Sheepskin Effects in the Returns To Education in New Zealand: Do They Differ By Ethnic Groups?

John Gibson[†]
University of Waikato

Abstract

Sheepskin effects are the wage returns specific to educational credentials rather than to accumulated years of education. They can occur because credentials may signal workers' productivity. Signalling high productivity may be more valuable for members of ethnic minority groups if employers practice statistical discrimination. Many studies estimate sheepskin effects indirectly, from non-linear wage returns to schooling years that correspond to the "usual" time taken to complete a qualification, but such methods are likely to be biased. This study directly estimates sheepskin effects in New Zealand using a special survey with information on both years of education and qualifications received. The results show large sheepskin effects, with the returns to credentials exceeding the returns to years of education, especially for ethnic minorities.

JEL: I20, J31
Keywords: Education, Human Capital, Minorities, Sheepskin Effects, Signalling

[†] Department of Economics, University of Waikato, Private Bag 3105, Hamilton, New Zealand. Phone: (64-7) 856-2889. Fax: (64-7) 838-4331. E-mail: jkgibson@waikato.ac.nz.

SHEEPSKIN EFFECTS IN THE RETURNS TO EDUCATION IN NEW ZEALAND: DO THEY DIFFER BY ETHNIC GROUPS?

I. Introduction

The poor labour market outcomes experienced by some ethnic minority groups in New Zealand are well known (Easton, 1995). Discrimination is sometimes listed as a possible cause (Nicol and ffiske, 1991) but the only statistical evidence is from a sample of fictitious non-Pakeha job applicants (Spoonley, 1978). The difficulties in testing for statistical discrimination may account for the persistence of this hypothesis.[1] What is more widely accepted is that disparities in education contribute to these poor labour market outcomes (Winkelmann and Winkelmann, 1997).

Economists thus need to find the causes of these disparities in education levels, and once again, statistical discrimination appears as a possible factor. As Dalziel (1991, p.212) notes, "occupational segregation due to employer prejudice or stereotyping is a good reason for an individual to invest in relatively low education." Yet when examining current educational outcomes for minorities, two conflicting trends are apparent which do not fit easily in the framework suggested by Dalziel (1991). On the one hand, the share of new university graduates who are Maori has increased sharply, up from only three percent in 1990 to almost eight percent in 1996 (Te Puni Kokiri, 1998). At the same time, the proportion of Maori leaving school with no qualifications stayed persistently above one-third (as opposed to a rate of less than one-sixth for non-Maori).

Signalling models give a possible framework for understanding why labour markets may provide especially large incentives for some members of minority groups to acquire high-level credentials while giving poorer incentives for other members of the same group (Golbe, 1985). These signalling models rely on what are called "sheepskin effects", which are the wage returns specific to educational credentials rather than to accumulated years of education.[2] There is overseas

evidence for the hypothesis that minorities enjoy larger sheepskin effects for signals of high productivity (Belman and Heywood, 1991) but there is no similar evidence, nor on sheepskin effects in general, for New Zealand.

The purpose of this paper is to report on an investigation into sheepskin effects in the returns to education. Unlike most studies, sheepskin effects are not estimated indirectly from non-linear wage returns to schooling years that correspond to the "usual" time taken to complete a qualification.[3] Such methods are likely to be biased by measurement errors (Jaeger and Page, 1996), especially in a country like New Zealand where people can terminate their schooling after Year 11, 12, or 13 and Bachelor's degrees can take either three or four years. Instead of the indirect approach, the results are obtained from a special survey with information on both years of education and qualifications received. If one was restricted to information on either years or qualifications, it would still be possible to test for differences in returns to education across ethnic groups,[4] but not for differences in the signalling value of credentials *per se*.

There are two potential contributions of this paper. The first, which is really an aside uncovered in the search for general sheepskin effects, is to question the existing evidence on the social returns to investments in education. For example, Maani (1999, Table 15) reports that in 1998 society could expect an 8.1 percent return on its investment in taking a male Sixth Form student and educating him up to the Bachelor's degree level. On the basis of results like this (which are claimed to be lower bounds because external benefits are excluded[5]), Maani concludes that public investment in higher education is socially desirable. But in the presence of sheepskin 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,[6] so a case can be made for interventions to raise the private cost of education (Riley, 1979). In other words, sheepskin effects are evidence of a wedge between private and social returns to education, and in the presence of such wedges, increases in educational expenditure may both increase inequality and decrease net national income (Stiglitz, 1975).

The second contribution of the paper is to see whether minorities face larger sheepskin effects for signals of high productivity, which may indicate the presence of statistical discrimination in the labour market.[7] An example can show why such an inference can be made. Consider two workers of equally high productivity but one is from a minority group whose average characteristics are less favourable than for the majority group. In the absence of information on individuals, workers are paid according to group average productivity, so the largest wage gain from obtaining a credential to signal high productivity accrues to the minority worker. The fact that there may be a low supply and high demand for educated minority workers should not affect the inference of statistical discrimination because such a supply/demand balance should also show up in the return to years of education and hence not affect the sheepskin effect *per se* (Belman and Heywood, 1991).

