

Time or Paper?

A Direct Test for Sheepskin Effects in the Returns to Education

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Abstract

Sheepskin effects are the wage returns specific to educational credentials rather than to accumulated years of education. Evidence on these effects is often used in debates about the educational signalling hypothesis. Many studies indirectly estimate sheepskin effects from non-linear wage returns to schooling years that correspond to the 'standard' time taken to complete a qualification but such methods are likely to be biased. Instead, this study directly estimates sheepskin effects from a survey with information on both years of education and qualifications received. The results show that the directly estimated sheepskin effects are considerably larger than the indirect estimates, with the returns to credentials exceeding the returns to accumulated years of education. The patterns of directly estimated sheepskin effects across population sub-groups contradict some previous findings from the literature.

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TIME OR PAPER?

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I. Introduction

Why do workers with educational qualifications earn higher pay than those who are unqualified? According to human capital theory, it is to compensate them for the cost and time spent learning. In the famous words of Adam Smith, “the wages of labour vary with the easiness and cheapness, or the difficulty and expense of learning the business”.¹ A different interpretation of the correlation between qualifications and wages is given by signalling theory; those who are inherently more productive gain qualifications in order to signal their productivity to employers (Arrow, 1973). Sheepskin effects, which are the wage returns specific to educational credentials rather than to accumulated years of education,² have been an important part of the debate between human capital and signalling explanations of wages (Layard and Psacharopoulos, 1974; Hungerford and Solon, 1987). But most evidence in this debate is indirect; testing whether wages rise faster with extra years of education when the extra year corresponds to the standard time needed for a credential, rather than looking directly at the value of credentials.

Recent evidence suggests that examining non-linear wage returns to the schooling years in which credentials might typically be granted understates the size of sheepskin effects (Jaeger and Page, 1996). The downward bias is due to measurement error – not everyone who is educated for the requisite number of years earns a credential while others take different amounts of time to complete their qualifications. The evidence on this bias comes from a unique case, when the US Current Population Survey (CPS) changed from asking about years of education to asking about highest degree received.³ The indirect method, using just information on years of education, suggests sheepskin effects of 3% for a high school diploma and 13% for a bachelor’s degree, while the directly estimated sheepskin effects are 9% and 21% (Park, 1999).

This paper reports further direct evidence on sheepskin effects, for New Zealand, using a survey with information on both years of education and qualifications received. In contrast to the US, the educational system in New Zealand has a complex structure, with students terminating their schooling after either Year 11, 12, or 13 and degrees designed to take either three or four years to complete.⁴ Hence, results from this setting may show whether previous reports of measurement error in indirect estimates of sheepskin effects apply more generally. A further aim is to compare patterns of sheepskin effects across population sub-groups with previously reported patterns from indirect estimates (that is, inferred from the standard time taken to complete a qualification). In particular, we test the claim of Belman and Heywood (1991, 1997) that sheepskin effects are larger for women and for younger workers, because both of these patterns have been used as evidence for signalling models.

Whether wages depend on the *time* spent learning or the *paper* that is accumulated along the way in the form of educational credentials has several important implications. In the presence of signalling effects there are external costs of education because each individual fails to take account of the effect of their investment decisions on the market equilibrium. Additional education obtained by individuals of a given ability raises the education needed by the more able if they are to signal their greater talents,⁵ so a case can be made for interventions to raise the private cost of education (Riley, 1979). There is also the practical implication of what questions to include in labour force surveys, which usually ask about *either* years of schooling or highest qualifications. Indeed, the recent change in the CPS reflected the belief that qualifications are the more important indicator of educational attainment, because of the effect of credentialing on labour market rewards (Kominski and Siegel, 1993).

Sheepskin effects may be important even if it is believed that they are not just returns to signals. Graduates may be more efficient learners (Chiswick, 1973) and as a result enjoy proportionately larger increases in their productivity than years of education alone would suggest. Alternatively, graduates may just have more perseverance, be better at following the rules, or apply more effort. To the extent that these characteristics are valuable, due, for example, to the likely impact of perseverance on absenteeism and quit behaviour, firms may be willing to pay more for graduates (Weiss, 1995).

II. Methods of Estimating Sheepskin Effects

A typical, indirect, way of measuring sheepskin effects is to use a wage equation that allows discontinuities in the schooling years that correspond to the usual time taken to complete a particular qualification. For example, if the 12th and 16th year of education are assumed to be synonymous with the receipt of high school diplomas and Bachelor's degrees, then

$$\ln w = \mathbf{b}_1 D(S \geq 12) + \mathbf{b}_2 D(S \geq 16) + f(S) + \mathbf{Zg} + \mathbf{e} \quad (1)$$

may be used, where w is the wage rate, S is years of schooling, $D(S \geq 12)$ is a dummy variable equal to 1 if $S \geq 12$, $D(S \geq 16)$ is similarly defined for $S \geq 16$, \mathbf{Z} is a matrix of control variables and \mathbf{e} is the regression error. In the literature, $f(S)$ has been either a linear or cubic function of school years or a linear spline with knot points corresponding to the diploma and degree years.⁶ An alternative is to use a string of dummy variables, one for each schooling year, thereby relaxing the assumption that education enters the wage equation linearly or piece-wise linearly (Hungerford and Solon, 1987; Patrinos, 1996). In the equation (1) framework, positive estimates of \mathbf{b}_1 and \mathbf{b}_2 are assumed to indicate sheepskin effects associated with the receipt of a high school diploma and a Bachelor's degree.

