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THE RETURNS TO EDUCATION FOR THE UNITED KINGDOM

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This paper uses data from the General Household Survey to examine the economic returns to education between 1985 and 2003 for men and women in the UK. The evidence suggests that the returns to education have increased for men and declined for women. Quantile regression estimates illustrate that younger workers have come to experience more unequal returns to education across the conditional earnings distribution. The evidence suggests that both time spent in education and educational credentials are important in explaining earnings with higher qualifications always conveying higher earnings, holding years of schooling constant.

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I. Introduction

The rapid and massive expansion in education over the last quarter century has led to renewed interest in the economic returns to investment in education. Although the relationship between education and individual earnings is one of the most commonly studied topics in the economics literature, comparable estimate of returns to education over time are difficult to find for the UK. This paper, using data from the General Household Survey, examines the impact of education on labor market earnings between 1985 and 2003 for men and women in the UK. People at work on average have one more year of continuous full-time education today than they had twenty or so years ago. Conventional estimates of the Mincerian human capital wage function suggest that the rate of return to an additional year of completed schooling has generally increased for men and declined for women between 1985 and 2003.

Over the last number of years, individuals have increasingly tried to differentiate

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themselves on the basis of distinguished educational qualifications. Most remarkably, the proportion of men holding university qualifications doubled while the proportion of women holding university qualifications trebled. Recognized educational qualifications have rarely been incorporated into the standard Mincerian framework for analyzing the returns to education. In this paper, having presented the conventional returns to years of schooling, I provide estimates of the returns to education defined by five educational qualifications. The rate of return to every education type for men remained fairly stable or slightly increased while the returns to all educational qualifications noticeably declined for women. Across age groups, the premium to a university qualification (over no educational qualifications) among younger men increased whereas the returns for older men remained stable. The returns to mostly school-awarded educational qualifications declined for younger women but remained stable for older women, while the returns to higher educational qualifications declined similarly for younger and older women. The large decline in the returns to all educational categories for women has not been reported in the prior literature. The decline in the returns to education for women accompanied the dramatic and massive increase in the educational standards of the female labor force.

Mean regression (Ordinary Least Squares) estimated returns to education constitute only a limited aspect of possibly more extensive changes across the conditional wage distribution. Recent research employing quantile regression methods has revealed that education has a greater effect upon the wages of individuals at the upper part of the wage distribution than upon wages of individuals at the lower part of the distribution (Buchinsky 1994). The results from quantile regression estimates indicate that for younger men the returns to university qualifications over time noticeably increased at the top of the conditional earnings distribution but remained flat at the lower end. For younger women there is (weak) evidence that the returns to mostly higher educational qualifications declined over time at the lower part of the earnings distribution while the returns remained unchanged at the top. These results suggest that younger workers have come to experience more unequal returns to education across the wage distribution.

The fundamental question of whether schooling enhances or signals productivity is at the heart of studies seeking to determine the value of investments in education. One of the predictions of signaling theory is that individuals who receive qualifications will earn more than their counterparts with the same number

of years of education who do not hold qualifications. This is known as the sheepskin effect. Previous econometrics models used to provide estimates of sheepskin effects have been limited by the lack of information on credentials. The use of years of schooling to measure sheepskin effects in the returns to education may lead to misleading inferences in the context of the complicated structure of the UK education system. The results indicate that both time spent in education and educational credentials are important in explaining earnings with higher qualifications always conveying higher earnings, holding years of schooling constant.

The remainder of this paper is organized as follows. In Section II the General Household Survey is outlined and changes in the composition of the workforce are discussed. Section III describes the econometric model underlying the estimation and presents the results from OLS and quantile regression estimations. Section IV looks at sheepskin effects in the returns to education. Finally, Section V summarizes and concludes the paper.

II. General Household Survey

This paper makes use of data from the General Household Survey. The GHS is a survey of approximately 13,000 households in England, Scotland and Wales conducted throughout the year by the Social Survey Division of the Office for National Statistics. The survey started in 1971 and has been carried out continuously since then, except for breaks in 1997/98 when the survey was reviewed and 1999/2000 when the survey was re-developed. The main aim of the survey is to collect data on a range of topics concerning both the household and the individual. The household questionnaire covers the following topics: demographic information about household members, household and family information, household accommodation, housing tenure, consumer durables including vehicle ownership, and migration. The individual questionnaire includes sections on employment, pensions, education, health and use of health services, family information including marriage, cohabitation and fertility history, and income. All adults age 16 and over are interviewed in each responding household. This paper focuses on men and women between 16 and 64 years of age who are in full-time or part-time employment in every dataset from 1985 through 2003. This gives a sample of 63,087 men and 60,489 women. Table 1 presents the means and standard deviations of the variables used in this paper.

Table 1. Summary statistics, men and women

	Men		Women	
Variable	Mean	Std. dev.	Mean	Std. dev.
Log hourly wages	1.210	0.890	0.898	0.923
Years of schooling	12.216	2.597	12.214	2.496
NVQ0	0.245	0.430	0.271	0.444
NVQ1	0.057	0.232	0.113	0.317
NVQ2	0.258	0.437	0.282	0.450
NVQ3	0.154	0.361	0.105	0.307
NVQ4	0.128	0.334	0.117	0.321
NVQ5	0.158	0.365	0.111	0.314
Age	38.218	12.297	37.881	11.948
Age squared	1611.845	976.936	1577.744	930.068
Part-time	0.038	0.192	0.389	0.488
N	63,087		60,489	

The central purpose of this paper is to estimate the economic returns to education over time. The main variables of interest are earnings and education. The wage measure used in this study is the log of real gross hourly wages deflated at 2003 prices using the Retail Price Index. This hourly wage measure is constructed by dividing usual weekly wages by usual hours worked.