The next section of the paper gives a brief review of previous evidence on sheepskin effects and signalling models. Section III describes the data and methods, while the following section reports the overall evidence on sheepskin effects and compares the implied social rates of return with those reported by Maani (1999). Section V tests whether sheepskin effects differ between minority and majority group workers while Section VI concludes.

II. Signalling and Sheepskin Effects

The suggestion that higher education is used as a screening device by the purchasers of labour, to sort out individuals of differing abilities, was first made by Arrow (1973). Under this interpretation, earnings differentials associated with education do not mainly reflect improvements in productive capacity caused by education but, rather, employers' use of education to identify pre-existing differences in talents. Although education remains privately valuable – so as to signal ones productivity – its only social value is in matching the right sort of workers to the right jobs, and such sorting should be possible using cheaper testing procedures (Layard and Psacharopoulos, 1974). Signalling models suggest sheepskin effects because being certified as having completed a course is likely to reveal more to an employer about a worker's ability and productivity than does a record of how many years the person attended classes.

In fact, the claimed failure of the sheepskin prediction that wages will rise faster with extra years of education when the extra year also conveys a credential was one of the grounds given by Layard and Psacharopoulos (1974) for rejecting the signalling hypothesis. However, the test used by these authors was not ideal because it simply compared the rates of return for dropouts to those for students completing courses, without using any information on years of school completed. Subsequent work by Hungerford and Solon (1987) on data that were disaggregated by years of schooling identified significantly larger returns to diploma years than to other years of education for U.S. workers, supporting the signalling hypothesis.

However, there are two problems with studies that infer sheepskin effects from non-linear wage returns to schooling years that correspond to the "usual" time taken to complete a qualification. To the extent that not everyone earns a degree, and others take different

amounts of time to earn degrees, measurement error should bias the estimated sheepskin effects towards zero. Jaeger and Page (1996) use a new data source, with evidence on both years of education and qualifications received, and find that direct estimates of sheepskin effects are twice as large as estimates based on the 'usual' time taken to complete a qualification. The second problem with using information just on years of education is that it makes the wrong comparison because the return to schooling years that usually entail 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). Such a comparison is possible if one has information on both years of education and qualifications received.

III. Data and Estimation Methods

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 key feature of the survey for the current study is that the ETS collected information on each respondent's years of education at secondary school and full-time equivalent years at post-school level and also obtained information on the highest educational qualifications received. Thus, the survey has the required information to separate the return to credentials from the return to years of education. A further feature of the survey is that it collected data on pre-tax earnings, albeit in interval form,[8] which is an improvement over the Census which only asks about incomes (also in interval form). The drawback of incomes data is that they include some components that are likely to be positively correlated with earnings, such as interest payments, and other components that are negatively correlated, such as government benefits, so they will bias the estimated wage returns to education in unknown directions.

The ETS has a sample of 22,257 but not all of these observations are eligible for inclusion in the sample for the current study. A total of 10,443 respondents were either not employed or else had missing information on earnings and so were excluded from the analysis. Also excluded were 469 respondents who were still at school, because their earnings are unlikely to reflect the full return to their education, and 169 respondents with missing information on years of schooling. The final group excluded from the analysis was those respondents whose highest school qualification was either from overseas (*n*=249) or recorded as "other" (*n*=32), where this exclusion was designed to maintain comparability with the sample selection rules used by Maani (1999).[9] Hence, there was a sample of *N*=10,895 available for estimation.

Table 1 reports descriptive statistics for this sample, disaggregated by gender because the initial models will follow Maani (1999) in estimating separate earnings functions for men and women. These initial earnings functions take the form:

$$(1) \quad \ln Y_i = \alpha + \hat{a}_1 \text{School Cert}_i + \hat{a}_2 \text{UE}_i + \hat{a}_3 \text{Bursary}_i + \hat{a}_4 \text{Diploma}_i + \hat{a}_5 \text{Bachelor's Degree}_i + \hat{a}_6 \text{Post-grad Degree}_i + \hat{a}_7 \text{AGE}_i + \hat{a}_8 \text{AGE}^2 + u_i$$

where the dependent variable is the natural logarithm of annual earnings and the data on highest qualifications enable six dummy variables to be defined, distinguishing between School Certificate, University Entrance, Seventh Form Bursary, Post-School Diploma, University Bachelor's degree, and Post-graduate degrees. The $\hat{a}_k$ (k=1,..6) coefficients estimate the marginal effect of each level of education, as compared with the excluded group who have no school qualifications. A model that replaces the quadratic in age with a quadratic in years of potential labour market experience is also estimated, following Winkelmann (1998). The initial test for sheepskin effects is based on a generalisation of equation (1) with a string of dummy variables for years of completed education, D_t added to the model. The coefficients on these

dummy variables should capture any (possibly non-linear) returns to schooling years, leaving the qualifications variables to capture any sheepskin effects (Jaeger and Page, 1996).