But to the extent that people take non-standard amounts of time to gain credentials, or do not earn them at all, measurement errors will make $\hat{\mathbf{b}}_1$ and $\hat{\mathbf{b}}_2$ attenuated measures of the true sheepskin effects. Using a string of dummy variables for schooling years may also make the wrong comparison because the returns to a year that usually entails a degree are contrasted with the returns to *other* schooling years. A stronger test would be to compare the earnings of those who have the degree and those who do not, conditional on both groups having the *same* number of years of schooling (Park, 1999).

If information is available on both years of schooling and qualifications received, *direct* estimates of sheepskin effects can be estimated from equations such as:

$$\ln w = \sum_{i=1}^I \mathbf{b}_i D(\text{qualification} = i) + \sum_{j=1}^J \mathbf{b}_j D(S = j) + \mathbf{Zg} + \mathbf{e} \quad (2)$$

where there are strings of dummy variables for both the vector of i qualifications and j school years (Jaeger and Page, 1996). Equation (2) restricts the sheepskin effects associated with each qualification to be the same for all years of education received. For example, the gain in wages from having a high school diploma compared with being uncertified is assumed to be the same regardless of whether one has 11, 12, or 13 years of education. A more general approach, used by both Jaeger and Page (1996) and Park (1999), is to include separate dummies for the interaction terms for each year of education and each qualification:

$$\ln w = \sum_{i=1}^I \sum_{j=1}^J \mathbf{b}_{ij} D(\text{qualification} = i) \times D(S = j) + \mathbf{Zg} + \mathbf{e}. \quad (3)$$

For example, the difference between $\mathbf{b}_{Bachelor's, 18}$ and $\mathbf{b}_{Master's, 18}$ gives an estimate of the extra return to obtaining a Master's degree, conditional on having 18 years of education. In the equation (3) framework, the marginal value of the Master's degree is allowed to vary between those with, say, 17 or 18 years of education.

III. Data

The data used in this study come from the Education and Training Survey (ETS), which was a one-off survey conducted by Statistics New Zealand as a supplement to the September 1996 Household Labour Force Survey (the local equivalent to the CPS). The ETS collected information on each respondent's years of education at secondary school and full-time equivalent years at post-school level. To convert these data into years of education, it is assumed that eight years of school are completed prior to secondary school.

The ETS also obtained information on the highest qualifications received from the following set: School Certificate, University Entrance, Bursary, post-school Diploma, Bachelor's degree, and Post-graduate degree. The first three of these credentials are obtained at secondary school and are typically received at the end of the 5th, 6th, and 7th Form (that is, at the end of Year 11, 12, and 13). The University Entrance qualification serves as the exit point from school for many students, and as the name suggests, it is sufficient for gaining access to university. However, many students stay an extra year for the Bursary examinations which can improve entry chances for competitive university courses such as medical degrees. The post-school Diploma covers a range of vocational qualifications, similar to those covered by "Associate degrees" in the US, and the transition from secondary school into post-school Diploma studies may occur after either the 5th, 6th or 7th Form.

Table 1 contains a cross-tabulation of highest qualification by full-time equivalent years of education. While higher qualifications are associated with more years spent schooling, many observations are in the off-diagonal cells. For example, amongst individuals whose highest qualification is School Certificate, only 33% of them received exactly 11 years of education. Similarly, only 34% of individuals with a Bachelor's degree received exactly 17 years of

education, with 26% taking less time to earn a degree (which is not surprising, given the presence of three-year degrees and the possibility of university entrance after 12 years of school) and 40% taking longer. In general, people appear to have studied for more years than would be predicted from the ‘standard’ time taken to receive their highest qualification.⁷

(Table 1 about here)

Looked at from the other dimension, the results in Table 1 show that using years of education to infer the highest qualification received leads to an overstatement of qualifications. For example, only 42% of those individuals who reported finishing exactly 12 years of education received the University Entrance qualification (normally gained in Year 12) or better. Hence, while analysts in the U.S. note that a non-trivial amount of misclassification occurs when one infers attainment of a degree from years of schooling (Kominski and Siegel, 1993), in an educational system like New Zealand’s the potential error appears even greater.

Dependent variable

One factor complicating estimation of the wage equations is that the ETS reports annual earnings rather than wages, and these data on earnings are not continuous. Instead, they fall into five intervals (<\$14,000, \$14,001-\$22,000, \$22,001-\$29,000, \$29,001-\$39,000, and >\$39,000)⁸ Despite being widely used, OLS estimation of an equation with interval data as the dependent variable (implemented, for example, by using the mid-points of the intervals) is generally inconsistent (Steward, 1983). Instead, a consistent maximum likelihood procedure, which is a generalisation of the Tobit model, is used here (StataCorp, 1997). This model requires the end points of the intervals to be specified (with the exception of the lower end-point for the bottom interval and the upper end-point for the top interval, which are censored).

The estimation method also takes account of the sampling weights and uses heteroscedastically-robust variance-covariance estimators.

Sample selection

Although the ETS has a sample of 22,257, a total of 10,443 respondents were either not employed or else had missing information on earnings and so were excluded from the analysis. Part-time workers ($n=2969$) are excluded because it is difficult to know from the annual earnings variable whether these workers have low wages or low labour supply.⁹ Also excluded were 319 workers who had either not completed their schooling or had missing information on years of schooling, leaving a final estimating sample of 8526. This was comprised of 5033 male workers and 3493 female workers. Appendix Table 1 reports descriptive statistics for this sample, disaggregated by gender.

