Returns to post-school qualifications: New evidence based on the HLFS Income Supplement (1997-2002)

Report to the Department of Labour by Sholeh Maani and Tim Maloney

Non-technical introduction to the research

This study is concerned with the causal effects of post-school education on individuals' income and earnings. The study builds on and extends previous New Zealand research evidence on this topic reported in Maani (1996, 1997, 1999), Hyslop, Mare and Timmins (2003), Winkelmann and Winkelmann (1998) and Dixon (1998).

Estimates of the effect of post-school education on earnings are of policy interest for a number of reasons. Most importantly, education-related earnings differentials provide information on the incentives that exist for young people to undertake higher education. Changes in the size of educational earnings differentials over time can also provide information on the balance that exists between the demand for higher education and the supply of these skills in the labour market.

Objectives and original contribution of the research

This study differs from the previous NZ studies in using an alternative and newer data source, the HLFS-Income Survey. The HLFS-IS measures earnings more directly and more accurately than the previously available data sources, and is collected every year. It also records multiple post-school qualifications for each individual, not just the highest.

The study extends previous research by calculating and comparing (within-sample) estimates of educational effects using three different 'outcome' measures: weekly income, weekly earnings and hourly earnings (Section IV). These estimates are compared with Maani's previous results from the 1996 census (Section III).

In Section IV, the study provides new information on the numbers of people in the workforce with different combinations of school and post-school qualifications, and gives some consideration to the question of how estimates of educational effects are altered when the multiple qualifications of each individual are taken into account. Finally, the effect of adjusting estimates of returns to education for sample selection effects is investigated (Section V). For reasons of brevity, that latter strand of the research is not summarised here.

Methods

Theoretical background: The 'returns to education' terminology comes from a theoretical framework in economics that considers higher education as a private decision to invest in 'human capital', and analyses the rate of return to that investment. Education is an investment of a person's current resources (including the

direct costs of education and the indirect costs of any foregone earnings while enrolled) in exchange for future returns. It is assumed that education raises an individual's productivity, and that the principal return from education is the higher earnings that can be obtained in the labour market as a result of that higher productivity.

Statistical model: The study uses regression analysis to estimate the returns to education. Three versions of a relatively simple model are used, differing in both the dependent variables and the number and range of independent variables that are included. The final and most complete version of the model, described in the paper as the 'extended' regression with time trend effects, can be written:

$$\ln Y_{it} = \alpha + \delta S_{it} + \gamma S_{it} T + \beta X_{it} + \varepsilon_{it}$$

$\ln Y_i$ is the log of income or earnings (measured in constant dollars) for each individual in each year (data from all years from 1997 to 2002 are pooled in the estimation). S_{it} is a vector of indicator variables that captures the highest qualification of each individual in the sample. Education is categorised as follows: School Certificate; Sixth Form Certificate; Bursary; any post-school certificate or diploma; bachelor degree; and masters or higher degree.[1] T is a 'time trend' vector, where T=1 in 1997 through to T=6 in 2002. This is interacted with the highest qualifications variables to get $S_{it}T$. The purpose of the $S_{it}T$ term is to identify whether there were any significant increases or decreases between 1997 and 2002 in the relationship between each educational attainment level and earnings X_{it} is a vector of other explanatory variables: age and age squared, ethnic group, whether born overseas, years lived in New Zealand if overseas born, whether living in a rural or urban area, region of residence and a complete set of dummy variables for the six years. The intercept is α and ε_{it} is the error term. The model is estimated using ordinary least squares.

The earnings effect of a given level of education, for example a bachelor degree, is identified in this statistical model in terms of the average difference in earnings between employees with a bachelor degree and employees with no qualifications, controlling for the effects of the other explanatory variables. Because the model is estimated on the pooled survey data from all six years, the results also represent average effects over the 1997-2002 period. However, the time trends that are included in the final model relax this averaging approach a little, and allow the effects of each level of education to change systematically over this sample period. In other words, rates of return associated with the highest qualification are allowed to fall or rise steadily over these six years.

Population of study

The population of study for most of the analysis is wage and salary earners aged from 25-64 years. Young people are excluded on the grounds that they may not have completed their education. A broader population of all employed people, including the self-employed, is used in the specifications in which weekly income, rather than earnings, is the dependent variable. In Section III the population is also broadened to

[1] See page 9 for a full explanation of the categorisation of education.

include 16-64 year olds, so that the results can be more validly compared with the results reported in Maani (1999).

Interpretation of the core regression estimates

The authors present estimates of the returns to education using three different 'outcome' measures: weekly incomes, weekly earnings and hourly earnings. To illustrate how the results in the core of the paper, Section IV, can be interpreted, it is useful to begin with the 'hourly wage' results that are presented in Table 8 and discussed on page 17.