One factor that complicates the estimation of the earnings functions is that the data on annual earnings are not continuous. Instead, they fall into five unequal intervals (<$14,000, $14,001-$22,000, $22,001-$29,000, $29,001-$39,000, and >$39,000). Despite being widely used by previous researchers in New Zealand, 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). The estimation method also takes account of the sampling weights and uses heteroscedastically-robust variance-covariance estimators.

IV. Results

Table 2 reports estimates of equation (1), using alternatively a quadratic in years of potential labour market experience and a quadratic in age. The results are quite similar to estimates from the Census reported by Winkelmann (1998) and Maani (1999), and thus should be a fair basis on which to comment on existing estimates of the social rate of return to investments in higher education. This similarity can also be seen from Figure 1, which reports the percentage earnings (income) gain for males with a given qualification – compared to those with no formal qualification.[10] These estimates from the two data sources are never more than a few percentage points apart, except for those workers whose highest qualification is Bursary. However, there is doubt about the Census estimate of Bursary effects because Maani (1999) estimates an income gain of only three percent while Winkelmann reports an income gain of 11 percent (close to the 15 percent found with the ETS data). The other feature of Table 2,

which will be returned to when setting up the framework for testing for differences across ethnic groups, is that the returns to qualifications are not statistically significantly different for men and women, although the shapes of the age-earnings profiles do differ.

More flexible estimates of earnings profiles, using the string of dummy variables for the number of years of completed education, are reported in columns (i) and (iii) of Table 3. Because qualifications variables are not included in these models, the results give the combined effect of returns to accumulated years of education and returns to credentials. It is apparent from Figure 2, which plots the implied percentage increase in earnings, that wages rise faster with extra years of education that may correspond to the receipt of a credential (e.g., Years 12, 17, and 19 for males and Years 13 and 18 for females). Observing this sort of non-linearity has been the basis of traditional, indirect, tests for sheepskin effects. But such an approach is essentially guesswork because we cannot be sure that the particular years noted are in fact when individuals received their credentials.

The stronger test of sheepskin effects uses direct information on both years of education and qualifications received (Table 3, column (ii) and (iv)). The hypothesis tests reported at the foot of Table 3 show that *both* years of completed schooling and highest qualifications gained earn a premium in the labour market ($p<0.002$ for each hypothesis). A substantial part of the total return to education appears to be due to sheepskin effects. The coefficients on the years-of-education dummy variables in columns (ii) and (iv) can be interpreted as the return to education net of credential effects. When the earnings increase implied by these coefficients is compared with the combined effect of credentials and years, it appears that two-thirds of the increase in earnings for those with higher education is due to credentials (Figure 2).

How does the presence of sheepskin effects alter the estimated social rate of return to investments in higher education? Normally, this rate of return is calculated by comparing the lifetime net earning stream for a person with and without a particular level of education. So for example, if *Yh* and *Ys* are pre-tax earnings associated with and without a Bachelor's degree, P_i is annual personal expenditures on Bachelor's level education (e.g., tuition fees) and G_i is annual government expenditures for a Bachelor's degree, then the social rate of return is the discount rate that solves:

$$\sum_{t=S+1}^{n} \frac{[Yh_i - Ys_i]_t}{(1+r_s)^t} = \sum_{t=1}^{S} \frac{[Ys_i + P_i + G_i]_t}{(1+r_s)^t}. \quad (2)$$

But with sheepskin effects, the earnings difference is not just due to the years spent learning for the degree, it is also due to the innate talent of the worker which is signalled by their having a degree. Hence, the earnings streams to use in equation (2) are those that are net of credential effects.

The results in column (ii) of Table 3 were used to generate the lifetime earnings of a male with 13 years and 17 years of education - corresponding to the difference between Bursary and a four-year Bachelor's degree. This person is assumed to begin earning at age 22, and otherwise without a degree at age 18, while $P_i = \$3000$ and $G_i = \$10{,}000$, based on calculations made by Maani (1999). Over the lifetime from age 18-65, the internal rate of return that solves equation (2) is 2.3 percent. If a three year degree is assumed, with earnings beginning at age 21, the rate of return rises to 3.9 percent but this is still a long way short of the social rate of return of 8.1 percent calculated by Maani (1999). If one believes that society is made better off by the returns to credentials, in addition to the returns to accumulated years of learning, then the results in column (i) of Table 3 can be used to calculate a social rate of return of 8.0 percent – but such a belief is difficult to justify seeing as sheepskin effects don't reflect any increase in social productivity.

V . Disaggregated Results for Ethnic Groups

It is apparent that sheepskin effects in the returns to education are important in New Zealand, so the next task of this research is to see if they differ between ethnic groups in the manner that would be suggested by statistical discrimination in the labour market. As a first step in the analysis, the sample was restricted to those classified as European/Pakeha, Maori or Pacific Island, while those observations who did not specify their ethnicity or were listed as "Other" were deleted, leaving a sample of N=10,550. This restriction on the sample reflects the emphasis on Maori and Pacific Island populations in previous discussions of discrimination in the New Zealand labour market (Spoonley, 1978; Nicol and ffiske, 1991). Because of the small size of the Pacific Island sample it was combined with Maori – this aggregation should not be too problematic because both groups appear to occupy a disadvantaged place in the labour market and previous research has used this grouping (Gibson, 1998).