IV. Results

Indirect estimates of sheepskin effect are made using equation (1), based on a specification originally from Hungerford and Solon (1987) with a cubic in years of education and discontinuities after the 12th and 16th years. The results for male's log annual earnings are:

$$\ln Y = 9.606 + 0.005S + 0.008S^2 - 0.001S^3 + 0.076D(S \geq 12) + 0.040D(S \geq 16) + \text{experience}$$

$$(0.058) \quad (0.032) \quad (0.005) \quad (0.000) \quad (0.029) \quad (0.034)$$

where standard errors are in () and the coefficients on the experience quadratic are not presented. This indirect approach to measuring sheepskin effects suggests that the completion of Year 12, which is assumed to mark the receipt of secondary school leaving qualifications that permit entry to university, causes a jump in earnings of 7.9%.¹⁰ But the indirect estimate of the sheepskin effect for the completion of Year 16, assumed to mark the receipt of a four-year Bachelor's degree,¹¹ is not significantly different from zero. Moreover, in the estimates of

this same equation for females, neither of the coefficients on the dummy variables are statistically significant. Hence, this indirect approach suggests that if there are sheepskin effects in the returns to education in New Zealand, they occur only for secondary school qualifications and only for males. However, as is made clear from Table 1, indirect approaches that infer the receipt of a credential from the time spent in school are fraught with difficulty in a setting like New Zealand where there are multiple transition points from secondary to tertiary education.

Another typical method of indirectly estimating sheepskin effects is to use a string of dummy variables, one for each year of school. The results of this approach are reported separately for males and females in columns (i) and (iii) of Table 2. The implied steps in predicted log earnings for each extra year of education are obtained as $\mathbf{b}_{j+1} - \mathbf{b}_j$. The results reported in Figure 1 show considerable non-linearity. However, it is more difficult to infer the presence of sheepskin effects; while the largest steps for males occur with the 11th, 12th, and 17th years of education that can coincide with the receipt of credentials, the steps are almost as large for the 15th, 16th and 20th years of education. The patterns for females are even more disparate, with a large step in the 17th year, when Bachelor's degrees are likely, but not in the 16th year when a degree is also possible, and a large step again in the 15th year when a degree is unlikely.¹²

(Figure 1 about here)

The stronger test of sheepskin effects uses direct information on both years of education and qualifications received (Table 2, column (ii) and (iv)). Several contrasts with the indirect estimates are apparent. First, all three of the secondary school qualifications earn their holders a significant earnings premium. For example, males who hold the University Entrance

qualification have annual earnings that are 23% higher than those of someone with the same number of years of education but no qualifications. This is substantially higher than the 8% sheepskin effect inferred from equation (1). The second contrast is that the sheepskin effects appear to be larger for women than for men, across all six qualifications considered in Table 2, while the equation (1) approach suggested no sheepskin effects for women.

(Table 2 about here)

It is also apparent from the results in Table 2 that *both* years of education and highest qualification gained are relevant in explaining earnings, with the null hypotheses excluding each group of variables easily rejected ($p < 0.001$). But typically the larger part of the total return to education appears to be due to sheepskin effects. The coefficients on the dummy variables in columns (i) and (iii) can be interpreted as the total return to education while the coefficients on the years-of-education dummy variables in columns (ii) and (iv) give the total return to education net of sheepskin effects (Jaeger and Page, 1996). Figure 2 plots the percentage earnings increase implied by these two sets of coefficients and it is apparent that over one-half of the increase in earnings for advanced years of education is due to credentials. For example, absent the effects of credentials, earnings for a male with 15 years of education are only 18% higher than earnings for someone with eight or fewer years of education, but when the effects of credentials are included the earnings gap rises to 38%. With 17 years of education, male earnings are 35% higher than for the reference group when the credential effects are purged but 70% higher when the effects of credentials are included. For similarly educated women, the earnings premia are 32% and 73%.

(Figure 2 about here)

Although the results in Table 2 use the full amount of information on both years and qualifications, they do constrain the effects for each credential to be independent of the years of education. The results for equation (3), which is the fully interacted model that allows effects for each credential to vary with years of education, are reported in Appendix Tables 2 and 3 for males and females. It should be noted that some of the regression output is suppressed because coefficients estimated for particular interactions of years and qualifications representing few sample members may be less reliable and so cause spurious estimates of sheepskin effects. Specifically, following Jaeger and Page (1996), the appendix tables only report those coefficients from cells with >40 observations, even though the underlying model contained all possible interaction terms.

Sheepskin effects for particular credentials change somewhat as the years of education vary, as can be seen from how the comparison across columns varies by row. For example, the marginal effect on earnings of having University Entrance over School Certificate is estimated as 10% from the Table 2 results.¹³ But using the fully interacted model, the marginal effect varies from 9%, conditional on 12 years of education, to 14%, conditional of 13 years of education.¹⁴ Even greater variation is apparent when comparing the returns to a Bachelor's degree with the returns to a post-school Diploma, with a marginal effect on earnings of 36% conditional on 16 years of education, as opposed to an effect of only 22% in Table 2. However, the fully interacted model is very demanding of data and given the relatively small sample, many of the coefficients are not statistically significant, especially for females.

