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TREASURY WORKING PAPER

99/2

Private and Public Returns to Investments in Secondary and Higher Education in New Zealand Over Time: 1981-1996

Sholeh Maani*

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ABSTRACT

With significant increases in the demand for new skills and participation in higher education in New Zealand since the 1980s, and the introduction of economic reforms toward market liberalisation since the mid 1980s, an examination of income returns to investments in higher education has been of significant interest. This study utilises micro level data from the New Zealand Census for the years 1996, 1991, 1986 and 1981 to examine the market returns to post-compulsory secondary and tertiary education for males and females. Internal rate of return estimations of private and public returns to education, and econometric modelling with formal stability tests of changes in returns over time are employed to examine the magnitude and changes in returns to higher education over the fifteen year period. The period of the study is of interest, spanning the period before and after the introduction of the first set of reforms in 1984, and labour market reforms in 1991. The results show strong support for an increase in the returns to tertiary education in the 1981-1991 period, and a stabilisation of results for males and a relative decline in the returns for females since 1991.

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I. Introduction

This study provides a 1996 analysis of the *private* and *public* returns to investments in higher education in New Zealand. The analysis utilises micro level data from the 1996 Census of New Zealand Population and Dwellings. Utilising the two conventional methods of ‘earnings functions’ and ‘internal rates of return’, it provides estimates of personal and public returns to investments in post-compulsory education. The study examines returns to secondary and higher education for males and females and it provides comparable estimates over the four census years of 1981 through 1996. The analysis extends earlier research for New Zealand over the 1981-1991 census years (Maani, 1994, 1996a, 1996b, 1997).

The economic reforms in New Zealand, the salient features of which were privatisation and market liberalisation, have attracted much international interest in recent years as a major economic case study. Now with the passage of more than a decade since the introduction of the reforms in 1984, studies of the economic impact of the reforms and economic conditions prior to and after the reforms are emerging in the international literature. The purpose of this study is to examine how relative income levels, and in particular the income returns to post-compulsory and higher education (education beyond age 16) have changed over the 1981-1996 period, spanning the period prior to and after the introduction of the reforms in 1984.

Major changes in the structure of the New Zealand economy, including market liberalisation over the past decade, have prompted a need for new skills, resulting in significant increases in participation in higher education. In addition, the economic reforms since 1984, skill shortages in new areas of economic activity, and increased pressures for international competitiveness have guided income returns to various skill levels, resulting in increased participation rates in higher education in the late 1980s and the 1990s.¹ Therefore, in examining the returns to investments in higher education since

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1981 and in 1996, both demand and supply forces are expected to have contributed to changes in education income premiums as observed in comparison with the three earlier years.

The link between educational qualifications and income levels has been of interest for a number of reasons, including the income distribution effects of educational investments, and the international literature in this area is vast and growing. These studies have generally utilised cross section analyses for one time period (e. g. Miller, 1982, and McNabb and Richardson, 1989 for Australia; Ogilvy, 1970 and Hunt and Hicks, 1985 for New Zealand; Demetriades and Psacharopoulos, 1987 for Cyprus; Rumberger, 1987, and Raymond and Sesnowitz, 1983 for the U.S.; and Vaillancourt, 1986 for Canada)-² The analysis of rates of return to education that are comparable over time has, however, been addressed in relatively few studies. For example, Miller (1984) and Chia (1990) have examined changes in returns to higher education in Australia over time, while Ryoo (1988), Wilson (1985), and Psacharopoulos (1994) provide international evidence on this question.

Earlier research for New Zealand utilising 1981, 1986 and 1991 census data (Maani, 1994, 1997) has shown that the returns to higher education are positive and significant in New Zealand. Moreover, the results have strongly indicated that consistent with the significant increases in participation rates, market rewards to education have been significant and increasing during the 1981-1991 decade.

Three features of the 1996 analysis compared to the earlier census years are noteworthy. First, a greater proportion of the New Zealand population has engaged in higher education since 1991, and the effect of this increased supply on the returns to higher education in 1996 is of interest. Second, fees, which were not a feature of tertiary decisions prior to 1991, have come to play a much more significant role in the financing

¹ For a detailed discussion of the New Zealand reforms the reader may refer to Evans, et. al. (1996), and Siverstone and Bollard (1996).

² Schultz (1988) provides an overview of relevant issues. Tan (1989) provides evidence for the Phillipines, Anderson (1988) for El Salvador, and Jamison and Van der Gaag (1987) provide estimates for the People's Republic of China.

of higher education by the middle part of the decade. Finally, and importantly, the composition of the New Zealand population has been significantly affected by the changes in New Zealand immigration law and the resulting immigration trends since 1991, which have increased the relative number of immigrants with higher education and from non-English speaking countries. These features are considered in the 1996 analysis.