To set up the testing framework, it first must be established whether the search for ethnic differences should be carried out separately for males and females. Hypothesis tests reported in Table 4 support the pooling of the male and female sub-samples because there is no evidence of sheepskin effects differing between men and women within the same ethnic group. This is consistent with the results in Table 2 which showed that the overall returns to qualifications did not differ by gender. However, one important difference between the earnings functions for males and females is the shape of the age-earnings profile, which is much flatter for females. To capture this effect, the pooled model interacts the quadratic in age with the intercept dummy variable for males.

The sheepskin effect associated with postgraduate degrees is significantly larger for Maori and Pacific Island workers than it is for European/Pakeha workers (Table 5). Controlling for years

of completed education, a postgraduate credential raises the annual earnings of a Pakeha worker by 77 percent,[11] compared with the base group of those with no qualifications, while for a Maori or Pacific Island worker the predicted increase in earnings is 153 percent. This is the only one of the sheepskin effects that is significantly different across ethnic groups. It does not seem likely that the higher signalling value of a postgraduate qualification for Maori and Pacific Island workers reflects a high demand for and/or low supply of highly educated minority workers because the returns to advanced years of education for Maori and Pacific workers are much smaller than are the returns to years of education for Pakeha workers.

Inspection of the hypothesis test results at the foot of Table 5 shows that the hypothesis that Maori and Pacific Island workers get *no* return to accumulated years of education cannot be rejected ($p<0.78$). But the hypothesis that the returns to credentials are zero for Maori and Pacific Island workers is conclusively rejected ($p<0.00$). Hence, the returns to education for Maori and Pacific Island workers are due almost entirely to the returns to credentials. In contrast, the returns to education for European/Pakeha workers are due to both returns to accumulated years of education and returns to credentials, with each component being of similar importance.

Thus, sheepskin effects appear to be more important for minority group workers, particularly for signals of high productivity such as a postgraduate qualification. It is interesting that the sheepskin effects for signals of lower productivity (e.g., high school qualifications) have smaller point estimates for Maori and Pacific Island workers than for Pakeha workers, although the differences are not statistically significant. These results are similar to those found by Belman and Heywood (1991) for the U.S., and are consistent with the effects of statistical discrimination in the imperfect signalling model of Golbe (1985).

IV. Conclusions

The possibility of statistical discrimination has been frequently mentioned in the New Zealand literature that seeks to explain the disparities in educational and labour market outcomes for various ethnic groups. But a framework where employer stereotyping reduces the incentives to accumulate education (Dalziel, 1991) does not explain why labour markets may provide large incentives for some members of minority groups to acquire high-level credentials, as seems to be happening with rapid growth in the number of Maori graduates, while giving poorer incentives for other members of the same group, which is also apparent from the persistently high proportion of Maori who leave school with no qualifications. However, signalling models, with the empirical implication of greater sheepskin effects for highly productive members of minority groups, do give a possible framework for understanding these patterns (Golbe, 1985).

This study has directly estimated sheepskin effects in New Zealand using a special survey with information on both years of education and qualifications received. The results show large sheepskin effects, with the returns to credentials exceeding the returns to years of education, especially for ethnic minorities. These results are similar to previous evidence for the U.S. reported by Belman and Heywood (1991) and would seem to give some support for the hypothesis that statistical discrimination occurs in the New Zealand labour market.

A byproduct of the research reported here is a set of estimates of the social rate of return to investments in higher education that differ dramatically from those reported by Maani (1999). These estimates differ because they remove the returns to credentials *per se* from the calculated returns to various levels of education, allowing the focus to be just on the returns to accumulated years of learning. Because giving someone a certificate does not, by itself, make someone more productive, the adjustment to the usual rate of return calculations which is

reported here would seem to be an appropriate one to make when evaluating public investments in higher education.

Acknowledgements

The results presented in this study are the work of the author, not Statistics New Zealand. The financial support of the University of Waikato and the New Zealand Department of Labour, Ministry of Education and Treasury is gratefully acknowledged. Access to the data used in this study was provided by Statistics New Zealand in a secure environment designed to give effect to the confidentiality provisions of the Statistics Act 1975.

References

Aigner, D. and Cain, G. (1977), "Statistical theories of discrimination in the labor market", *Industrial and Labor Relations Review* 30(2): 175-187.

Arrow, K. (1973), "Higher education as a filter", *Journal of Public Economics* 2(3): 193-216.

Belman, D. and Heywood, J. (1991), "Sheepskin effects in the returns to education: an examination of women and minorities" *Review of Economics and Statistics* 73(4): 720-724.

Dalziel, P. (1991), "Economists' analyses of Maori economic experience: 1959-1989' in *Society and Culture: Economic Perspectives*, J. Whitwell and M. A. Thompson (eds.), Proceedings of the Conference of the New Zealand Association of Economists, pp. 193-217.