Years of schooling are calculated as age left continuous full-time education minus five years, as individuals begin school in the UK at age five. Today all British children must attend school until at least the age of 16, however, for some individuals in the GHS the minimum school leaving age was 15. Educational qualifications provide more information about an individual's educational career than the usual measure of years of schooling. The Labour Force Survey for the UK, like the Current Population Survey for the US, did not record information on educational qualifications until the early 1990s. Since that time several papers have been written describing the returns to educational qualifications using this survey from 1992 to 2002 (see, for example, Walker and Zhu 2001; Chevalier et al. 2004; McIntosh 2004; O'Leary and Sloane 2004). The GHS is the only British annual survey which contains detailed educational qualifications as well as years of education prior to 1991.[1]

[1] The British Household Panel Survey, which contains information on credentials, began in 1991, and the Labor Force Survey began recording educational qualifications in 1992.

Table 2. A description of qualifications by NVQ or equivalent classification

NVQ or equivalent	
Level 5	University or CNAA Higher Degree (eg MSc, PhD)
	University or CNAA First Degree (eg BA. BSc)
	University Diploma
Level 4	Teaching qualifications
	Nursing qualifications
	Other higher qualifications
Level 3	More than 1 GCE at A level
	Scottish Higher Grade Equivalent
	Level 3 vocational qualifications
Level 2	1 GCE at A level
	Scottish standard grades – grades 1-3
	GCE O level – passes or grades A-C
	GCSE grades A-C
	CSE grade 1
	Scottish O grade – passes or grades A-C
	Level 2 vocational qualifications
Level 1	CSE grade 2-5
	Other qualifications
	Level 1 vocational qualifications
Level 0	No qualification

Table 2 provides a list and a brief description of all qualification variables used in this study. Qualifications are re-classified into five groups using the National Vocational Qualification (NVQ) or academic equivalent framework derived by the Centre for Longitudinal Studies at the Institute of Education. Qualifications are organized into this classification from the lowest to the highest on the basis of the number of years of schooling usually required as well as the contribution of qualifications to improvements in intelligence and productivity. Individuals potentially may have any number of qualifications. The measure of education used here is the highest educational qualification obtained during full-time education.

Table 3 illustrates the trends in the proportions of men and women with different years of education and educational qualifications between 1985 and 2003. The

Table 3. Educational composition of the labor force, men and women

	Schooling	NVQ0	NVQ1	NVQ2	NVQ3	NVQ4	NVQ5
(a) Men							
1985	11.70	34.17	6.33	25.36	13.58	9.12	11.44
1986	11.77	31.15	7.64	26.22	12.94	9.96	12.08
1987	11.88	31.20	5.55	25.13	12.77	12.75	12.60
1988	11.89	29.88	5.69	25.67	13.42	12.91	12.43
1989	11.96	27.69	5.41	26.06	14.53	13.57	12.74
1990	11.97	26.73	5.58	25.61	15.24	13.28	13.55
1991	12.01	26.73	5.24	26.47	14.65	13.90	13.01
1992	12.10	25.31	5.14	25.52	17.58	13.22	13.22
1993	12.41	21.95	4.87	26.20	17.94	13.81	15.21
1994	12.48	20.71	5.33	27.99	17.68	12.76	15.29
1995	12.53	19.73	4.81	25.63	17.84	13.61	17.90
1996	12.64	18.76	6.05	26.55	17.66	13.72	16.59
1998	12.95	16.14	5.00	26.03	19.05	15.12	18.33
2000	12.56	17.25	3.86	24.15	14.68	15.39	24.69
2001	12.53	17.92	3.94	23.99	14.71	16.08	23.36
2002	12.61	16.92	8.09	25.18	16.45	10.05	23.32
2003	12.62	18.87	7.81	25.67	15.31	9.91	22.43
(b) Women							
1985	11.79	48.32	16.28	21.16	8.18	9.57	6.16
1986	11.84	46.31	16.81	23.24	8.52	9.97	5.82
1987	11.82	44.52	12.98	25.22	7.54	10.88	6.53
1988	11.87	42.09	12.19	28.74	7.84	10.35	6.65
1989	11.90	41.12	12.62	28.74	7.67	10.78	7.45
1990	11.97	39.57	11.48	29.66	8.69	11.11	7.82
1991	12.02	38.11	10.68	28.64	10.49	11.52	7.79
1992	12.23	34.20	11.11	31.19	10.54	12.66	8.15
1993	12.37	34.48	10.35	30.40	13.12	12.04	8.77
1994	12.40	32.08	11.14	32.32	11.73	11.25	9.19
1995	12.51	31.75	11.38	29.82	11.86	11.83	11.89
1996	12.51	31.50	10.94	29.80	13.35	11.38	11.98
1998	12.90	25.39	9.28	28.49	16.42	11.63	15.68
2000	12.43	27.56	3.40	28.81	12.91	14.88	21.10
2001	12.44	27.43	3.35	29.86	12.83	14.13	20.81
2002	12.56	25.35	13.32	26.74	9.58	12.83	20.64
2003	12.52	25.37	11.70	27.43	11.06	13.31	19.94

statistics show that today men and women spend about one more year in full-time continuous education than they did 20 or so years ago. For men these changes in education have resulted in the number holding no educational qualifications greatly declining from 34 percent in 1985 to approximately 20 percent in 2003. For women the number holding no qualifications fell from 48 percent in 1985 to 25 percent in 2003. In addition, there has been a movement away from lower qualifications and towards qualifications awarded at the top of the education system. The most striking observation from these tabulations is the enormous increase in the proportions of men and women holding qualifications at NVQ level 5. Over the entire duration of the data, the percentage of men with NVQ level 5 qualifications doubled, while the percentage of women holding qualifications at level 5 trebled. Today some 22 percent of the men and 20 percent of the women in the workforce hold qualifications at the highest level of education.

