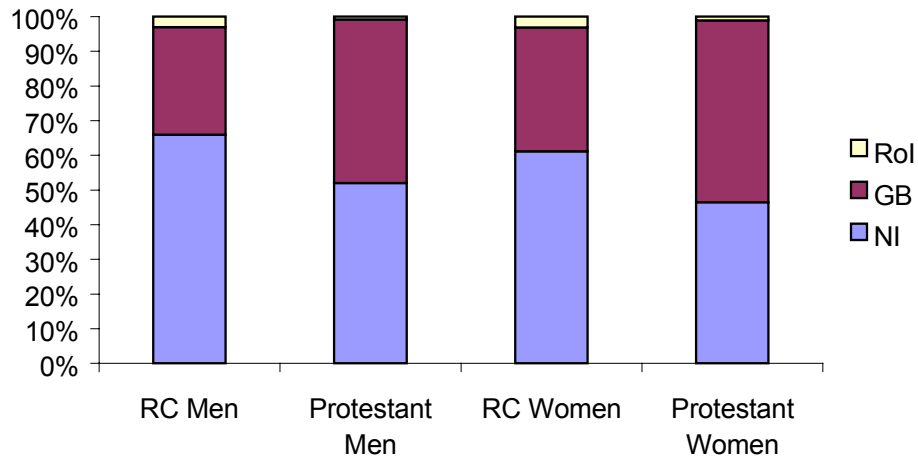
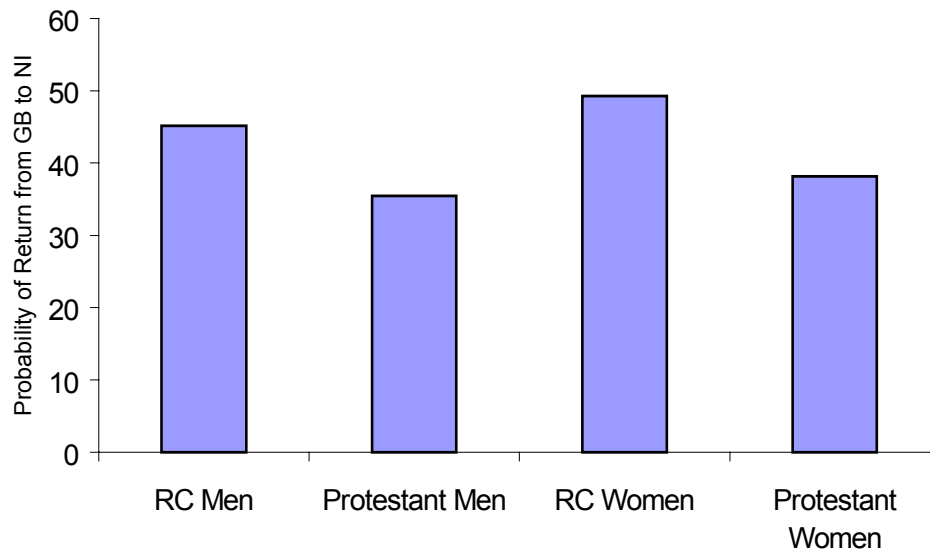


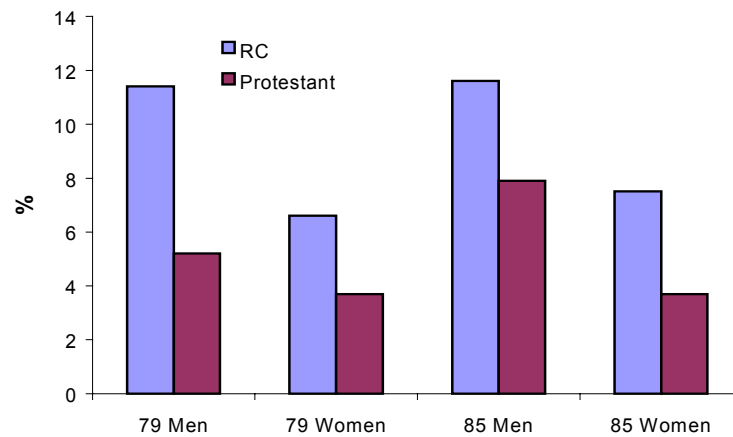
Figure 15 *Probability of Return to NI after Education in GB by Religion and Gender: HENI 1979 and 1985*



7.13 The proportion studying in GB is the same for both cohorts irrespective of religion. The proportions returning to NI after education in GB is identical across cohorts even though the '79 cohort has had an additional 6 years to return - this suggests that individuals return to NI, if they are going to, quite soon after graduation in GB.