V. Sheepskin Effects Across Population Sub-groups

Several studies that infer sheepskin effects from the non-linear returns to years of education also examine the patterns across population sub-groups. For example, Belman and Heywood

(1991) find women and minorities earning larger sheepskin effects for advanced qualifications but smaller sheepskin effects for high school graduation than do white males. Signalling models that predict that minorities have smaller returns to low productivity signals but larger returns to high productivity signals (Golbe, 1985) are considered to be supported by this pattern. However, it is not clear whether these patterns across population sub-groups hold up when sheepskin effects are measured directly using information on both years of education and qualifications received. For example, Jaeger and Page (1996) find few statistically significant differences in sheepskin effects between race and sex groups and there is no consistent pattern to the differences that would lend support to the signalling model of Golbe (1985).

The results in Table 2 also do not lend support to this signalling model because although sheepskin effects usually appear larger for women, the gender difference is most marked for the lower qualifications while there is no difference in the sheepskin effect of postgraduate degrees for men and women. To further test the hypothesis of differences in sheepskin effects between males and females, the models in column (ii) and (iv) were pooled in a single regression by interacting a sex dummy variable with each of the years of education and qualifications dummy variables, and with the quadratic in experience. None of the differences in sheepskin effects between men and women across individual qualifications were statistically significant and the joint test of differences was also insignificant ($p < 0.83$).

Another interesting pattern that has been found across population sub-groups is that sheepskin effects appear to be significant for younger age cohorts but virtually non-existent for older workers (Belman and Heywood, 1997). This pattern fits predictions from a model where employers gain additional information – that is not orthogonal to the educational signal – about the actual productivity of their workers over time. To test their hypothesis that the

returns to educational signals decline with experience, Belman and Heywood (1997) use data from the 1991 CPS, split into five age cohorts. Because this CPS file has data on years of education but not on credentials, they use a linear spline with knot points at 8, 12, and 16 years of education to examine the pattern of (indirect) sheepskin effects across age cohorts.

The results in Table 3 report a replication of this test, albeit with some adaptations, for both male and female workers in New Zealand. The main change is that the sample is split into only two age cohort groups because the ETS sample is much smaller than the 70,000 observations used by Belman and Heywood. This splitting of the sample occurs at age 35, which is approximately the median age. To test the hypothesis of differences in sheepskin effects between less and more experienced workers, the age dummy variable was interacted with each of the years of education and qualifications dummy variables, and with the quadratic in experience. In direct contrast to the existing (indirect) evidence of declining sheepskin effects with age, for male workers in New Zealand the sheepskin effects for all qualifications except the post-school Diploma were *larger* for the older cohort, although the joint difference was not statistically significant. The results for females are even less supportive of the hypothesis, with significantly larger sheepskin effects found amongst the older workers for the University Entrance and Bursary qualifications. The joint test of the difference in sheepskin effects across all qualifications was also statistically significant for females ($p < 0.01$).

(Table 3 about here)

The fact that the returns to educational signals are possibly larger, and certainly not smaller, for older, more experienced workers than they are for younger workers is not necessarily inconsistent with the educational signalling hypothesis. For example, Riley (1979) points out that a signalling equilibrium requires that employers find out that their predictions of worker's

productivity based on the educational signals are correct on average. Hence, the wage increases for the workers who prove to be unexpectedly productive should offset the wage decreases for those workers who prove to be less productive than their credentials would have predicted. In other words, the effect of the signal on the level of wages is independent of labour market experience (Farber and Gibbons, 1996). However, the results in Table 3 may count against the particular signalling model constructed by Belman and Heywood (1997), and once again illustrate the point that the patterns of sheepskin effects that are found using indirect estimation methods based on years of education may not hold when direct information on both qualifications and years of education is available.

VI. Conclusions

This study has directly estimated sheepskin effects in New Zealand using a survey with information on both years of education and highest qualifications received. The results show that methods of indirectly estimating sheepskin effects from non-linear wage returns to schooling years that correspond to the ‘standard’ time taken to complete a qualification are biased by measurement error. The bias found with the New Zealand data appears larger than that previously found by studies that exploit the change in the US Current Population Survey from asking about years of education to asking about qualifications (Jaeger and Page, 1996; Park, 1999). This larger bias is not surprising, given the more complex structure of the educational system in New Zealand. Hence, these results suggest that it would be sensible for labour force surveys to include questions on *both* years of schooling and highest qualifications, particularly in countries where there are multiple transition points from secondary to tertiary level education.

In terms of the question contained in the title of this paper, the results suggest that earnings depend on both the *time* spent learning and the *paper* that is accumulated along the way in the form of

educational credentials. However, in the New Zealand setting, the returns to credentials appear to exceed the returns to years of education. It also appears that the patterns of these directly estimated returns to credentials across population sub-groups do not conform to the patterns found previously, where indirect estimation methods have been used. Hence, there are further grounds for caution in interpreting the results of studies that infer sheepskin effects from non-linear wage returns to schooling years that correspond to the usual time taken to complete a qualification.