Easton, B. (1995), "The Maori in the labour force", In P.S. Morrison (ed) *Labour, Employment and Work in New Zealand* Wellington: Victoria University of Wellington, pp. 206-213.

Gibson, J. (1998), *Ethnicity and Schooling In New Zealand: An Economic Analysis Using a Survey of Twins*, Institute of Policy Studies, Wellington.

Golbe, D. (1985), "Imperfect signalling, affirmative action, and black-white wage differentials", *Southern Economic Journal* 51(4): 842-848.

Hungerford, T. and Solon, G. (1987), "Sheepskin effects in the returns to education", *Review of Economics and Statistics* 69(1): 175-178.

Jaeger, D. and Page, M. (1996), "Degrees matter: new evidence on sheepskin effects in the returns to education", *Review of Economics and Statistics* 78(4): 733-739.

Layard, R. and Psacharopoulos, G. (1974), "The screening hypothesis and the returns to education", *Journal of Political Economy* 82(5): 985-998.

Maani, S. (1999), "Private and public returns to investments in secondary and higher education in New Zealand over time: 1981-1996", *Treasury Working Paper* 99(2): 1-79.

Nicol, A. and ffiske, C. (1991) *Maori and Work: The Position of Maori in the New Zealand Labour Market*, Economic Development Unit, Manata Maori, Wellington.

Park, J. (1999), "Estimation of sheepskin effects using the old and new measures of educational attainment in the Current Population Survey", *Economics Letters* 62(3): 237-240.

Patrinos, H. (1996), "Non-linearities in the returns to education: sheepskin effects or threshold levels of human capital?", *Applied Economics Letters* 3(3): 171-173.

Riley, J. (1979), "Testing the educational screening hypothesis", *Journal of Political Economy* 87(5): S227-S252.

Spoonley, P. (1978) “The multicultural workforce: the role of employers as gatekeepers”, *New Zealand Journal of Industrial Relations* 3(2): 63-70.

StataCorp (1997), *Stata Statistical Software: Release 5.0*, College Station: Stata Corporation.

Steward, M. (1983), “On least squares estimation when the dependent variable is grouped”, *Review of Economic Studies* 50(4): 737-753.

Stiglitz, J. (1975), “The theory of ‘screening,’ education and the distribution of income”, *American Economic Review* 65(3): 283-300.

Te Puni Kokiri, (1998), *Progress Towards Closing Social and Economic Gaps between Maori and Non-Maori: A Report to the Minister of Maori Affairs*, Wellington.

Vella, F. and Karmel, T. (1999), “Evaluating the impact of educational expansion on the occupational status of youth”, *Australian Economic Papers* 38(3): 310-327.

Winkelmann, L. and Winkelmann, R. (1997), “Determining the relative labour force status of Maori and non-Maori using a multinomial logit model”, *Labour Market Bulletin* 3(1): 24-62.

Winkelmann, R. (1998), “The economic benefits of schooling in New Zealand: comment and update”, *New Zealand Economic Papers* 32(2): 187-195.

Figure 1. Percentage Increase in Pre-tax Annual Earnings (Income) for Males
(Relative to Those With No Qualifications)

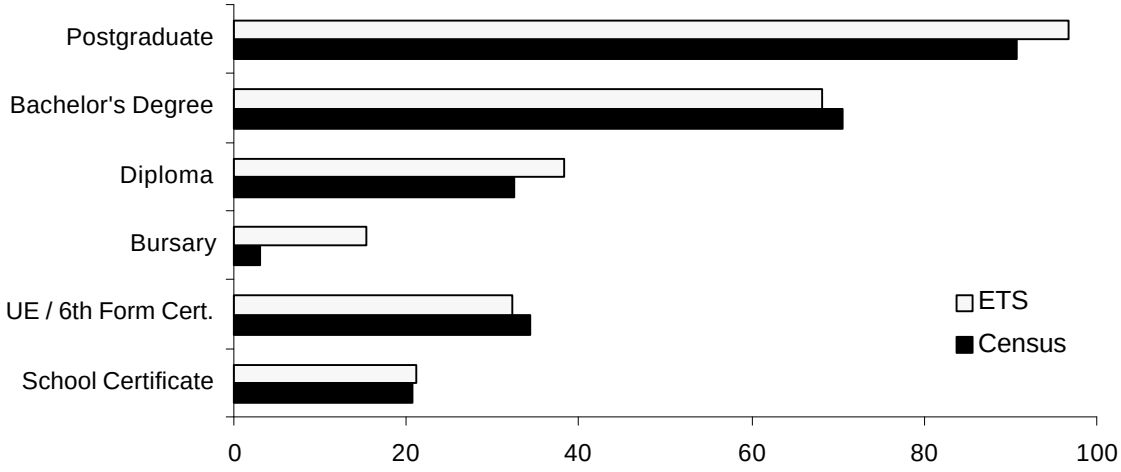

Figure 2a. Returns to Years of Education for Males
(Relative to Base Group With 8 or Fewer Years of Education)