The two methods of ‘earnings-function’ regression analysis and the Internal Rates of Return (IRR) methods are used in estimating income returns to higher education. The earnings function method uses semi-logarithmic functions and binary variables for different education levels, utilising individual level data. In the internal rate of return model, in turn, (see Psacharopoulos, 1981 and 1994, the ‘elaborate method’) age income profiles are estimated based on regression models. The IRR models utilise individual level data to estimate the internal rates of return at which (a) the sum of the net present values of expected lifetime incomes, and (b) foregone earnings and direct expenses during the years of education, are equated.

The two methods are complementary. Regression analysis, generally favoured for its convenience, provides estimates of *private* market returns to various educational levels. This method is also favoured for allowing formal stability tests of returns to educational degrees over time, as employed here for the test of potential change in income returns to education over the four census years. The regression method, however, does not incorporate direct costs of education such as fees. The ‘internal rate of return’ method, in turn, has the advantage of incorporating both the direct costs of education and the lifetime nature of returns to education, where the costs include foregone earnings and out of pocket payments such as fees. The *social* rates of return are further estimated by the ‘internal rate of return’ method, which incorporates the private and public costs of education. Computationally, the IRR method estimates are expected to result in lower rates of return than the regression method, when foregone earnings are significant. The complementary relationship of these methods is expected to present a more comprehensive set of results for this analysis.

In the next section the data set and the characteristics of the sample are discussed. In section III returns to secondary and tertiary education in 1996 are examined, based on

‘earnings-function’ regression analysis of income levels, and comparisons are made to results for the census years of 1981, 1986 and 1991. In Section IV the analysis of returns to education using the Internal Rate of Return (IRR) method is presented for 1996, and over time. This analysis is extended to incorporate the personal financing of tertiary education. In Section V, the IRR method is further employed to incorporate government expenditures on education in the analysis of the public returns to education, based on the 1996 census and in comparison to the three earlier census years. This analysis incorporates the effect of fees in 1996. Finally, conclusions are presented in section VI.

II. Data and Characteristics of Sample

The data set for the study consists of the ten percentage sample of the New Zealand Census of Population and Dwellings for 1996 (in conjunction with 10% data sets from 1981, 1986 and 1991), and the samples consist of those in the age group 16-65. Of the various New Zealand data sets, the census utilised provides the most suitable option by representing the overall New Zealand population, providing comparable information over time, information on educational qualifications and sufficient observations at each education level.

The census provides information on an individual's highest educational qualifications, making a distinction between the levels of School Certificate (year 11), Sixth Form Certificate (Year 12)³, Bursary (Year 13), Post-School Diploma, University Bachelor's degree, and Postgraduate degrees, in comparison to the control group with no secondary school qualifications, providing useful education levels for the analysis. Since primary education is nearly universal in New Zealand, returns to that level of education are not estimated.

Education is compulsory in New Zealand up to and including the Fifth Form (Year 11, and age 16), at the end of which nationally administered School Certificate examinations on up to six subjects are taken. Traditionally, School Certificate has been the highest educational qualification for at least half of the New Zealand population, and many

³ Sixth Form Certificate refers to the successful completion of examinations at the end of Year 12.

vocational, clerical and trade professions require it.⁴ The 1996 Census shows that 45.5 per cent of males and 50.2 per cent of females had completed their education at or below School Certificate level.⁵

Bursary examinations at the end of the 7th Form (Year 13) were originally designed to determine merit-based bursary payments to students for studies at university. Admission to the universities in New Zealand requires Year 13 Bursary, while a number of polytechnic diplomas and degrees require Sixth Form Certificate (Year 12) or Year 11 School Certificate.⁶ Nevertheless, some students choose to complete Years 12 or 13 and then go to polytechnic. As a result, it is noteworthy that the idea of the completion of secondary school has a wider application in New Zealand by referring to either 12 or 13 years, compared to the 12-year degree in some other countries such as the U.S.

It may be noted that the largest component of income in the census is earnings, but it also includes unearned income such as interest, rent, and government assistance. To the extent that higher unearned income is likely to be positively correlated with higher earned income, the overall effect of the inclusion of these incomes may be to result in rates of return that are higher than those based on earnings alone. However, the inclusion of government assistance as a part of income in the census is likely to introduce a negative correlation and somewhat flatten the age-income profiles, thereby decreasing the above effect. Despite this characteristic of the data, the New Zealand census provides the most suitable source of data for the study and since higher education may result in both increased earned and unearned income, the marginal returns estimated may be considered

⁴ In New Zealand, schooling starts during a child's fifth year and continues for thirteen years—six years of primary school (Junior 1-2, and Standard 1-4), two years of intermediate school (Form 1-2) and five years of secondary school (Form 3-7). The first year of school (Junior 1) is academically equivalent to the first grade in most other countries, so by the time students complete year 13 they are about 18 years old. In this system, secondary school (Forms 3 through 7) is equivalent to years 9 through 13 of study.