Table 8 gives regression coefficient estimates for six levels of education (excluding 'no qualifications', the omitted category) and the other explanatory variables, from a model specification in which log hourly earnings is the dependent variable. Because the model is semi-logarithmic, the coefficients for each level of education can be interpreted, very roughly, as the percentage differential between the predicted hourly wage of individuals with that educational level and the hourly wage of those with no formal qualifications. An accurate conversion of each coefficient into a percentage effect uses the following formula:

$$g_j = [\exp(b_j) - 1] * 100$$

where g_j is the percentage gain relating to this educational level, and b_j is the estimated regression coefficient. For example, the coefficient of 0.236 for 'diplomas' in the first column of Table 8 (males, specification without time trend) indicates that the hourly earnings of individuals with a post-school qualification below degree level are around [exp(0.236)-1]*100 = 26.6 percent higher than those of individuals with no qualifications. In the same column, the coefficient of 0.560 for 'masters' indicates a wage differential of 75.1 percent for people with masters or higher degrees, relative to those with no qualifications. The coefficients for other categorical variables in the model, such as region, can be interpreted in the same way, relative to the omitted variable in each group. Finally, the coefficients on continuous variables such as age can be interpreted as the proportional change in earnings that is associated with a one-unit increase in the variable (or the percentage change, when multiplied by 100).

The model is re-estimated with a time trend variable included for each level of education (results shown in the second column of Table 8). Positive coefficients for the time trend variables can be interpreted as showing an *increase* over time in the wage differential for that level of education, and negative coefficients can be interpreted as decreases. While some of the time trend coefficients reported in Table 8 are positive and some are negative, none are statistically significant, suggesting there is little evidence of trend in the wage differentials for education during the study period.

An alternative (and perhaps more intuitive) method of looking for evidence of changes through time in educational wage effects, is to include a dummy variable for each year, and interact those year dummies with the educational dummies. The results of this approach are reported in Appendix D. If the qualification-by-year coefficients shown in the table increased or decreased consistently, this would be interpreted as evidence of rising/falling returns.

In Section VI the researchers briefly consider the effect of multiple and different combinations of post-school qualifications on earnings. The regression models estimated in this section of the paper (shown in Table 15) include information on all the post-school qualifications of each individual, and allow for interactions between the effects of any pair of qualification. Statistically significant interaction effects were found between 'bachelor degree' and four other groups of post-school qualification. All other interactions tested by the authors were not statistically significant and were therefore dropped from the models shown in Table 15.

To interpret the results, note that the effect of each qualification is additive, and for a person with multiple qualifications the total return to post-school qualifications will be the sum of the coefficients of each qualification held. For example, the total 'return to education' for a male with a bursary, a bachelor degree and a teaching diploma is calculated as 0.204 + 0.037 + 0.259 – 0.195 = 0.305, which is equivalent to 35.7 percent. The estimated return for a male with a bursary and bachelor degree only can be calculated, from the same model, as 0.204 + 0.259 = 0.463, which is equivalent to 58.9 percent.

Summary of results

Estimates of the size of returns to education
Estimates of the 'returns' to education based on the results in Table 8, using *hourly earnings* as the outcome variable, are consistent with previous New Zealand evidence indicating large positive returns. For example, the estimated average wage premium gained by males with higher education is around 27 percent for a post-school diploma or certificate; 59 percent for a bachelor degree; and 75 percent for a masters or higher degree (these are all relative to the wages of unqualified males). For females, the comparable estimates shown in the third column of Table 8 are 26 percent for a post-school diploma or certificate; 60 percent for a bachelor degree; and 77 percent for a masters or higher degree.

While large, these estimated returns are smaller than the returns estimated in previous work by Maani (1999) using the 1996 census data on individuals' annual incomes, and a broader subject population (including the self-employed and youth). Another finding worthy of note is that the educational coefficients for males and females are similar in size, suggesting that the returns to education do not vary much by gender.

Estimates using *weekly* earnings as the outcome variable are reported in Table 7. Hours of work are no longer controlled for (and full-time and part-time employees are included in the same regression). Comparing the two specifications, these results show higher returns to education, especially for women. For example, the coefficient for 'Masters' in the weekly earnings regression for females is 0.85, compared with 0.57 in the hourly earnings regression. The difference between the two specifications is basically the result of differences across the educational groups in hours of work: people with higher levels of education tend to work for more hours per week, and this

relationship is particularly strong among women.[2] In previous research using Census data on annual incomes, Maani (1999, p.31) found that private rates of return for females were higher than for males, for various educational levels. The results of the current study, which is able to compare estimates of returns based on different measures of earnings, show that this is not generally the case.[3]

Results using weekly *income* as the dependent variable are reported in Table 6. These results are obtained using a larger population, including the self-employed. The HLFS-IS measure of weekly income includes income from self-employment, interest, rent, private superannuation, and all forms of government income support. The general effect of these changes in population and outcome variable is to reduce the size of the education coefficients. This may be because non-earned income flows are less closely related to an individual's level of education than are earnings.