7.14 Non-graduation (drop-out) rates are given in Figure 16, which shows a much higher rate for men than women and much higher rate for RC relative to Protestant. This may partly reflect the lower ability levels of Catholics in HE relative to the ability of Protestants. However, this does not explain the deterioration in the rate for Protestants between 1985 and 1991.

Figure 16 *Non-graduation Probability by Gender and Religion:
HENI 1979 and 1985*



7.15 The A-level scores of Catholics and Protestants appear to have converged somewhat with Protestant scores declining and Catholic scores rising (but note that this is among a selected sample and this may not be a reflection of overall scores) as shown in Table 21. Note that Table 21 is for all observations in the dataset including dropouts.

7.16 The A-level scores differ systematically between Protestants and Catholics and between those that graduate in GB and those that graduate in NI as shown in Table 22. The table suggests that it is the more able Protestants that leave for GB.

7.17 Table 23 shows how this breaks down by subject studied. Since medicine demands the top grades wherever it is studied the difference only manifests itself in other subjects - the gap is smallest for Social Science and Business subjects.

Table 21 *A Level Scores: by Cohort and Religion*

	Catholic	Protestant
85 cohort	15.9	18.4
91 cohort	16.7	17.4

Table 22 *A Level Scores: by Place of HE and Religion*

	Catholic	Protestant
GB graduate	16.8	20.4
NI graduate	16.5	17.3

Table 23 A Level Scores: by Place of HE and Subject

	GB graduate	NI graduate
Medicine	22.9	23.1
Science	20.8	16.6
Engineering	18.5	15.7
Soc Sci/Business	17.7	16.5
Arts/Human	18.8	15.7
All	19.3	16.9

7.18 The score of 16.9 for NI graduates in the table is little different when broken down by whether individuals now live in GB or not. Thus, of the NI educated the more able are just as likely to leave as the less able. However, the score of 19.3 for GB graduates breaks down into 17.9 for the ones that return to NI and 20.0 for those that remain to take up work in GB. This difference is particularly large for medical students and social scientists (where the City of London may be particularly attractive to the most able).

7.19 Thus, it appears that *the most able Protestants choose to study in GB and the best of those choose to remain in GB.*

7.20 There are large differences in the A level scores for drop-outs and graduates as shown in Table 24 which breaks down the results in table 10 for the 1985 cohort. Protestant graduates have A level scores that exceed Protestant dropouts by approximately 48% which is much smaller than for Catholic men (78%) and for women (approximately 70% on average). Protestant men in HE have higher ability than other groups in HE and the dropout rate is lower than for Catholic men. Protestant male dropouts are more able than dropouts for other groups. It is unclear why this is happening but it could be that Protestant men take more demanding courses, say medicine, and the dropouts are therefore of higher quality than dropouts from less demanding courses.

Table 24 A level scores of Graduates/Dropouts: HENI 85

	Male	Female	All
Protestant	18.4/13.3	19.0/11.0	18.7/12.6
Catholic	16.4/9.2	16.8/10.3	16.6/9.6
All	17.5/11.0	18.1/10.6	

7.21 The effect of degree class, gender, labour market experience and marital status on (the log of) earnings is given in Table 25. The coefficients reported show the *proportionate* effect of those characteristics. Thus, a figure of 0.1 implies that that characteristic is associated with a 10% higher level of earnings. Bold figures indicate that the effect is statistically significantly different from zero.

7.22 The constant term shows the predicted log earnings for the default individuals (single male, who lives in GB, is Protestant and obtained a 1st class degree). The other coefficients show departures

from this default individual. Thus a lower-class of degree leads to lower earnings in NI (but not significantly so in GB); the "general" category is largely dominated by medicine and other unclassified professional qualifications which is significantly positive in NI; women get paid less than men; there is a large wage premium associated with living in GB; and there is a small effect of A level score.