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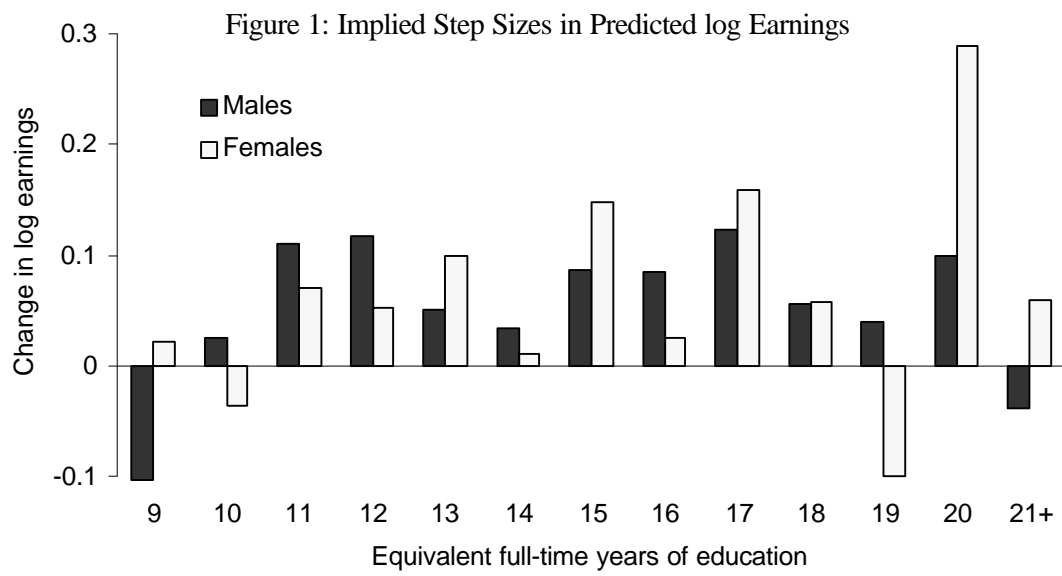


Figure 2a. Returns to Years of Education for Men
(Relative to Base Group With 8 or Fewer Years of Education)

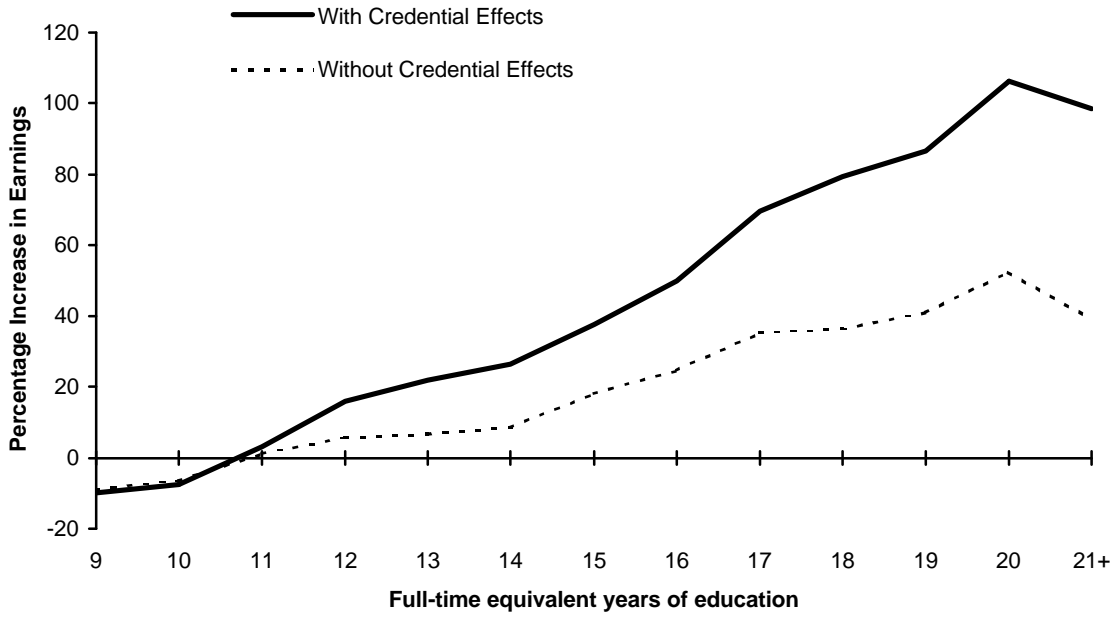


Figure 2b. Returns to Years of Education for Women
(Relative to Base Group With 8 or Fewer Years of Education)