III. The returns to education

The Mincer (1974) human capital wage model specifies:

$$\ln y_i = \beta_0 + \beta_1 s_i + \beta_2 x_i + \beta_3 x_i^2 + \varepsilon_i \tag{1}$$

where ln y is the log of earnings, s is the years of schooling completed, x represents age, and ε denotes the error term. The index i refers to individuals (i = 1, 2,…, n). The parameter β_1 is interpreted as the rate of return to an additional year of education. The human capital model is estimated for men and women separately for each year of data between 1985 and 2003 excluding 1997 and 1999 when data were not collected. The human capital model is also estimated over the pooled sample (1985-2003) and includes in addition to the above variables year interaction dummies with education. This specification is as follows:

$$\ln y_i = \lambda_0 + \lambda_1 s_i + \lambda_2 \left(s_i T_i\right) + \lambda_3 x_i + \lambda_4 x_i^2 + \lambda T_i + \upsilon_i \tag{2}$$

where T is the year from which the observation is taken. By interacting education with a time trend I can test whether there were significant long-run differences in the returns to qualifications over time.

Table 4 reports standard cross-sectional regression estimates of the returns to

an additional year of schooling for each year of GHS data between 1985 and 2003. For men, the return to an additional year of education grew from 5.5 percent in 1985 to 7 percent in 2003. Much of this growth in the return to an additional year of education had taken place in the early 2000s. This upward movement is confirmed by the positive trend term from the pooled regression which shows that men experienced a 0.1 percent rise per annum in the return to an extra year of education between 1985 and 2003. For women, the return to an additional year of education steadily declined from 8.3 percent in 1985 to about 6.8 percent in 1998 and then increased substantially to 8 percent in 2003. Pooled sample estimates where years of schooling are interacted with a trend term indicate that the returns to education for women fell by 0.1 percent a year on average over the entire length of the data. The results show that the return to an extra year of schooling has increasingly become similar for men and women.

In the standard human capital specification the coefficient on years of schooling can be interpreted as the average private return to one additional year of schooling, regardless of the educational level to which this schooling refers. The above equations are re-estimated for each year of data where years of schooling are replaced by five binary variables for highest educational qualifications attained. The excluded educational qualification level represents the group with no educational qualifications. The estimated coefficients of the educational dummies reported in the tables should be interpreted as differentials with respect to the baseline return accruing to individuals with no formal qualifications.

Tables 5.A and 5.B reports the OLS returns to distinguished educational qualifications for men and women between 1985 and 2003. The results show that higher educational qualifications yield higher returns for both men and women. Over time the returns to educational qualifications generally remained fairly stable for men. The trend terms derived from the pooled sample for men show that there were small although statistically insignificant increases in the returns to qualifications awarded at all levels, apart from NVQ level 5 which is statistically significant at the 10 percent level of significance. These results are in line with those of previous studies over the 1990s (Walker and Zhu 2001; Chevalier et al. 2004; McIntosh 2004; Card and Lemieux 2000). For women there is a statistically significant downward trend in the returns to all educational qualifications especially at the

Table 4. OLS returns to years of schooling, men and women

	(a) Men	(b) Women
1985	0.055	0.083
	(0.003)***	(0.003)***
1986	0.055	0.084
	(0.003)***	(0.003)***
1987	0.058	0.083
	(0.003)***	(0.003)***
1988	0.061	0.083
	(0.003)***	(0.003)***
1989	0.054	0.092
	(0.003)***	(0.003)***
1990	0.064	0.090
	(0.003)***	(0.003)***
1991	0.062	0.087
	(0.003)***	(0.003)***
1992	0.065	0.084
	(0.003)***	(0.003)***
1993	0.057	0.082
	(0.003)***	(0.003)***
1994	0.055	0.078
	(0.003)***	(0.003)***
1995	0.055	0.079
	(0.003)***	(0.003)***
1996	0.057	0.075
	(0.003)***	(0.003)***
1998	0.058	0.068
	(0.003)***	(0.003)***
2000	0.070	0.080
	(0.004)***	(0.004)***
2001	0.075	0.081
	(0.004)***	(0.004)***
2002	0.067	0.082
	(0.004)***	(0.004)***
2003	0.070	0.080
	(0.003)***	(0.003)***
Pooled regression (1985-2003) Coefficient	0.057	0.087
	(0.001)***	(0.001)***
Trend	0.001	-0.001
	(0.000)***	(0.000)***

Note: Standard errors are presented in parentheses underneath the coefficients. * significant at 10%; ** significant at 5%; *** significant at 1%. Specifications include dummy variables for part-time status and controls for age and age squared.

highest educational qualifications. It is apparent that the general deterioration in the returns to education for women over the late 1980s and 1990s corresponds to the abrupt fall in the proportion of women in the workforce holding no formal qualifications and the significant rise in the proportion holding higher educational qualifications. For men and women, there is a noticeable change in the returns to most educational categories at the beginning of the 2000s. The subsequent rise in the returns to education over the early 2000s is thought to correspond to the increased demand by firms for educated workers brought about by technological changes which favored skilled workers (Davis and Haltiwanger 1991; Bound and Johnson 1992; Krueger 1991).

