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The Economic Benefits of Schooling in New Zealand: Comment and Update.

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A recent study by Maani (1997 Ch5) reports income function estimates for New Zealand 1981, 1986 and 1996 Census data using a model of the form[2]

$$\ln Y_i = \beta_0 + \beta_1 \textit{School Certificate}_i + \beta_2 \textit{Sixth Form Certificate}_i + \beta_3 \textit{Bursary}_i + \beta_4 \textit{Diploma}_i + \beta_5 \textit{Bachelor's Degree}_i + \beta_6 \textit{Postgraduate Degree}_i + \beta_7 \textit{Age}_i + \beta_8 \textit{Age}_i^2 + u_i \quad (1)$$

The dependent variable is the natural logarithm of annual income and the variables on the right are dummy variables for the highest qualification level. As Maani points out, in this framework the predicted percentage gain in income from qualification level j relative to having no formal qualifications (the reference group) is given by $(\exp(\beta_j) - 1)$, $j = 1,2,...,6$. *Age* and Age^2 "control for the possibly non-linear effect of work experience with age. Age is included as a proxy for years of experience." (Maani, 1997, page 70). After acknowledging in footnote 4 of Chapter 5 that the original human capital model prescribes the inclusion of experience rather than age, Maani states that experience and experience squared "are virtually age variables".

[1] The assistance of Statistics New Zealand in providing access to the data through the Data Laboratory is gratefully acknowledged.
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[2] See also Maani, 1996.

From these statements, one might wrongly conclude that the inclusion of age rather than experience is only a matter of form rather than substance, and that material results won't be affected.

However, this is not the case. The problem arises since we want to estimate how incomes differ, on average, between two workers, one without formal qualifications and the other with qualification level j, given that the two workers are similar with respect to their other productive characteristics. In the human capital model, the most relevant "other characteristic" is labour market experience that, through formal and informal on-the-job training, increases the stock of human capital of the worker. If we compare two workers who are of the same age but have different qualification levels it must follow that, on average, the more highly qualified worker has less labour market experience. Hence, the estimated income enhancing effect of the qualification will be understated (since the regression does not take into account the different levels of experience and therefore "penalises" the more highly qualified worker).

A simple model might clarify this point. Assume that the relationship between age and experience can be expressed as

$$age = 5 + years_j + years\ of\ labour\ market\ experience \qquad (2)$$

where $years_j$ are standardized years needed to obtain a qualification level j. This equation is only an approximation, albeit a useful one, as persons differ in the amount of time they need to complete a specific degree, and might afterwards have periods of unemployment or non-participation. If we drop for simplicity Age^2 from equation (1), and then combine (1) and (2) into a single expression, we obtain

$$\begin{aligned} ln\ Y_i = {} & (\beta_0 + \beta_7\ Years_0) + (\beta_1 + \beta_7\ Years_1)\ School\ Certificate_i + \\ & (\beta_2 + \beta_7\ Years_2)\ Sixth\ Form\ Certificate_i + (\beta_3 + \beta_7\ Years_3)\ Bursary_i + \\ & (\beta_4 + \beta_7\ Years_4)\ Diploma_i + (\beta_5 + \beta_7\ Years_5)\ Bachelor's\ Degree_i + \\ & (\beta_6 + \beta_7\ Years_6)\ Postgraduate\ Degree_i + \beta_7\ Experience_i + u_i \end{aligned}$$

where $Years_0$ is the number of years of schooling that individuals without qualifications have taken (i.e., up to the compulsory schooling age). Hence, the "true" income differential for two workers with the same experience level, one without qualification and the other with qualification level j, is given by $\beta_j + \beta_7 (Years_j - Years_0)$. Since $Years_j > Years_0$ and $\beta_7 > 0$, the qualification specific income differentials in a model that includes experience will be always above the income differentials that are estimated in a model with age. Moreover, the (absolute) difference between the two estimates, i.e. the size of the bias, is an increasing function of the qualification level.

In the following, I illustrate how the use of age rather than experience affects the results by re-estimating Maani's model for 1986 alternatively with age and experience. Moreover, I also provide results for the 1996 Census data that were not analysed in Maani's studies. Maani (1997) reports increasing income differentials between highly qualified and less qualified workers over the three observation points 1981, 1986, and 1996, and it will be interesting to see whether or not the trend continued in 1996.