Changes 1997-2002

Figures 2 (weekly earnings) and 3 (hourly earnings) give a graphical summary of some of the study's findings with respect to *trends* in the returns to education. While the estimates vary from year to year, there is little sign of consistent increases or decreases in the returns to bachelor or masters degrees, between 1997 and 2002. Results for other qualifications are given in the tables in Appendix D and can be interpreted in the same way.

Effects of multiple post-school qualifications

Section VI of the paper provides some unique evidence on patterns of multiple post-school qualifications within the working-aged population. For example, Table 13 summarises the post-school qualifications that are held by people that have no school qualifications; School Certificate only; and other levels of school qualifications. It shows, for example, that around 30 percent of those with no school qualification went on to acquire a post-school qualification. Of these, the majority were trade certificates, New Zealand certificates, or polytechnic certificates or diplomas. Table 14 focuses on those with more than one post-school qualification and gives the (unweighted) number of people with each combination.

The regression estimates in Table 15, which include information on all the post-school qualifications that are held by each individual, show quite large differences in average hourly earnings between sub-groups with different combinations of qualifications. (As explained above, the coefficients can be added across qualifications to give the total return to post-school education.) Those variations in earnings could reflect complementarities between qualifications (or the lack of them), or differences in the unmeasured skills of people in the different qualifications groups, or differences in industrial or occupational employment patterns that are in turn associated with different wage outcomes.

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[2] In a review of the international research evidence on the effects of education on earnings, Card (1999) notes that 'since individuals with higher schooling tend to work more, the measured return to schooling with be higher for weekly or annual earnings than for hourly earnings'. (p.1808).

[3] The authors note on page 28 that there are a number of possible explanations for the pattern of additional hours of work for women with higher qualifications. It might reflect additional returns to education (if higher education lifts hours supply constraints), or it might be the product of self-selection in educational choices and labour supply behaviour (women who have a greater long-term commitment to the labour market have greater incentives to acquire higher education).

Limitations of the research

The following limitations of the research are worth noting:

- The earnings function approach to estimating educational returns focuses on the benefits of education, and does not include any information on the costs of education. A more comprehensive approach would model the costs of education as well (see Maani, 1999).
- Average returns can't be interpreted as the returns likely to be gained by any one individual. The latter can vary according to a person's industry and sector of employment, subject field, institution of study, birth cohort, vintage or quality of qualification, and where in the wage structure they are located (see Grubb, 1997, and Harmon et al, 2000 for overseas evidence on these types of variations).
- The earnings functions estimated in this paper include a relatively limited number of additional explanatory or 'control' variables, based on what was available in the HLFS-IS dataset. Omitted variable bias is a risk. Other research evidence suggests that estimates of the effects of education are particularly sensitive to the inclusion of good measures of labour force experience (Harmon et al, 2000, p10 and Winkelmann, 1998).
- In this study, standard errors on the regression coefficients have not been adjusted for HLFS-IS survey design features, such as the overlapping panel design (individuals are retained in the sample for up to two years), and the geographical clustering of the sample. This means that the standard errors reported in the paper probably underestimate the true standard errors, and the tests of significance reported in the paper *could* be supporting incorrect inferences, particularly where the significance level is not very high.
- Economists have noted a number of reasons why simple models of the type used in this study may give biased estimates of the returns to education. The possible sources of bias include:
    - Unmeasured attributes that differ across individuals and are correlated with both educational attainment and earnings. It is possible that people with higher education earn more because they have higher levels of various unmeasured attributes, such as intellectual ability or interpersonal skills, and not purely because of the education itself.
    - Systematic but unmeasured differences between people who are currently employed and those who are not. If employees differ from non-employees in their unmeasured attributes, the returns to education that are estimated using a sample of current employees will not necessarily apply to the rest of the population. The authors attempted to adjust their estimates for possible selection effects in Section V, but noted that their results showed that sufficient instruments were not available in the data set to apply sample selection in a satisfactory way.

  While these sources of bias are potential threats to the validity of the research findings, studies using far more sophisticated methods have continued to identify substantial educational returns, and often reach estimates that are larger or not much smaller than those estimated using a simple earnings function approach and ordinary least squares (Card, 1999, p.1855).

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