To this point estimates are based on the assumption that the returns to education are the same for all age groups. This is only true if older and younger workers are perfect substitutes in production. However, if workers of different ages are not perfect substitutes for each other, a large group of well-educated workers in one cohort may depress the wages of the better-educated members of their own cohort, but leave the wages of other cohorts unaffected. Table 6 presents an overview of trends in the returns to education for three different age groups: ages 26 to 36, ages 37 to 47, and ages 48 to 58. Younger men on average earn lower returns to education especially at the higher levels of education. Looking at trends in the returns to education, the growth in earnings among younger men with qualifications at NVQ level 5 is statistically significant whereas for older men it is not statistically significant. NVQ level 5 are university qualifications which have seen the most rapid growth over the last two decades. Trend terms on other educational qualifications are not statistically significant. These results are in line with those of Card and Lemieux (2000) using the GHS data, which shows that the increase in the education-related wage premium for men was almost entirely attributable to increases in the relative earnings of younger college-educated workers (relative to secondary-school-educated workers) while the return for older men has remained stable or declined.

The returns to education declined over time for women. This was due to fairly similar proportionate declines in the returns to education for older and younger women with higher educational qualifications i.e., qualifications at NVQ level 4 and NVQ level 5. Among individuals with qualifications at NVQ level 2 and NVQ

Table 5.A. OLS returns to highest educational qualifications, men

	NVQ1	NVQ2	NVQ3	NVQ4	NVQ5
1985	0.144	0.157	0.323	0.396	0.525
	(0.029)***	(0.017)***	(0.021)***	(0.025)***	(0.022)***
1986	0.109	0.136	0.267	0.345	0.519
	(0.028)***	(0.018)***	(0.022)***	(0.024)***	(0.022)***
1987	0.126	0.175	0.320	0.379	0.596
	(0.032)***	(0.018)***	(0.022)***	(0.022)***	(0.022)***
1988	0.060	0.187	0.314	0.405	0.595
	(0.033) *	(0.019)***	(0.023)***	(0.023)***	(0.023)***
1989	0.169	0.182	0.316	0.402	0.580
	(0.033)***	(0.019)***	(0.023)***	(0.023)***	(0.023)***
1990	0.135	0.239	0.357	0.429	0.656
	(0.035)***	(0.020)***	(0.024)***	(0.024)***	(0.024)***
1991	0.155	0.199	0.350	0.444	0.662
	(0.035)***	(0.020)***	(0.024)***	(0.024)***	(0.024)***
1992	0.067	0.201	0.333	0.469	0.685
	(0.035)*	(0.020)***	(0.022)***	(0.024)***	(0.024)***
1993	0.079	0.204	0.324	0.455	0.650
	(0.039)**	(0.022)***	(0.025)***	(0.026)***	(0.025)***
1994	0.075	0.170	0.322	0.408	0.654
	(0.038)**	(0.022)***	(0.025)***	(0.027)***	(0.026)***
1995	0.168	0.207	0.331	0.436	0.659
	(0.039)***	(0.023)***	(0.025)***	(0.027)***	(0.025)***
1996	0.115	0.176	0.314	0.436	0.645
	(0.036)***	(0.023)***	(0.026)***	(0.027)***	(0.026)***
1998	0.101	0.189	0.353	0.374	0.705
	(0.041)**	(0.025)***	(0.027)***	(0.029)***	(0.028)***
2000	0.038	0.192	0.217	0.284	0.604
	(0.059)	(0.033)***	(0.037)***	(0.037)***	(0.033)***
2001	0.041	0.180	0.261	0.311	0.638
	(0.050)	(0.028)***	(0.032)***	(0.031)***	(0.028)***
2002	0.037	0.154	0.283	0.409	0.566
	(0.039)	(0.029)***	(0.032)***	(0.037)***	(0.030)***
2003	0.089	0.178	0.279	0.392	0.600
	(0.034)***	(0.025)***	(0.028)***	(0.032)***	(0.026)***
Pooled regression (1985-2003)					
Coefficient	0.107	0.173	0.317	0.414	0.607
	(0.015)***	(0.009)***	(0.011)***	(0.012)***	(0.011)***
Trend	0.002	0.001	0.001	0.002	0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)*

Note: Standard errors are presented in parentheses underneath the coefficients. * significant at 10%; ** significant at 5%; *** significant at 1%. Specifications include dummy variables for part-time status and controls for age and age squared.