The following analysis is based on a 5 percent random sample of the working age population (individuals aged between 16 and 64) in the 1986 and 1996 Census years. The 1991 Census year was not available. Every effort was made to make the dataset as comparable as possible to the one described in Maani (1997). In particular, the analysis alternatively uses a sample of all persons who were employed at Census day, or a sample of full-time employed workers only, a crude control for the level of labour market activity. The grouped income data are transformed into a continuous measure by assigning group midpoints to each income category. The same classification system of qualifications as in Maani (1996, 1997) is adopted. In addition, it was necessary to assign standardised years to each of the seven qualification levels in order to compute the years of labour market experience along equation (2), and the following concordance was used (years in parentheses): no qualification (8 years), school certificate (11 years), sixth form certificate (12 years), Bursary (13 years), Diploma (14 years), Bacherlor's Degree (16 years), Postgraduate degree (18 years).

The regression results are given in Table 1 for males and in Table 2 for females, respectively. The tables show the estimated percentage income gain for a given qualification compared to having no formal qualification, for all workers and full-time employed workers only. The first column for 1986 is directly comparable to the pre-tax income results in Maani (1997) in Table 5.1 . The results are quite similar and do not diverge by more than 4 percentage points. For instance, a Bachelor's degree was associated with incomes that were 63.9 percent higher than incomes of those with no school qualifications when comparing workers of the same age. The comparable estimate in Maani was 60.0 percent.

Table 1. Percentage Income Returns to Secondary and Tertiary Education for Males, 1986 and 1996 (Dependent Variable: Logarithmic Income).

	All Employed Males				Full-time Employed Males			
	1986		1996		1986		1996	
School Certificate	7.3	11.5	15.6	17.0	9.6	13.9	19.6	22.4
UE or Sixth Form Certificate	18.8	27.3	20.9	26.9	22.4	30.8	28.9	35.5
Bursary	10.0	22.4	11.4	23.3	16.9	29.4	27.2	38.3
Diploma	25.7	40.3	31.6	47.3	26.2	40.3	30.5	43.8
Bachelor's Degree	63.9	97.6	65.5	103.8	66.9	99.3	70.5	101.7
Postgraduate Qualification	73.2	109.4	86.5	133.4	77.4	113.2	92.3	131.1
Age and Age squared	Yes	No	Yes	No	Yes	No	Yes	No
Experience and Experience squared	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.248	0.240	0.324	0.318	0.234	0.237	0.244	0.236
Sample Size	41758		35145		39957		31616	

The next column of Table 2 drops the age-polynomial and includes experience and experience squared instead, using the same sample of male employed workers in 1986. As predicted by the above theoretical considerations, a comparison of the first and second columns shows substantially larger estimated income differentials in the experience equation. Moreover, the difference increases with the qualification level. For instance, the income differential between an unqualified worker and a worker with a bachelor's degree, holding experience constant, is now estimated at 97.6 percent.

Table 2. Percentage Income Returns to Secondary and Tertiary Education for Females, 1986 and 1996 (Dependent Variable: Logarithmic Income).

	All Employed Females				Full-time Employed Females			
	1986		1996		1986		1996	
School Certificate	12.2	13.6	18.0	17.9	18.2	20.2	24.2	24.7
UE or Sixth Form Certificate	21.9	23.9	30.0	32.0	26.3	30.2	43.8	46.0
Bursary	14.0	16.5	9.9	14.2	19.2	24.9	28.0	32.2
Diploma	37.4	41.4	46.6	56.3	37.1	44.7	42.1	50.3
Bachelor's Degree	70.7	78.2	79.0	107.8	66.7	83.7	72.1	95.7
Postgraduate Qualification	89.7	99.6	117.4	157.8	87.3	107.7	103.5	135.0
Age and Age squared	Yes	No	Yes	No	Yes	No	Yes	No
Experience and Experience squared	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.040	0.040	0.159	0.150	0.083	0.081	0.165	0.157
Sample Size	28487		29733		20617		19290	

The same pattern is observed in all cases. For instance, the estimated 1986 Postgraduate degree income differentials based on the age regression are about 36

percentage points *below* those based on the experience regression for both all employed males and full-time employed males. The differences are even larger for the 1996 sample. For women the bias, though still significant, tends to be smaller. The reason for this attenuation is that women typically have flatter age-income profiles than men. In summary, the Maani (1996, 1997) estimates potentially understate the economic benefits of higher education by a substantial amount as they confound the direct effects of a qualification and the indirect effects of less labour market experience.[3]

Maani (1997, page 184) concludes her analysis of the earlier Census years by noticing that "the rates of return to most educational qualifications, and especially returns to tertiary education, have increased for both males and females over the 1981-1991 period". This result holds true both for the income function estimates discussed here, and for alternative internal rate of return calculations that incorporate the schooling cost (foregone earnings and tuition) and thus provide a more accurate measure of the "investment returns". The finding of increased returns might go some way in explaining the concurrent increased participation in higher education that was observed during the period.