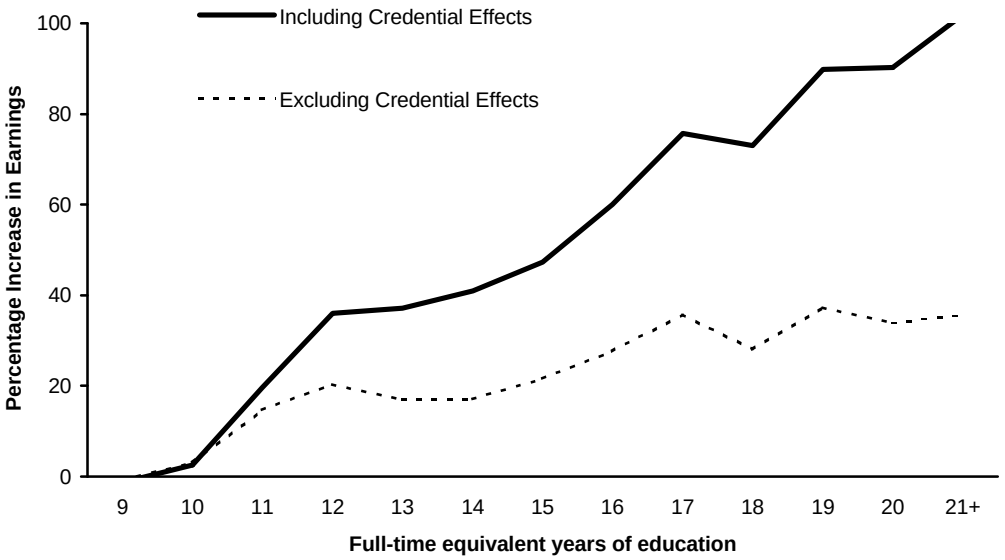

Figure 2b. Returns to Years of Education for Females
(Relative to Base Group With 8 or Fewer Years of Education)

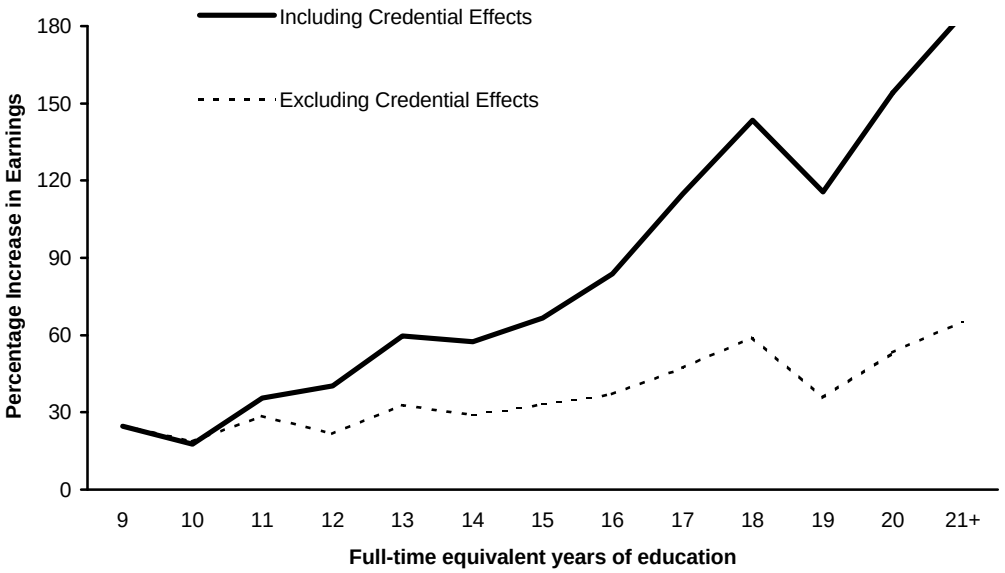

Table 1: Descriptive Statistics for the Sample

	Males	Females
Age	36.01	36.50
Years of full-time equivalent education		
Secondary school	3.79	3.83
Post-secondary school	2.29	1.72
Ethnic Origin		
European/Pakeha	83.72%	85.14%
Maori	8.61%	8.10%
Pacific Islands	3.90%	3.82%
Other and not specified	3.77%	2.94%
Highest Qualification		
No Qualifications	23.59%	23.47%
School Certificate	12.41%	17.10%
UE or Sixth Form Certificate	10.34%	13.39%
Bursary[a]	5.81%	6.33%
Diploma[b]	33.10%	27.72%
Bachelor's Degree	9.04%	7.77%
Postgraduate Qualification	5.71%	4.20%
Annual (pre-tax) earnings interval		
Under $14,000	9.71%	31.82%
$14,001 to $22,000	14.42%	22.51%
$22,001 to $29,000	19.61%	18.55%
$29,001 to $39,000	23.06%	16.99%
$39,001 and over	33.20%	10.14%
Sample Size	5461	5434

Note: Estimates use population sampling weights.

[a] Includes Higher Leaving Certificate and Higher School Certificate.

[b] Includes Basic, Skilled, Intermediate, and Advanced Vocational Qualifications.