7.23 These results suggest that, controlling for the other variables: living in GB (but not RoI) as opposed to NI carries a large positive premium (about 26%); men earn more than women (a differential of 11% for those HE in GB, and 8% for those HE in NI); and being Protestant seems to be unimportant for the earnings of graduates.

Table 25 *The Impact of Characteristics on Log Earnings: HENI 1985*

	HE in GB All	HE in GB Men	HE in GB Women	HE in NI All	HE in NI Men	HE in NI Women
Constant term	9.303 (0.079)	9.330 (0.112)	9.112 (0.101)	9.436 (0.052)	9.382 (0.069)	9.429 (0.082)
A score	0.006 (0.002)	0.004 (0.003)	0.011 (0.003)	0.0035 (0.001)	0.005 (0.002)	0.003 (0.002)
Live in GB	0.250 (0.033)	0.253 (0.047)	0.235 (0.043)	0.269 (0.025)	0.271 (0.038)	0.263 (0.034)
Live in RoI	0.012 (0.133)	0.087 (0.210)	0.008 (0.159)	0.139 (0.106)	0.248 (0.158)	0.059 (0.141)
Catholic	0.019 (0.033)	0.034 (0.048)	0.007 (0.043)	0.021 (0.021)	0.028 (0.033)	0.010 (0.029)
Not RC or Protestant	-0.047 (0.106)	-0.033 (0.159)	-0.045 (0.129)	-0.165 (0.097)	-0.190 (0.146)	-0.158 (0.129)
Upper 2 nd	0.026 (0.061)	-0.059 (0.088)	0.129 (0.079)	-0.143 (0.043)	-0.124 (0.059)	-0.178 (0.066)
Lower 2 nd	-0.029 (0.063)	-0.137 (0.090)	0.041 (0.080)	-0.180 (0.043)	-0.157 (0.059)	-0.218 (0.067)
3 rd class	-0.047 (0.095)	-0.210 (0.158)	0.093 (0.111)	-0.236 (0.072)	-0.192 (0.105)	-0.289 (0.102)
General grade	0.096 (0.076)	0.044 (0.111)	0.161 (0.095)	0.123 (0.054)	0.154 (0.075)	0.067 (0.082)
Ordinary grade	0.069 (0.081)	-0.057 (0.118)	0.155 (0.103)	0.014 (0.057)	0.053 (0.075)	-0.030 (0.092)
Married	0.014 (0.035)	0.040 (0.048)	0.028 (0.048)	0.061 (0.025)	0.115 (0.039)	0.013 (0.032)
Female	-0.105 (0.029)	-	-	-0.074 (0.021)	-	-

Note: Figures in parentheses are standard errors. Bold figures are significant.

7.24 There are differences between NI and GB (apart from the effects of current residential location) - note, in particular that the constant terms differ by place of HE for both sexes. This implies that after controlling for ability via the A level score, the wages are higher for NI graduates than GB graduates - by a significant 31% for women and an insignificant 5% for men. The implication is that (at least for

women) NI HE institutions generate more value added than GB institutions.

7.25 The implication is that (at least for women) NI HE institutions generate more value added than GB institutions

7.26 Finally, in this section, we attempt to put together what we have gleaned from our description of migration with our knowledge of the determinants of wages to model these phenomena jointly.

7.27 Our initial analysis of the HENI 1985 cohort is reported in Table 26a. Here we are interested in distinguishing between where HE was undertaken and where the individual now lives. We use the 85 cohort of HENI since we need to use A level scores to control for initial ability. Wages in the model are determined by A level score, gender, marital status, degree class and religion. Note however that no correction for the potential effect of non-randomness in the migration decision is made.