Table 5.B. OLS returns to highest educational qualifications, women

	NVQ1	NVQ2	NVQ3	NVQ4	NVQ5
1985	0.153	0.216	0.362	0.588	0.718
	(0.021)***	(0.020)***	(0.027)***	(0.025)***	(0.030)***
1986	0.135	0.197	0.373	0.558	0.757
	(0.022)***	(0.021)***	(0.029)***	(0.026)***	(0.033)***
1987	0.122	0.242	0.369	0.577	0.791
	(0.023)***	(0.019)***	(0.029)***	(0.024)***	(0.030)***
1988	0.194	0.239	0.410	0.604	0.736
	(0.024)***	(0.019)***	(0.029)***	(0.025)***	(0.030)***
1989	0.140	0.250	0.366	0.665	0.761
	(0.023)***	(0.019)***	(0.029)***	(0.024)***	(0.028)***
1990	0.143	0.253	0.416	0.608	0.816
	(0.025)***	(0.019)***	(0.028)***	(0.025)***	(0.029)***
1991	0.173	0.256	0.428	0.637	0.784
	(0.025)***	(0.019)***	(0.026)***	(0.024)***	(0.028)***
1992	0.136	0.234	0.342	0.630	0.792
	(0.025)***	(0.020)***	(0.027)***	(0.024)***	(0.028)***
1993	0.166	0.240	0.353	0.650	0.831
	(0.027)***	(0.021)***	(0.027)***	(0.026)***	(0.030)***
1994	0.154	0.242	0.377	0.625	0.818
	(0.026)***	(0.021)***	(0.027)***	(0.026)***	(0.029)***
1995	0.124	0.246	0.319	0.604	0.776
	(0.024)***	(0.019)***	(0.025)***	(0.024)***	(0.025)***
1996	0.144	0.199	0.266	0.571	0.722
	(0.027)***	(0.021)***	(0.026)***	(0.026)***	(0.027)***
1998	0.095	0.203	0.336	0.501	0.733
	(0.031)***	(0.023)***	(0.027)***	(0.029)***	(0.027)***
2000	0.043	0.161	0.305	0.434	0.631
	(0.053)	(0.027)***	(0.034)***	(0.032)***	(0.030)***
2001	0.005	0.199	0.266	0.417	0.648
	(0.049)	(0.024)***	(0.031)***	(0.029)***	(0.027)***
2002	0.099	0.189	0.257	0.435	0.649
	(0.032)***	(0.028)***	(0.036)***	(0.032)***	(0.030)***
2003	0.124	0.159	0.323	0.441	0.661
	(0.029)***	(0.025)***	(0.031)***	(0.029)***	(0.027)***
Pooled regression (1985-2003)					
Coefficient	0.158	0.246	0.397	0.656	0.819
	(0.011)***	(0.009)***	(0.013)***	(0.012)***	(0.014)***
Trend	-0.004	-0.003	-0.007	-0.013	-0.010
	(0.001)**	(0.001)***	(0.001)***	(0.001)***	(0.001)***

Note: Standard errors are presented in parentheses underneath the coefficients. * significant at 10%; ** significant at 5%; *** significant at 1%. Specifications include dummy variables for part-time status and controls for age and age squared.

Table 6. OLS returns to education by age group, men and women

	(a) Men			(b) Women		
Age Group	26-36	37-47	48-58	26-36	37-47	48-58
(a)Years of education						
School	0.044	0.059	0.068	0.083	0.087	0.089
	(0.002)***	(0.002)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
School trend	0.001	0.001	0.001	-0.001	0.000	-0.001
	(0.000)***	(0.000)**	(0.000)*	(0.000)***	(0.000)	(0.000)*
(b) Educational qualifications						
NVQ1	0.086	0.110	0.221	0.141	0.143	0.210
	(0.027)***	(0.061)*	(0.066)***	(0.024)***	(0.021)***	(0.024)***
NVQ2	0.192	0.179	0.160	0.262	0.204	0.220
	(0.019)***	(0.018)***	(0.020)***	(0.019)***	(0.017)***	(0.022)***
NVQ3	0.289	0.293	0.322	0.451	0.271	0.286
	(0.020)***	(0.022)***	(0.031)***	(0.025)***	(0.030)***	(0.044)***
NVQ4	0.353	0.414	0.450	0.632	0.678	0.710
	(0.021)***	(0.020)***	(0.028)***	(0.023)***	(0.021)***	(0.024)***
NVQ5	0.515	0.629	0.723	0.810	0.820	0.869
	(0.020)***	(0.020)***	(0.026)***	(0.024)***	(0.026)***	(0.034)***
NVQ1 trend	-0.003	0.000	-0.010	-0.003	-0.002	-0.007
	(0.003)	(0.005)	(0.006)*	(0.003)	(0.003)	(0.003)**
NVQ2 trend	0.000	0.002	0.002	-0.006	0.001	-0.003
	(0.002)	(0.002)	(0.002)	(0.003)**	(0.002)	(0.002)
NVQ3 trend	0.003	0.004	-0.002	-0.010	0.005	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)***	(0.003)	(0.004)
NVQ4 trend	0.002	-0.002	-0.001	-0.011	-0.011	-0.016
	(0.003)	(0.003)	(0.003)	(0.003)***	(0.003)***	(0.003)***
NVQ5 trend	0.009	0.005	-0.003	-0.011	-0.005	-0.013
	(0.002)***	(0.002)**	(0.003)	(0.003)***	(0.003)*	(0.003)***

Note: Standard errors are presented in parentheses underneath the coefficients. * significant at 10%; ** significant at 5%; *** significant at 1%. Specifications include dummy variables for part-time status and controls for age and age squared.

level 3, the returns to education declined significantly for younger women but remained stable for middle-aged and older women over the course of the data.