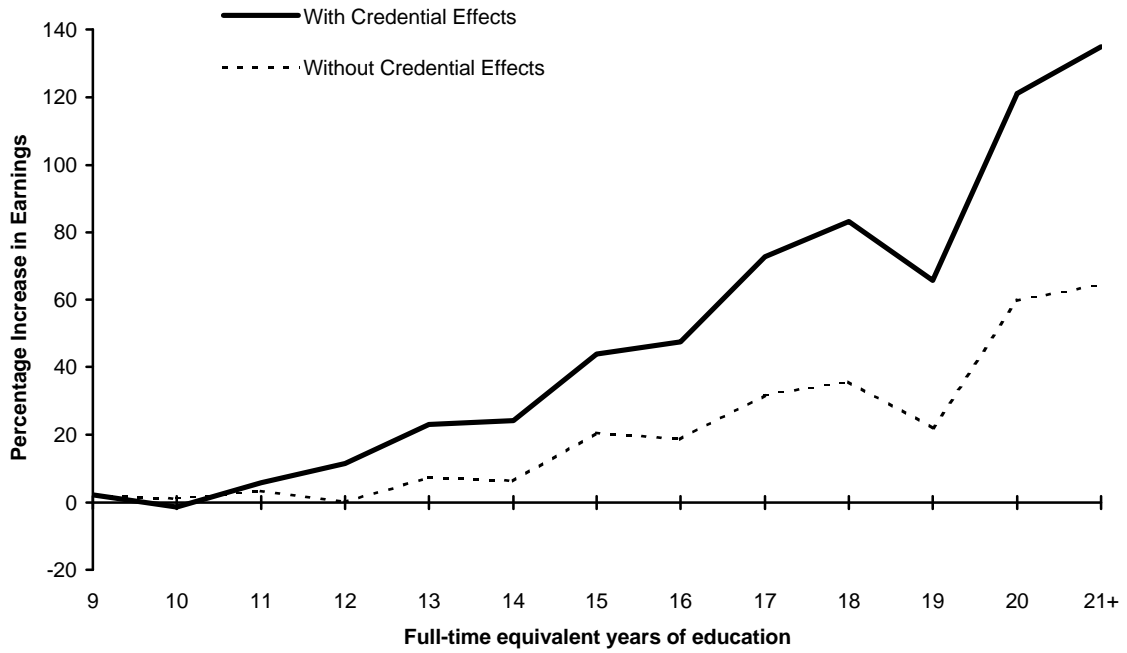


Table 1: Cross-Tabulation of Highest Qualification by Full-time Equivalent Years of Education

Years of education	Highest Qualification Received							TOTAL
	None	School Certificate	University Entrance	Bursary	Diploma	Bachelor's Degree	Post-graduate	
0 – 8	67							71
9	91							96
10	550	19						576
11	935	406	31		45			1419
12	348	466	329	25	218			1389
13	129	190	289	96	340			1052
14	47	79	144	75	483			849
15	36	37	78	52	561	34	13	811
16	14	27	29	35	499	141	34	779
17			15	25	275	224	61	619
18					126	145	73	365
19					66	72	63	207
20					33	30	46	110
≥ 21					32	34	111	183
TOTAL	2229	1244	929	327	2684	689	424	8526

Note: Tabulated from a sample of full-time workers in the 1996 Education and Training Survey. Empty cells are suppressed for confidentiality reasons and usually contain 10 or fewer observations (row and column totals include all observations).

Table 2: The Effect of Years of Education and Highest Qualification on log Annual Earnings^a

	Males				Females			
	(i)		(ii)		(iii)		(iv)	
	β$	|t|$	β$	|t|$	β$	|t|$	β$	|t|$
<i>Completed school years^b</i>								
$S = 9$	-0.103	(1.21)	-0.093	(1.16)	0.022	(0.18)	0.020	(0.21)
$S = 10$	-0.078	(1.00)	-0.065	(0.88)	-0.015	(0.25)	0.011	(0.18)
$S = 11$	0.032	(0.42)	0.010	(0.14)	0.055	(0.97)	0.033	(0.55)
$S = 12$	0.149	(1.93)	0.056	(0.76)	0.107	(1.86)	0.001	(0.01)
$S = 13$	0.199	(2.56)	0.065	(0.86)	0.206	(3.48)	0.069	(1.10)
$S = 14$	0.234	(2.99)	0.082	(1.06)	0.216	(3.65)	0.061	(0.95)
$S = 15$	0.320	(4.11)	0.166	(2.16)	0.363	(5.96)	0.186	(2.80)
$S = 16$	0.405	(5.16)	0.220	(2.82)	0.388	(6.29)	0.171	(2.50)
$S = 17$	0.528	(6.57)	0.302	(3.72)	0.547	(8.88)	0.276	(3.99)
$S = 18$	0.584	(6.90)	0.310	(3.63)	0.605	(9.07)	0.306	(4.06)
$S = 19$	0.624	(6.85)	0.343	(3.70)	0.505	(6.56)	0.199	(2.39)
$S = 20$	0.724	(7.32)	0.422	(4.14)	0.794	(8.50)	0.468	(4.92)
$S = 21$ or more	0.685	(6.99)	0.330	(3.26)	0.853	(9.79)	0.498	(5.16)
<i>Highest qualification</i>								
School Certificate	...	...	0.109	(4.62)	...	...	0.150	(6.34)
University Entrance	...	...	0.205	(6.79)	...	...	0.243	(7.35)
Bursary	...	...	0.175	(4.08)	...	...	0.200	(4.64)
Diploma	...	...	0.167	(6.33)	...	...	0.217	(7.48)
Bachelor's Degree	...	...	0.369	(8.65)	...	...	0.407	(9.61)
Postgraduate	...	...	0.461	(8.18)	...	...	0.455	(7.98)
Potential experience	0.046	(22.1)	0.046	(22.3)	0.031	(14.0)	0.031	(14.6)
Potential experience ²	-0.001	(16.5)	-0.001	(16.4)	-0.001	(11.2)	-0.001	(11.4)
Intercept	9.671	(126)	9.655	(134)	9.641	(166)	9.578	(160)
Wald test (slopes = 0)	$\chi^2_{(15)} = 1322.4$		$\chi^2_{(21)} = 1457.2$		$\chi^2_{(15)} = 818.2$		$\chi^2_{(21)} = 1004.4$	
H_0 : Years dummies = 0			$\chi^2_{(13)} = 111.6$				$\chi^2_{(13)} = 100.0$	
H_0 : Qualifications = 0			$\chi^2_{(6)} = 113.7$				$\chi^2_{(6)} = 122.0$	

Note: Estimates weighted by population sampling weights and t -statistics based on heteroscedastically-consistent standard errors. The sample has 5033 males and 3493 females. The default category is eight or fewer completed years of education (i.e. nil years of secondary schooling) and no educational qualifications.