Table 26a *Wages by Education Location and Residence: HENI 85*

	Graduate from GB, Live NI	Graduate from GB, Live GB	Graduate from NI, Live NI	Graduate from NI, Live GB
Constant	8.506 (0.285)	9.359 (0.477)	8.980 (0.103)	9.828 (0.336)
Catholic	0.003 (0.048)	0.017 (0.038)	0.004 (0.025)	0.031 (0.038)
Other Religion	0.310 (0.254)	-0.047 (0.112)	-0.126 (0.106)	-0.279 (0.225)
Married	-0.028 (0.054)	0.022 (0.040)	0.050 (0.028)	0.037 (0.046)
Part-Time	-0.630 (0.145)	-1.096 (0.118)	-0.640 (0.064)	-1.303 (0.149)
Age	0.026 (0.010)	0.006 (0.019)	0.009 (0.003)	-0.009 (0.013)
Female	-0.067 (0.048)	-0.129 (0.034)	-0.071 (0.025)	-0.087 (0.038)
A-Level Score	0.006 (0.003)	0.006 (0.002)	0.007 (0.002)	-0.001 (0.003)
Grade – 2(i)	0.162 (0.064)	0.079 (0.056)	0.006 (0.037)	0.051 (0.058)
Grade – 2(ii)	0.039 (0.060)	0.031 (0.056)	-0.040 (0.036)	0.002 (0.056)
Grade – Third Class	0.196 (0.161)	-0.017 (0.098)	-0.084 (0.077)	-0.023 (0.121)
Grade General	0.207 (0.088)	0.144 (0.083)	0.303 (0.053)	0.130 (0.093)
Grade Ordinary	0.287 (0.112)	0.085 (0.087)	0.220 (0.057)	0.020 (0.090)

Note: Figures in parentheses are standard errors. Bold figures are significant.

- 7.27 The results from before remain largely unchanged and still suggest that the NI institutions generate a large value-added effect for their graduates. Having controlled for other covariates, the constant terms between GB residents indicate a difference of some 47% in favour of the NI graduates. For NI residents the difference is again around 47% in favour of the NI educated group.
- 7.28 A further point suggested from Table 26a is the lack of any obvious religious penalty. However it is possible that the groups represented here are not a random grouping of the population, particularly in the context of the NI system where, as seen for example in Figure 14, evidence exists on issues such as the higher propensity of Protestant youths to migrate for their higher education.
- 7.29 In order to examine the extent to which migrants, whether for education or living (or both), are a non-random grouping of the population generally we adopt a relatively simple model, reported in Table 26b. The framework (a bivariate probit) jointly models the probability of studying in GB and the probability of being a resident in NI, as functions of: whether one's father was self-employed (since you might be more likely to study in NI and more likely to return to the family firm if you do study in GB) and the interaction between Protestant and ability (since our tabulations suggested that more able Protestants were more likely to leave and more likely not to return). We also allow the specific school district (Education and Library Board) to have an effect on the decision to pursue education outside of NI. Finally we control for whether the graduate came from a school district where there was a Protestant minority. From this a selection correction of the type proposed by Heckman is proposed. Statistical significance (at the 95% level) is indicated in bold.
- 7.30 The first two columns of results refer to the probability of being a GB graduate and the probability of being a NI resident. The ρ value at the bottom of these columns is a measure of the extent to which the two outcomes (the probability of studying in GB, and the probability of returning to live in NI) are correlated and that, unsurprisingly, the correlation is negative and highly significant. That is, unobservable factors that are positively correlated with studying in GB are negatively correlated with returning to NI.
- 7.31 Observable characteristics have similar effects. As our earlier tabulations suggested, Protestants (who dominate the "other religion" group in Table 26b) are significantly more likely to be graduates of a GB institution and significantly less likely to return to NI. Moreover, higher ability Protestants (indicated here by the interacted variable "Protestant * A-level score") are more likely to study in GB. Similarly those Protestants originally from areas where they are the minority grouping are also more likely to have left NI for their higher education. Those with children when sampled in 1991 are more likely to be resident in NI perhaps reflecting the higher probability of returning after

initial migration for personal reasons. Individuals from self-employed backgrounds are also more likely to be NI domiciled.