Ordinary Least Squares estimates are based on the assumption that the returns to education are the same across the conditional distribution of earnings. Recent studies suggest that restricting the analysis to mean effects may miss an important feature of the earnings structure if the returns to education vary across the condition wage distribution (Buchinsky 1994). Table 7 reports the returns to each educational

qualification estimated by quantile regression for younger and older workers over the pooled sample (1985-2003). The coefficient estimates on education derived from log wage quantile regressions may be interpreted as the returns to education at a particular decile of the log wage distribution. The results suggest that for men and women alike, across all age groups, there is no consistent tendency for the returns to increase linearly with deciles, from top to bottom, as would be implied by a tendency for ability to bias returns upward. These findings confirm those of Chevalier et al. (2004) who also using the GHS found that the returns to education are not lower at the bottom of the distribution.

Trends in the returns to educational qualifications across the conditional wage distribution are remarkable. In the previous section it was shown that education-related wage increases for men were primarily increases experienced by younger men who held qualifications at NVQ level 5. Quantile regression estimates now show that younger men who hold qualifications at NVQ level 5 have experienced significant wage increases at the 90^{th} decile but stable wages at the 10^{th} decile over the last two decades. This evidence suggests that the rate of return to new investment in university education among men is complementary to unobserved ability. Similar findings were reported for the US by Buchinsky (1994).

In the previous section it was shown that the returns to education for women declined over time across all levels of education for both younger and older workers. The results from quantile regression estimates show that older women at the 10^{th} and 90^{th} deciles experienced similar declines in the returns to educational qualifications. By contrast, there is weak evidence that the returns to education among younger women at the 10^{th} decile declined over time whereas at the 90^{th} decile it remained unchanged apart from the returns to qualifications at NVQ level 3 which statistically significantly (at the 10 percent level of significance) declined by 1 percent per annum.

IV. Sheepskin effects

Economic theories of education offer different explanations for the observed correlation between higher levels of schooling and higher wages. The theory of human capital suggests that it is time spent in school which directly increases the

Table 7. Quantile regression estimates, men and women by age group

	Age 26-36		Age 48-58	
	10th	90th	10th	90th
(a) Men				
NVQ1	0.115	0.071	0.256	-0.004
	(0.040)***	(0.061)	(0.135)	(0.184)
NVQ2	0.201	0.211	0.178	0.137
	(0.033)***	(0.036)***	(0.027)***	(0.024)***
NVQ3	0.305	0.275	0.286	0.316
	(0.034)***	(0.037)***	(0.033)***	(0.074)***
NVQ4	0.424	0.284	0.438	0.429
	(0.034)***	(0.043)***	(0.025)***	(0.023)***
NVQ5	0.511	0.444	0.676	0.701
	(0.032)***	(0.027)***	(0.034)***	(0.018)***
NVQ1 trend	-0.005	-0.002	0.011	-0.002
	(0.005)	(0.007)	(0.007)	(0.010)
NVQ2 trend	-0.002	-0.002	0.007	0.011
	(0.004)	(0.004)	(0.002)	(0.003)**
NVQ3 trend	-0.004	0.006	-0.005	0.004
	(0.004)	(0.005)	(0.004)	(0.003)
NVQ4 trend	-0.007	0.006	0.009	0.002
	(0.004)*	(0.005)	(0.005)*	(0.003)
NVQ5 trend	0.003	0.016	-0.011	0.012
	(0.004)	(0.004)***	(0.003)	(0.004)
(b) Women				
NVQ1	0.126	0.171	0.251	0.161
	(0.040)***	(0.055)***	(0.032)***	(0.022)***
NVQ2	0.202	0.316	0.161	0.304
	(0.047)***	(0.046)***	(0.042)***	(0.016)***
NVQ3	0.364	0.489	0.387	0.304
	(0.037)***	(0.053)***	(0.063)***	(0.124)***
NVQ4	0.545	0.604	0.776	0.789
	(0.047)***	(0.048)***	(0.027)***	(0.042)***
NVQ5	0.723	0.818	0.933	0.754
	(0.051)***	(0.055)***	(0.110)***	(0.055)***
NVQ1 trend	0.001	-0.006	-0.006	-0.014
	(0.005)	(0.006)	(0.003)***	(0.005)***
NVQ2 trend	-0.002	-0.007	-0.004	0.000
	(0.005)	(0.005)	(0.004)	(0.002)
NVQ3 trend	-0.008	-0.010	0.002	-0.001
	(0.004)*	(0.005)*	(0.004)	(0.008)
NVQ4 trend	-0.010	-0.009	-0.016	-0.011
	(0.005)*	(0.005)	(0.006)***	(0.005)***
NVQ5 trend	-0.009	-0.010	-0.010	-0.014
	(0.005)*	(0.006)	(0.003)***	(0.005)***

Note: Standard errors are presented in parentheses underneath the coefficients. * significant at 10%; ** significant at 5%; *** significant at 1%. Specifications include dummy variables for part-time status and controls for age and age squared.

worker's productivity. This conclusion is only true if education groups reflect true productivity differentials, and not inherent ability differences that happen to be correlated with education. According to signaling theories of education, individuals with more education tend to earn more not solely because education makes them more productive, but rather because it serves as a credential which signals higher innate productivity (Spence 1973; Arrow 1973; Weiss 1995).

One version of signaling theory is that individuals who receive qualifications will earn more than their counterparts with the same number of years of education who do not hold qualifications. The existence of differences in earnings between individuals with and without credentials holding accumulated years of schooling constant is known as sheepskin effects. Evidence of sheepskin effects may be interpreted as corroboration of the signaling hypothesis if more able individuals are more likely to succeed in examinations than less able individuals (Weiss 1983). Educational credentials provide a mechanism for the more able workers to separate themselves from the less able ones.