^a Earnings are pre-tax and are reported in interval form.

^b It is assumed that eight years of education are completed prior to secondary school because the data refer only to equivalent full-time years of secondary school attendance and post-secondary school educational study.

Table 3: Sheepskin Effects by Age Groups

	Males				Females			
	Age ≤ 35 years		Age > 35 years		Age ≤ 35 years		Age > 35 years	
	β	|t|	β	|t|	β	|t|	β	|t|
<i>Completed school years^b</i>								
<i>S</i> = 9	0.248	(1.57)	-0.093	(1.13)	0.032	(0.21)	0.025	(0.33)
<i>S</i> = 10	0.314	(2.39)	-0.052	(0.66)	-0.168	(1.73)	0.094	(1.42)
<i>S</i> = 11	0.438	(3.39)	-0.002	(0.02)	-0.075	(0.94)	0.131	(2.00)
<i>S</i> = 12	0.494	(3.80)	0.034	(0.41)	-0.054	(0.68)	0.065	(0.95)
<i>S</i> = 13	0.531	(4.03)	0.016	(0.19)	0.015	(0.19)	0.137	(1.84)
<i>S</i> = 14	0.527	(3.95)	0.072	(0.81)	0.032	(0.37)	0.180	(2.37)
<i>S</i> = 15	0.652	(4.87)	0.119	(1.38)	0.179	(2.04)	0.248	(3.08)
<i>S</i> = 16	0.757	(5.62)	0.104	(1.18)	0.193	(2.15)	0.205	(2.47)
<i>S</i> = 17	0.769	(5.56)	0.269	(2.84)	0.302	(3.25)	0.343	(3.98)
<i>S</i> = 18	0.903	(6.42)	0.151	(1.47)	0.410	(4.12)	0.298	(3.23)
<i>S</i> = 19	0.925	(6.20)	0.211	(1.83)	0.218	(1.78)	0.257	(2.46)
<i>S</i> = 20	0.906	(5.83)	0.335	(2.52)	0.498	(3.28)	0.544	(4.89)
<i>S</i> = 21 or more	1.041	(6.53)	0.167	(1.39)	0.695	(4.11)	0.478	(4.33)
<i>Highest qualification</i>								
School Certificate	0.070	(2.48)	0.171	(4.17)	0.182	(5.18)	0.103	(3.40)
University Entrance	0.158	(4.50)	0.284	(5.00)	0.185	(4.72)	0.307	(5.15)
Bursary	0.113	(2.26)	0.345	(4.11)	0.139	(2.87)	0.392	(4.71)
Diploma	0.127	(3.60)	0.191	(4.76)	0.192	(4.77)	0.201	(4.95)
Bachelor's Degree	0.304	(5.51)	0.384	(5.76)	0.349	(6.28)	0.396	(6.31)
Postgraduate	0.329	(4.55)	0.561	(6.90)	0.355	(4.41)	0.463	(6.05)
Potential experience	0.085	(14.2)	0.014	(1.53)	0.093	(14.2)	-0.017	(1.87)
Potential experience ²	-0.003	(8.33)	0.000	(1.73)	-0.003	(9.43)	0.000	(1.90)
Intercept	9.074	(70.0)	10.109	(66.0)	9.411	(111)	10.124	(67.9)
Wald test (slopes = 0)	$\chi^2_{(21)} = 1122.8$		$\chi^2_{(21)} = 418.8$		$\chi^2_{(21)} = 739.1$		$\chi^2_{(21)} = 523.9$	
H ₀ : Years dummies = 0	$\chi^2_{(13)} = 138.0$		$\chi^2_{(13)} = 34.4$		$\chi^2_{(13)} = 97.5$		$\chi^2_{(13)} = 50.0$	
H ₀ : Qualifications = 0	$\chi^2_{(6)} = 43.0$		$\chi^2_{(6)} = 71.9$		$\chi^2_{(6)} = 51.0$		$\chi^2_{(6)} = 71.7$	
H ₀ : Sheepskin effects equal across age groups		$\chi^2_{(6)} = 9.37$ [<i>p</i> <0.16]				$\chi^2_{(6)} = 18.31$ [<i>p</i> <0.01]		
Sample size	2442		2591		1675		1818	

Note: See notes to Table 2.

Appendix Table 1: Descriptive Statistics for the Sample

	Males	Females
Potential experience (years)	18.28	18.58
<i>Years of full-time equivalent education</i>		
Secondary school	3.77	3.86
Post-secondary school	2.32	1.79
<i>Highest Qualification</i>		
No Qualifications	23.41%	21.85%
School Certificate	12.63%	17.04%
UE or Sixth Form Certificate	10.18%	13.61%
Bursary ^a	4.48%	4.67%
Diploma ^b	34.41%	29.08%
Bachelor's Degree	9.01%	8.96%
Postgraduate Qualification	5.88%	4.79%
<i>Annual (pre-tax) earnings interval</i>		
Under \$14,000	3.64%	7.58%
\$14,001 to \$22,000	14.52%	25.31%
\$22,001 to \$29,000	21.01%	26.69%
\$29,001 to \$39,000	24.93%	25.34%
\$39,001 and over	35.91%	15.07%
Sample Size	5033	3493

Note: Estimates use population sampling weights.