Table 26b Migration, Residence and Selectivity Corrected Wages: HENI
85

	Prob. Of being GB Graduate	Prob. Of being NI Resident	Graduate from GB, Live NI	Graduat e from GB, Live GB	Graduate from NI, Live NI
Constant	0.742 (.761)	-1.155 (0.528)	8.735 (0.797)	9.889 (0.536)	9.430 (0.169)
Catholic	-0.154 (0.140)	-0.107 (0.139)	-0.165 (0.088)	0.079 (0.069)	0.002 (0.025)
Other Religion	0.658 (0.294)	-0.681 (0.310)	0.086 (0.353)	-0.051 (0.114)	-0.140 (0.111)
Married	--	--	0.033 (0.063)	0.018 (0.043)	0.069 (0.029)
Part-Time	--	--	-0.661 (0.148)	-1.081 (0.120)	-0.630 (0.063)
Age	-0.059 (0.029)	0.063 (0.020)	0.012 (0.030)	-0.011 (0.021)	0.003 (0.004)
Female	0.042 (0.061)	-0.041 (0.059)	-0.053 (0.056)	-0.139 (0.037)	-0.065 (0.025)
A-Level Score	0.003 (0.006)	-0.004 (0.006)	0.012 (0.005)	0.006 (0.003)	0.007 (0.002)
Grade – 2(i)	--	--	0.003 (0.105)	0.060 (0.076)	-0.139 (0.051)
Grade – 2(ii)	--	--	-0.105 (0.106)	0.017 (0.077)	-0.185 (0.051)
Grade – Third Class	--	--	0.043 (0.174)	-0.023 (0.115)	-0.223 (0.084)
Grade General	--	--	0.048 (0.122)	0.132 (0.098)	0.162 (0.061)
Grade Ordinary	--	--	0.102 (0.137)	0.068 (0.102)	0.064 (0.066)
Protestant * A Level Score	0.023 (0.007)	-0.012 (0.007)	--	--	--
Minority Protestant School District	0.465 (0.219)	0.237 (0.218)	--	--	--
Father Self- Employed Children	--	0.097 (0.049)	--	--	--
	--	0.096 (0.031)	--	--	--
$\lambda_{\text{Graduate in GB}}$	--	--	0.324 (0.198)	-0.145 (0.145)	0.008 (0.005)
$\lambda_{\text{Living in NI}}$	--	--	-0.220 (0.262)	0.007 (0.011)	-0.297 (0.159)
ρ	-0.645 (0.026)	--	--	--	--

Note: Figures in parentheses are standard errors. Bold figures are significant.

- 7.32 The last three columns of Table 26b show the equations that explain the wages of the three groups of individuals (those that stayed in NI, those that left NI to study in GB and stayed, and those that left to study in GB and then returned), controlling for their unobservable differences using information from the first two columns. We exclude some variables from the wage equations because the statistical methodology demands it.
- 7.33 The selection-correction terms are not significant.

7b GHS/CHS Data

- 7.34 The advantage of GHS is that it is large and representative. The disadvantage is that one cannot tell where individuals were educated only whether their place of birth was NI. Thus, we begin by modelling wages and being NI born (i.e. being an immigrant from NI) in the GB GHS data but cannot control for place where one completed HE and so cannot tell whether immigration occurred before or after HE occurred. This could be important in the light of our finding in the HENI data that, controlling for ability, the place where HE took place makes a difference. While the analysis is partial - in the sense that we do not observe in the GB data NI-born individuals who have been GB-educated - it does cover the main topic of interest: the NI to GB "brain drain".
- 7.35 The methodology is quite standard, but nonetheless rather demanding of the data. In particular, in order to control for the fact that immigrants from NI are not a random subset of the population in the data we need to explain NI to GB migration using (at least some) explanatory variables that do not affect wages. Thus, current relative unemployment rates would clearly not be an appropriate "instrumental" variable since this affects relative wages (see Blanchflower and Oswald (1994)). However, we feel that the variables that compare the two regions earlier in the life of individuals would be appropriate. Thus we include: the past relative sizes of the two HE sectors and the past relative unemployment rates would be an appropriate variables to "explain" migration from NI to GB. Thus we include the ratio of NI to GB HE places and the ratio of NI to GB unemployment rates, *at the time when the individual was 18*, as explanatory variables in the migration equation but not in the current real log wage equation.
- 7.36 We estimate separate equations for GB residents who were born in GB (labelled 'GB Born') and the NI born now resident in GB labelled 'NI Born'). The results underlying Tables 27a and 27b suggest that migration does respond to the relative sizes of unemployment rates and HE availability and that this is has the expected sign and seems to be larger for women than men. We find statistically significant evidence of selectivity for men but not women – it is the case that men that are more likely to migrate, for unobservable reasons, are more likely to have high wages relative to GB born. For example, ambitious people are more likely to migrate and ambition is positively rewarded