However, the existence of sheepskin effects need not be taken as evidence in favor of the signaling hypothesis. An alternative interpretation due to Chiswick (1973) is that dropouts are disproportionately comprised of inefficient learners who leave school when they realize how little their productivity is improved by education. Graduates are disproportionately comprised of efficient learners who complete their qualification programs because their productivity is greatly improved by education. Comparisons of earnings of graduates and dropouts then appear to show large sheepskin effects because the graduates are much more productive. Under this interpretation, education's effect on earnings arises solely from its effect on productivity and not from any signaling role.

The existence of sheepskin effects has been documented by Hungerford and Solon (1987), Belman and Heywood (1991), and Card and Krueger (1992) using a variety of US data sets. Inferences about sheepskin effects were drawn from imputed information about the "usual" number of years to obtain a high-school diploma (12 years) or university qualification (16 years) and not actual information on receipt of qualifications. Sheepskin effects based on individuals' years of schooling will be biased measures of the true effects if some individuals do not earn qualifications, and others take different amounts of time to complete them. In investigating this

issue, Jaeger and Page (1996) for the US found that the estimates of sheepskin effects for high-school diplomas and Bachelor's degrees using information on degrees received are more than twice as large as those which only use information on completed years of education.

In this section, I examine sheepskin effects in the returns to education for the UK. Table 8 presents a cross-tabulation of qualifications received by completed years of continuous education. Generally higher qualifications are associated with more time spent in education. For example, 95 percent of individuals who have no qualifications have less than 12 years of full-time continuous education, whereas almost 80 percent of university qualifications (qualifications at NVQ level 5) are awarded following the completion of 16 years or more of education. However, there is considerable variability. For instance, among individuals whose highest reported qualification is NVQ level 3, 13 percent had 12 years of education, 26 percent had 13 years of education and 9 percent had 14 years of education. However approximately 37 percent of individuals who hold qualifications at NVQ level 3 had left education before completing 12 years of full-time continuous education i.e., before 17 years of age. Also there is great variability in the number of years of continuous education that it takes to complete qualifications awarded at NVQ level 4 with 55 percent of individuals completing these qualifications after the age of 18. In contrast to the US, the flexible features of the UK education system make any possibility of identifying a straightforward relationship between years of schooling and educational qualifications cumbersome.

Table 8. Cross tabulation of highest qualification received by completed years of education

Years of education	Highest educational qualification					
	None	NVQ1	NVQ2	NVQ3	NVQ4	NVQ5
10	71.12	24.58	19.13	10.10	11.55	2.04
11	23.58	56.92	47.00	26.62	22.96	5.80
12	2.24	10.61	17.32	13.63	10.31	2.91
13	1.01	4.15	10.00	26.38	11.35	5.77
14	0.61	1.17	2.62	8.75	4.13	1.67
15	0.24	0.49	1.00	4.55	6.04	2.95
16	0.23	0.23	0.84	3.51	14.39	20.98
17	0.18	0.22	0.33	1.64	5.83	21.41
18	0.80	1.63	1.76	3.82	13.45	36.47
	100	100	100	100	100	100

Following Hungerford and Solon (1987) I begin by estimating the wage equation with a string of dummy variables corresponding to each distinct number of years of completed schooling:

$$\ln y_i = \beta_0 + \sum_{j=11}^{18} \beta_j D\left(s = j\right)_i + \varepsilon_i \tag{3}$$

This is an indirect method of estimating sheepskin effects. The idea is that the completion of 13 years of education, for example, is assumed to mark the receipt of a qualification awarded at NVQ level 3 such as A-levels' qualifications. As outlined above, the mapping from years of schooling to educational qualifications is far from exact. Therefore using only information on years of education may result in biased estimates of the effects of qualifications on earnings.

As Jaeger and Page (1996) show, given information on qualifications and years of schooling it is possible to directly test for sheepskin effects. Following these authors I also estimate the human capital equation where there is a string of dummy variables for each schooling year and educational qualification as follows:

$$\ln y_i = \beta_0 + \sum_{j=11}^{18} \beta_j D\left(s = j\right)_i + \sum_{k=1}^{5} \beta_k NVQ_k + \varepsilon_i \tag{4}$$

The major advantage of this specification is that the effects of educational qualifications are identified for individuals who have completed a course of study, regardless of when they finish.

The results of these specifications estimated over the pooled sample (1985-2003) are presented in Table 9 for men and women, respectively. Estimates based on the first specification, which has been traditionally used in this literature, largely overstate the effects of years of schooling where qualifications have not been produced. There are large returns to educational qualifications as well as (marginal) returns associated with specific years of schooling. Furthermore, sheepskin effects appear to be smaller for women with lower years of education than for men but larger for women than for men with higher specific years of education. These results are in line with those of Belman and Heywood (1991) who compared sheepskin effects for men and women using specific years of education. However, when sheepskin effects are measured using educational qualifications, the results suggests that sheepskin effects are somewhat larger for women across all educational qualifications than those of men, although the differences in estimates

are not always statistically significant. These results are in agreement with those of Jaeger and Page (1996) who found that when using actual information on degree receipt there are few statistically significant differences in sheepskin effects between men and women.