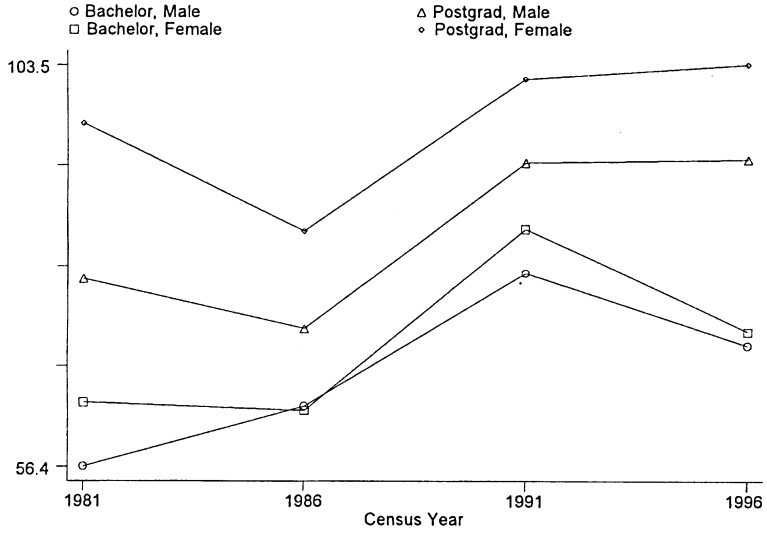
Figure 1 graphs the 1981-1996 trends in relative income differentials for Bachelor's degrees and for Postgraduate degrees, respectively, both relative to having no qualification. The numbers refer to the sample of full-time workers. In order to combine my 1996 estimates with the values reported by Maani, I use the results from Model (1) that controls for age rather than experience. Notwithstanding the fact that these estimates are downward biased, they still are likely to allow for valid statements on trend movements in income differentials. Based on the results presented here, the trend towards increasing returns has come to a halt in the first half of the 1990s. This

[3] It is possible that controlling for experience as suggested here is not free of bias either. Bias may arise if there are systematic departures from the approximation formula (2) that is used to compute the *years of experience*. For instance, if unqualified workers tend to have longer non-employment spells than more qualified workers, (2) overstates the true level of labour market experience for unqualified workers and the resulting qualification income differentials in the income-experience equation will be upwardly biased.

finding is consistent with results reported in Dixon (1996) based on *Household Economic Survey* data for 1984-1994.

As Figure 1 demonstrates, estimated income differentials for a Bachelor's degree reached a peak in 1991 and declined thereafter. Postgraduate estimates showed a slight increase between 1991 and 1996 that is minor, however, in comparison with the large increases that occurred between 1986 and 1991. Essentially, income differentials for Postgraduate degrees stabilised in the first half of the 1990s. When combined with the substantial decline in the differentials for a Bachelor's degree, the evidence shows that the income differentials between workers with a Postgraduate degree and workers with a Bachelor's degree actually increased between 1991 and 1996.

Figure 1: Percentage Income Returns to Bachelor's Degree and Postgraduate Degree, Male and Female Full-Time Workers, 1981-1996 (Age-equation).



One possible "supply-side" explanation is a lagged adjustment cycle: the increasing differentials in the second half of the 1980's made investments into higher education more attractive to a larger number of people. These people entered the labour market in the early 1990s, thereby increasing the supply of workers with a Bachelor's degree

which, in turn, forced a decrease in their relative incomes. Apparently, the relative supply of workers with a postgraduate degree increased underproportionally (which might be a reflection of both the fact that it takes longer to acquire a postgraduate degree as well as the small return to this additional investment for Bachelor's at the time), driving up subsequently the relative wages, and thereby incomes, of postgraduates.

In summary, from the perspective of remuneration of the various qualification levels, the early 1990s have not seen continued forces towards more income inequality. This comes perhaps somewhat as a surprise, in particular, as the initial event of the period was a substantial modification of New Zealand's industrial relations system. The passing of the Employment Contracts Act 1991 opened up the possibility for a more flexible and dispersed wage structure and one of the concerns voiced by its opponents was that the Act would increase inequality. In terms of relative income levels between educational groups, the empirical evidence shows that there was no such increase.

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