in the labour market. However, we find no significant differences in the rates of return to education between migrants and non-migrants controlling for their unobservable differences using the selection method. The results indicate that, although there is statistically significant non-randomness in where one was born this does not affect our estimates of the returns to education – which are close to 7% in all specifications for men and 9% for women. This suggests that those in GB who are NI born, on average, have different values of the unobservable determinants of wages than do the GB born; this does not affect the estimate of the rate of return.

*Table 27a The Return to Education and NI/GB Migration: GB
GHS Men Only*

	OLS Wage Equation	Selection Adjusted Wage Equation
GB Born	0.067 (0.009)	0.064 (0.016)
NI Born	0.069 (0.019)	0.061 (0.028)

Note: The specification includes age, age squared, a year trend, and decade cohort dummies in both equations and region dummies in the wage equation. The selectivity wage equation contains a term to correct for the endogeneity of place of birth and this is statistically significant and positive implying that individuals who move have unobservable characteristics associated with higher wage. This selectivity term is determined by unemployment and the relative ease of university admission when the individual was 18. Individuals born before 1930 were dropped since we do not have these variables going back earlier than 1948. Bold figures are significant.

*Table 27b The Return to Education and NI/GB Migration: GB
GHS Women Only*

	OLS Wage Equation	Selection Adjusted Wage Equation
GB Born	0.079 (0.011)	0.081 (0.022)
NI Born	0.082 (0.021)	0.089 (0.035)

Note: The specification includes age, age squared, a year trend, and decade cohort dummies in both equations and region dummies in the wage equation. The selectivity wage equation contains a term to correct for the endogeneity of place of birth but this is statistically significant and positive implying that individuals who move do not have unobservable characteristics associated with higher or lower wages than average. This selectivity term is determined by unemployment and the relative ease of university admission when the individual was 18. Individuals born before 1930 were dropped since we do not have these variables going back earlier than 1948. Bold figures are significant.

7.37 In Table 28 we use the CHS NI data to estimate simple equations that do not control for selection (into GB education) effects. These reiterate earlier results: higher returns for women relative to men and a lower rate of return to Protestants relative to Catholics so that wage differentials, both by religion and by gender, appear to fall with education.

7.38 However, CHS data is actually a little more informative than this: it contains information about place of birth **and**, for those that have HE (i.e. teaching qualification, degree or higher degree), where it took place – GB, NI or elsewhere. In Table 29 we use a subsample of individuals who have taken higher education and examine the effect of where that took place. Note that this is for the sample of individuals *who have returned from GB and those who never left* – those that went to GB but did not return are censored by the sample design.

7.39 Unfortunately the sample size in Table 29 is too small to generate any statistically significant results so we can make no inferences from these results and are unable to demonstrate any differences between those students who were born in the West relative to those born in the East of N. Ireland.

Table 28 *Wages, Education, Religion and Gender: NI CHS*

	Men		Women	
Education	0.092 (0.003)	0.100 (0.005)	0.128 (0.003)	0.138 (0.005)
Age	0.089 (0.006)	0.089 (0.006)	0.022 (0.006)	0.022 (0.006)
Age ²	-0.001 (0.0001)	-0.001 (0.0001)	-0.0002 (0.00008)	-0.0002 (0.0001)
Protestant	0.154 (0.014)	0.276 (0.080)	0.003 (0.015)	0.203 (0.076)
Educ*Protestant		-0.009 (0.006)		-0.015 (0.006)
Sample size	4310		4529	

Note: The specification, year dummies, other/no religion dummy, and regional unemployment rate. Omitted category is Catholic. Bold figures are significant.