Table 9. Sheepskin effects, men and women, specifications (1) and (2)

	(a) Men		(b) Women	
Default school=10	1	2	1	2
School=11	0.178	0.105	0.142	0.063
	(0.005)***	(0.005)***	(0.005)***	(0.006)***
School=12	0.269	0.148	0.258	0.127
	(0.008)***	(0.008)***	(0.007)***	(0.007)***
School=13	0.371	0.204	0.338	0.159
	(0.008)***	(0.008)***	(0.007)***	(0.008)***
School=14	0.326	0.164	0.33	0.146
	(0.012)***	(0.012)***	(0.011)***	(0.012)***
School=15	0.373	0.163	0.49	0.192
	(0.014)***	(0.014)***	(0.013)***	(0.013)***
School=16	0.535	0.197	0.636	0.241
	(0.009)***	(0.010)***	(0.008)***	(0.010)***
School=17	0.549	0.172	0.656	0.228
	(0.010)***	(0.011)***	(0.010)***	(0.012)***
School=18	0.457	0.098	0.584	0.209
	(0.007)***	(0.009)***	(0.008)***	(0.010)***
NVQ1		0.066		0.105
		(0.009)***		(0.007)***
NVQ2		0.139		0.168
		(0.005)***		(0.006)***
NVQ3		0.237		0.254
		(0.007)***		(0.008)***
NVQ4		0.328		0.43
		(0.007)***		(0.008)***
NVQ5		0.53		0.566
		(0.008)***		(0.009)***

Note: Standard errors are presented in parentheses underneath the coefficients. * significant at 10%; ** significant at 5%; *** significant at 1%. Specifications include dummy variables for part-time status and controls for age and age squared.

Table 10. Sheepskin effects, fully-interacted model, men and women

Schooling	NVQ0	NVQ1	NVQ2	NVQ3	NVQ4	NVQ5
(a) Men						
School=10	Default		0.101	0.200	0.285	
			(0.008)***	(0.013)***	(0.013)***	
School=11	0.052	0.156	0.243	0.337	0.443	
	(0.009)***	(0.011)***	(0.007)***	(0.010)***	(0.010)***	
School=12			0.301	0.338	0.489	
			(0.011)***	(0.014)***	(0.016)***	
School=13			0.324	0.454	0.528	
			(0.014)***	(0.011)***	(0.017)***	
School=14						
School=15						
School=16					0.470	0.736
					(0.018)***	(0.012)***
School=17						0.697
						(0.011)***
School=18					0.404	0.620
					(0.016)***	(0.009)***
(b) Women						
School=10	Default	0.139	0.144			
		(0.010)***	(0.010)***			
School=11	0.056	0.155	0.238	0.334	0.455	
	(0.008)***	(0.009)***	(0.007)***	(0.013)***	(0.015)***	
School=12		0.221	0.310	0.347	0.561	
		(0.016)***	(0.009)***	(0.014)***	(0.017)***	
School=13			0.316	0.434	0.555	
			(0.011)***	(0.011)***	(0.015)***	
School=14				0.431		
				(0.018)***		
School=15						
School=16					0.694	0.783
					(0.012)***	(0.012)***
School=17						0.786
						(0.012)***
School=18					0.672	0.794
					(0.013)***	(0.010)***

Note: Standard errors are presented in parentheses underneath the coefficients. * significant at 10%; ** significant at 5%; *** significant at 1%. Specifications include dummy variables for part-time status and controls for age and age squared. Empty cells contain less than 1 percent of the sample size.

This model constrains the sheepskin effects associated with each qualification to be the same for all years of continuous education received. To test the robustness of these results I estimate a fully-interacted model like that estimated by Jaeger and Page (1996) and Park (1999) which includes separate dummies for the interaction terms for each year of education and each qualification:

$$\ln y_i = \beta_0 + \sum_{j=10}^{18} \sum_{k=0}^{5} \beta_{jk} NVQ_k \times D\left(s = j\right)_i + \varepsilon_i \tag{5}$$

This model is a more accurate measure of sheepskin effects associated with a particular qualification in that it measures the wage differential between those who have that qualification and those who do not, conditioning on both groups of individuals having the same number of years of continuous education. The results of this model are reported over the pooled sample for men and women in Table 10. The table only report coefficients from cells which contain more than one percent of the sample size.

For both men and women higher educational qualifications always convey higher earnings, holding years of schooling constant. For men the marginal earnings difference between a qualification at NVQ level 5 and NVQ level 4 varies from 9 percent conditioning on 17 years of full-time schooling to as much as 17 percent conditioning on 18 years of schooling, for example. A high level of variation is also apparent when comparing the returns to qualifications at NVQ level 4 and NVQ level 3, with a marginal effect of 11 percent conditioning on 11 years of education, as opposed to an effect of 16 percent conditioning on 12 years of education. Similar variation in sheepskin effects by years of schooling can also be illustrated for women.

V. Conclusion

Despite the considerable educational upgrading of the labor force, few studies have examined changes in the returns to education over time for the UK. In this article I examined the returns to education between 1985 and 2003 for men and women separately. The results make clear the existence of significant and large returns to investments in education whether measured by years of schooling or educational qualifications. The rate of return to all levels of education for men

remained fairly stable or slightly increased over time while the returns to all educational qualifications noticeably declined for women. Quantile regression estimates indicate that over time younger workers have come to experience more unequal returns to education across the wage distribution. Highly-educated groups of younger men and women at the top end of the earnings distribution have fared considerably better than men and women at the lower end.

I also examined the value of specific years of education in relation to educational qualifications in the context of sheepskin effects. The results suggest that higher education qualifications are always associated with higher earnings, even if qualifications take the same number of years of schooling to complete. If this is not entirely a signaling story, then aiming for higher certified standards in education would on average increase the social as well as private returns to investment in education.

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