Table 2: The Effect of Highest Qualification on log Annual Earnings in 1996[a]

	Males	Females	Males	Females	*t*-test for pooling[b]
Intercept	9.492	9.392	7.932	8.730	7.42
	(355.96)	(279.63)	(96.66)	(86.88)	
School Certificate	0.179	0.157	0.191	0.168	1.01
	(7.37)	(5.52)	(7.89)	(5.95)	
UE or Sixth Form Certificate	0.288	0.251	0.279	0.263	0.88
	(9.75)	(7.03)	(9.57)	(7.42)	
Bursary	0.195	0.088	0.143	0.084	0.92
	(4.53)	(1.57)	(3.36)	(1.51)	
Diploma	0.377	0.353	0.324	0.348	0.11
	(19.10)	(13.77)	(16.75)	(13.97)	
Bachelor's Degree	0.649	0.693	0.521	0.654	1.33
	(16.27)	(16.57)	(13.22)	(16.19)	
Postgraduate Qualification	0.792	0.865	0.677	0.831	0.94
	(15.00)	(14.27)	(13.61)	(14.05)	
Age	…	…	0.110	0.045	10.15
			(24.36)	(8.31)	
Age^2	…	…	-0.001	-0.001	8.85
			(21.47)	(7.29)	
Years of potential experience	0.061	0.025	…	…	…
	(24.12)	(8.69)			
Years of potential $experience^2$	-0.001	-0.000	…	…	…
	(19.90)	(7.21)			
Zero slopes χ^2 (8 df)	1332.56	558.15	1534.12	579.37	…
Sample Size	5461	5434	5461	5434	…

Note: Estimates weighted by population sampling weights and *t*-statistics in ( ) based on heteroscedastically-consistent standard errors.

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

[b] Based on a model where a dummy variable for males is interacted with all other explanatory variables.

Table 3: 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	$\|t\|$
Completed school years[b]								
S = 9	-0.012	(0.14)	-0.009	(0.10)	0.220	(1.41)	0.222	(1.48)
S = 10	0.026	(0.32)	0.031	(0.40)	0.162	(1.54)	0.170	(1.68)
S = 11	0.180	(2.32)	0.136	(1.86)	0.305	(2.97)	0.252	(2.55)
S = 12	0.307	(3.94)	0.185	(2.43)	0.338	(3.29)	0.196	(1.96)
S = 13	0.316	(4.00)	0.157	(1.99)	0.468	(4.48)	0.283	(2.75)
S = 14	0.343	(4.33)	0.158	(1.98)	0.455	(4.34)	0.253	(2.42)
S = 15	0.388	(4.91)	0.196	(2.46)	0.511	(4.77)	0.286	(2.66)
S = 16	0.470	(5.91)	0.244	(3.01)	0.609	(5.74)	0.316	(2.93)
S = 17	0.564	(6.89)	0.305	(3.62)	0.765	(7.07)	0.387	(3.49)
S = 18	0.548	(6.20)	0.247	(2.73)	0.890	(7.95)	0.464	(4.01)
S = 19	0.641	(6.91)	0.317	(3.28)	0.768	(6.16)	0.305	(2.36)
S = 20	0.644	(5.76)	0.292	(2.51)	0.933	(5.21)	0.427	(2.36)
S = 21 or more	0.702	(6.92)	0.304	(2.83)	1.046	(7.02)	0.504	(3.21)
Highest qualification								
School Certificate	…	…	0.137	(5.04)	…	…	0.154	(5.04)
UE or 6th Form Cert.	…	…	0.215	(6.09)	…	…	0.232	(5.70)
Bursary	…	…	0.055	(1.15)	…	…	0.020	(0.32)
Diploma	…	…	0.220	(7.17)	…	…	0.274	(7.32)
Bachelor's Degree	…	…	0.358	(6.97)	…	…	0.497	(8.62)
Postgraduate	…	…	0.514	(8.23)	…	…	0.652	(8.91)
Age	0.113	(24.9)	0.108	(24.0)	0.051	(9.47)	0.045	(8.22)
Age^2	-0.001	(21.9)	-0.001	(21.1)	-0.001	(8.33)	-0.001	(7.20)
Intercept	7.750	(71.1)	7.844	(73.8)	8.405	(60.2)	8.519	(61.7)
Wald test (slopes = 0)	$\chi^2_{(15)} = 1511.7$		$\chi^2_{(21)} = 1631.7$		$\chi^2_{(15)} = 498.5$		$\chi^2_{(21)} = 645.5$	
$H_{0:}$ Years dummies = 0			$\chi^2_{(13)} = 46.0$				$\chi^2_{(13)} = 34.3$	
$H_{0:}$ Qualifications = 0			$\chi^2_{(6)} = 104.9$				$\chi^2_{(6)} = 130.9$	

Note: Estimates weighted by population sampling weights and *t*-statistics based on heteroscedastically-consistent standard errors. The sample has 5461 males and 5434 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 4: Hypothesis Test for Equality of Sheepskin Effects Across Males and Females