^a Includes Higher Leaving Certificate and Higher School Certificate.

^b Includes Basic, Skilled, Intermediate, and Advanced Vocational Qualifications.

Appendix Table 2: Estimated Relative Log Earnings for Years of Education
by Highest Qualification Received for Men

Years of education	Highest Qualification Received						
	None	School Certificate	University Entrance	Bursary	Diploma	Bachelor's Degree	Postgraduate
0 – 8	ref						
9	-0.093 (1.11)						
10	-0.059 (0.77)						
11	0.006 (0.07)	0.137 (1.70)					
12	0.080 (1.00)	0.183 (2.33)	0.273 (3.23)		0.127 (1.52)		
13	0.062 (0.70)	0.113 (1.35)	0.248 (3.04)	0.266 (2.81)	0.273 (3.27)		
14		0.192 (1.94)	0.283 (3.09)	0.156 (1.62)	0.267 (3.42)		
15					0.335 (4.32)		
16					0.363 (4.66)	0.670 (6.47)	
17					0.479 (5.86)	0.664 (7.63)	
18					0.447 (4.72)	0.659 (6.62)	0.876 (6.54)
19						0.679 (5.92)	0.692 (4.95)
20							1.146 (8.40)
21 or more							0.832 (6.86)

Note: Estimates weighted by population sampling weights and *t*-statistics based on heteroscedastically-consistent standard errors. The default category is eight or fewer completed years of education (i.e. nil years of secondary schooling) and no educational qualifications. Model also contains a quadratic in years of potential labour market experience. The sample size is 5033 and the zero slopes Wald test is $\chi^2=2060.9$ ($p<0.000$). Empty cells contain 40 or fewer observations.

Appendix Table 3: Estimated Relative Log Earnings for Years of Education
by Highest Qualification Received for Women

Years of education	Highest Qualification Received						
	None	School Certificate	University Entrance	Bursary	Diploma	Bachelor's Degree	Postgraduate
0 – 8	ref						
9							
10	-0.133 (1.26)						
11	-0.117 (1.12)	0.064 (0.61)					
12	-0.106 (0.99)	0.016 (0.15)	0.079 (0.73)		0.063 (0.58)		
13	-0.050 (0.44)	0.051 (0.46)	0.204 (1.84)	0.164 (1.37)	0.126 (1.17)		
14			0.175 (1.51)	0.052 (0.44)	0.152 (1.45)		
15					0.253 (2.38)		
16					0.261 (2.45)	0.484 (4.23)	
17					0.371 (3.41)	0.539 (4.93)	
18					0.382 (3.09)	0.527 (4.62)	0.700 (5.61)
19							
20							
21 or more							

Note: Estimates weighted by population sampling weights and *t*-statistics based on heteroscedastically-consistent standard errors. The default category is eight or fewer completed years of education (i.e. nil years of secondary schooling) and no educational qualifications. Model also contains a quadratic in years of potential labour market experience. The sample size is 5033 and the zero slopes Wald test is $\chi^2=2060.9$ ($p<0.000$). Empty cells contain 40 or fewer observations.

Notes

¹ Reprinted in Heilbroner (1986) p.212 from Book I, Chapter X, Part I of the *Wealth of Nations*.

² The term originates from the tradition of presenting diplomas on parchments that are made from the skin of a sheep.

³ Jaeger and Page (1996) exploit the rotation sampling structure of the CPS by matching individuals who appeared in the March 1991 survey, and were asked questions on years of education, with individuals in the March 1992 survey who were asked questions about highest qualifications. Park (1999) uses the results from a February 1990 pretest that included questions on *both* highest qualification and completed years of schooling.

⁴ Jaeger and Page report that 91% of individuals in the US whose highest qualification is a high school diploma received exactly 12 years of education and university degrees in the US are usually designed for four years of study.

⁵ Evidence for this comes from Australia, where the large increase in educational levels has not resulted in a shift toward a better occupational distribution (Vella and Karmel, 1999).

⁶ Hungerford and Solon (1987) use the cubic and the linear spline; Belman and Heywood (1991, 1997) use the linear spline; Jaeger and Page (1996) use the linear spline, while Park (1999) uses the simple linear function of school years.

⁷ This pattern may also reflect the fact that the survey instructed respondents to round *up* to the nearest year.

⁸ The questionnaire allowed respondents to answer in weekly, fortnightly, monthly or annual terms but all data were converted to annual equivalents during the processing of the survey.

⁹ Booth (1991) also excludes part-time workers when using bracketed annual earnings data to estimate the effect of training on wages.

¹⁰ The percentage gain is derived from the regression coefficient, b_j as $100 \times [\exp(b_j) - 1]$.

¹¹ Alternatively, a three-year degree after receiving the 7th Form qualifications in Year 13.

¹² Of course, sheepskin effects may differ between males and females, as suggested by Belman and Heywood (1991) although not confirmed by Jaeger and Page (1996). This hypothesis is tested below.

¹³ This is calculated as $100 \times [\exp(0.205 - 0.109) - 1]$.

¹⁴ These are calculated from the fifth row of Appendix Table 2, as $100 \times [\exp(0.273 - 0.183) - 1]$ and from the sixth row as $100 \times [\exp(0.248 - 0.113) - 1]$.