Table 29 *Wages and Location of Higher Education: NI CHS*

	Men	Women
Higher degree	0.060 (0.074)	0.116 (0.085)
Degree	0.053 (0.058)	-0.033 (0.047)
Higher degree in GB	0.093 (0.134)	0.060 (0.137)
Degree in GB	0.084 (0.131)	0.040 (0.102)
Protestant	-0.015 (0.040)	-0.036 (0.039)
East NI	0.087 (0.049)	0.040 (0.051)
West NI	0.011 (0.048)	-0.018 (0.051)
Sample size	609	633

Note: The specification includes, year dummies, other/no religion dummy and a quadratic in age. Omitted category is Catholic, Northern Ireland educated to teacher qualification level, living in Belfast in 1991. Bold figures are significant.

8. Conclusions - Education, Migration and Labour Market Returns

8.1 A novel data source available to us is the Higher Education Northern Ireland (HENI) cohort study of 1992 that examines two groups – one who entered further or higher/further education in 1979 and another who entered in 1985. The most notable feature of

the data is that it is made up entirely of NI born graduates and hence is quite different from NIFES or CHS. The raw HENI data suggests very large regional differentials between GB and NI annual earnings both for those who received their HE in GB and those that remained in NI for their HE.

- 8.2 The HENI data suggests that the probability of studying in GB rather than NI is slightly higher for women than for men and somewhat higher for Protestant than Catholic. The proportion studying in GB is the same for both cohorts irrespective of religion. The proportions returning to NI after education in GB is identical across cohorts even though the '79 cohort has had an additional 6 years to return - this suggests that individuals return to NI, if they are going to, quite soon after graduation in GB. Non-graduation (drop-out) rates show a much higher rate for men than women and much higher rate for RC relative to Protestant.
- 8.3 From a statistical analysis of the HENI data we observe how a better class of degree outcomes lead to higher earnings in NI (but not significantly so in GB); women get paid less than men; there is a large wage premium associated with living in GB; and there is a small effect of A level score. These results suggest that, controlling for the other variables: living in GB as opposed to NI carries a large positive premium (about 26%); men earn more than women (a differential of 11% for those whose HE was in GB, and 8% for those whose HE was in NI); and being Protestant seems to be unimportant for the earnings of graduates.
- 8.4 Important differences are noted by location of the HE "treatment". Controlling for A level score, wages are higher for NI graduates than GB graduates - by a significant 31% for women and an insignificant 5% for men. The implication is that (at least for women) NI HE institutions generate more value added than HE received at GB institutions.
- 8.5 Finally we estimated separate equations with the CHS data for two groupings - GB residents who were either GB born or NI born. The results suggest that internal migration from NI does respond to the relative sizes of unemployment rates and HE availability and that this is has the expected sign. Moreover the effect seems to be larger for women than men. We find statistically significant evidence that men that are more likely to migrate, for unobservable reasons, are more likely to have high wages relative to those born in GB. For example, ambitious people are more likely to migrate and ambition is positively rewarded in the labour market. However, we find no significant differences in the rates of return to education between migrants and non-migrants controlling for their unobservable differences using a more advanced econometric method.

References

- Blanchflower, D. and Oswald, A. (1994), **The Wage Curve**, MIT Press.
- Card, D. (1999). *The Causal Effect of Education on Earnings*. In Ashenfelter, O. and Card, D. **Handbook of Labour Economics Volume IV**. Elsevier.
- Cormack, R.J. *et al.* (1994), *Higher education participation of Northern Irish students*, **Higher Education Quarterly** 48, 207-226.
- Dearden, L. (1999), *The Return to Education for Young Men in the UK*, **Labour Economics**, November 1999.
- Harmon, C. and I. Walker (1995), *Estimates of the Economic Return to Schooling for the UK*, **American Economic Review**, December 1995.
- Harmon, C. and I. Walker (1999), *The Marginal and Average Returns to Education*, **European Economic Review**.
- Krueger, A. and Lindahl (1999), *Education for Growth in Sweden and the World*. Princeton Industrial Relations Section Paper # 411.
- Spence, M. (1970), *Job Market Signalling*, **Quarterly Journal of Economics**.
- Stewart, M. (1983), *Maximum Likelihood Estimation of a Grouped Dependent Variable Model*, **Review of Economics and Statistics**.