	Hypothesis	
	European/Pakeha Female = European/Pakeha Male	Maori/Pacific Female = Maori/Pacific Male
School Certificate	0.26 (p<0.61)	0.14 (p<0.71)
UE or Sixth Form Certificate	0.01 (p<0.93)	1.32 (p<0.26)
Bursary	0.42 (p<0.52)	2.25 (p<0.14)
Diploma	0.75 (p<0.39)	0.90 (p<0.35)
Bachelor's Degree	1.51 (p<0.22)	0.07 (p<0.79)
Postgraduate Qualification	0.48 (p<0.49)	0.18 (p<0.68)

Note: Entries in table are Wald test c^2 statistics with one degree of freedom and are based on heteroscedastically-robust maximum likelihood estimates of an earnings function with dummy variables for educational years completed, highest qualification, and a quadratic in age. This earnings function is fully interacted with dummy variables for gender and ethnic group. N=10550.

Table 5: Estimated Sheepskin Effects by Ethnic Group[a]

	European/Pakeha		Maori/Pacific		*t*-test
	β	|*t*|	β	|*t*|	for pooling[c]
Completed school years[b]					
S = 9	0.079	0.71	0.063	0.62	0.08
S = 10	0.108	1.21	0.013	0.15	0.71
S = 11	0.211	2.41	0.087	1.03	0.94
S = 12	0.203	2.28	0.104	1.19	0.71
S = 13	0.247	2.71	0.073	0.79	1.25
S = 14	0.223	2.42	0.134	1.42	0.56
S = 15	0.269	2.91	0.063	0.62	1.42
S = 16	0.310	3.34	0.135	1.18	1.09
S = 17	0.383	4.04	0.076	0.55	1.72
S = 18	0.391	3.96	-0.025	0.13	1.79
S = 19	0.370	3.51	0.160	1.00	0.99
S = 20	0.469	3.80	0.018	0.09	1.80
S = 21 or more	0.463	3.79	0.177	0.89	1.10
Highest qualification					
School Certificate	0.144	5.99	0.092	2.39	0.95
UE or 6th Form Cert.	0.221	7.08	0.146	2.71	1.03
Bursary	0.051	1.15	-0.056	0.72	1.22
Diploma	0.238	8.49	0.201	4.37	0.45
Bachelor's Degree	0.449	10.47	0.318	2.17	0.66
Postgraduate	0.570	10.49	0.928	5.52	2.31
Age	0.047	8.30	0.011	1.08	2.77
Age × Male dummy	0.074	9.70	0.060	4.14	0.54
Age^2	-0.001	7.30	0.000	0.43	2.76
Age^2 × Male dummy	-0.001	8.49	-0.001	3.65	0.21
Male dummy	-0.970	7.18	-0.762	3.12	0.54
Intercept	8.529	64.66	9.311	46.82	2.94
Wald test (slopes = 0)	$\chi^2_{(24)} = 2828.5$		$\chi^2_{(24)} = 394.0$		
$H_{0:}$ Years dummies = 0	$\chi^2_{(13)} = 58.2$		$\chi^2_{(13)} = 8.97$		$\chi^2_{(13)} = 11.34$
$H_{0:}$ Qualifications = 0	$\chi^2_{(6)} = 179.3$		$\chi^2_{(6)} = 50.5$		$\chi^2_{(6)} = 9.44$
Sample Size	8966		1584		

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.

[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.

[c] Based on a model where a dummy variable for Pakeha is interacted with all other explanatory variables.

Notes

[1] Statistical discrimination occurs when employers use group average characteristics to make decisions about individual workers and job applicants (Aigner and Cain, 1977). It can be seen as a response to the cost of information and is thus a natural complement to the signalling theories discussed below.

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

[3] Hungerford and Solon (1987) and Belman and Heywood (1991) are examples of this approach, which seems to rule out the possibility of genuine non-linearities and threshold effects (Patrinos, 1996).

[4] See Gibson (1998) for an example of this approach using data on years of schooling.

[5] They may also be biased down because the earnings functions use age rather than years of labour market experience (Winkelmann, 1998).

[6] As anecdotal evidence of this process, 80 percent of applicants for a junior office school-leaver position had tertiary qualifications or diplomas ('Degrees no longer a guarantee of quality' *New Zealand Herald*, Jan 6, 2000, p. A13). More formal evidence 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).

[7] An alternative explanation is that signals are more closely correlated with productivity for minorities because they have less resources with which to purchase inaccurately large signals (Belman and Heywood, 1991).

[8] The annual earnings brackets are "under $14,000", $14,001 to $22,000", "$22,001 to $29,000", "$29,001 to $39,000" and "$39,001 or over". Corresponding earnings brackets were given for respondents who preferred to answer in terms of weekly, fortnightly, or monthly earnings.

[9] I am grateful to Peter McMillen of Statistics New Zealand for advice on this issue.

[10] These estimates are based on the specification using age. The percentage gain to the *j*th qualification is derived from the coefficient for that qualification, b_j as $100\times[\exp(b_j) - 1]$.

[11] This is calculated as $100\times[\exp(0.57) - 1]$.