⁵ In comparison, the 1981 census indicates that, a decade earlier, these measures were 62 per cent for males and 69 per cent for females, as shown in Table 1.

⁶ Bursary examinations at the end of the 7th Form are nationally administered examinations on five subjects which determine eligibility for application to various university majors.

as the differences in the relative standard of living associated with different education levels.⁷

A summary of the characteristics of the 1996 samples for males and females and in comparison to the census years 1981-1991 is provided in Table 1. Most significantly, the statistics in Table 1 show the greater educational attainment of the New Zealand population over the 1981-1996 period. For example, in 1981 about one half of the sample (50.1% of males and 54.4% of females) had no school qualifications, but by 1991 this group had decreased to become approximately one third of the population (e.g. 34.06% of males and 34.62% of females in 1996).

In addition, education levels have continued to increase between 1991 and 1996, especially at the tertiary level, for which continued increased attainment levels are prominent. For example, by 1996, 12.6% of males and 10.0% of females had university qualifications. This represents a significant increase in tertiary qualifications over the 1981-1996 period from 5.5% of males and 2.7% of females in 1981, or even compared to 7.7% of males and 5.2% of females in 1991.⁸

A further examination of Table 1 reflects increased labour force participation and employment rates, and decreased unemployment rates, for both males and females since 1991. In 1996, 80.4% of males and 64.3% of females were employed (compared to 74.5% of males and 56.4% of females in 1991). The 1981-1991 period witnessed decreasing trends in male employment and participation in the labour force, but corresponding increases for females. In part, this reflected the changes in labour force participation patterns, and was also a reflection of increases in the unemployment rates. In 1981, only 7.4% of males but 51.3% of females were out of the labour force, compared with 17.3% of males and 37% of females in 1991. In comparison, in 1996, 14.3% of

⁷ The reader may refer to Psacharopoulos, 1985 and 1994; and Miller, 1982 for a number of international studies which have used incomes for rates of return estimations.

⁸ While all education levels show increasing trends, the only exception is the Diploma level which shows decreasing trends in 1996, after a significant increase between 1981-1991, (in 1991 one third of the sample had Diplomas (35.5% of males and 29.5% of females), compared with 25.8% of males and 22.4% of females in 1996).

males and 30.0% of females were out of the labour force, which represents a reversal of the trend for males and a continuation of the trend for females since 1991. In addition, unemployment rates, which had increased significantly over the 1981-1991 decade, were lower in 1996 for both males and females.

For the analysis of the effect of educational qualifications on income levels, comparisons of age-income profiles are initially considered in Figures 1 through 4, for the 1996 samples of 'all employed' and 'full-time employed' males and females. Since sample characteristics and age-income profiles are significantly different for males and females, throughout this report separate analyses are presented for the two groups. In addition, estimates are presented separately for the samples of the employed, and its sub-sample of the full-time employed, to account for the effect of the hours of work.

Figures 1-4 show the higher age-income profiles over the life cycle, with higher educational qualifications in 1996. (The age-income profile data used for creating Figures 1-4 is also presented in Tables A1- A4 in Appendix A). These figures further show that, similar to results for the 1981-1991 census years, the incomes profiles for females are consistently lower and flatter than the profiles for males. Although hours of work are likely to contribute to this effect, flatter and lower age-income profiles for females persist for the sample of full-time employed, indicating that other factors, such as different degrees of on-the-job training and different career paths, are also at work.

The lower overall income levels for females are confirmed when mean income levels by educational qualifications for males and females are compared in Tables 2 and 3 of the sample characteristics for the seven educational qualifications in 1996. For example, as reflected in Table 2, the average annual income for males with Postgraduate qualifications was \$56,059 in 1996, compared to \$48,449 for a Bachelor's degree, \$29,829 for School Certificate, and \$24,069 for no secondary school qualifications. In turn, for females the average income for those with Postgraduate qualifications was \$33,645 compared to \$26,218 for a Bachelor's degree, \$18,048 for School Certificate, and \$13,887 for those with no secondary school qualifications. Similar tables for the four sub-samples of the 'all employed' and 'full-time employed' males and females are also included in Tables B1-B4 in Appendix B.

Tables 2 and 3 (and Tables B1-B4 in Appendix B) also provide statistical evidence on labour market status and personal characteristics of the population by education level. These measures indicate that there is a clear increase in rates of employment and labour force participation at higher education levels for females. In comparison to the three previous census years, the 1996 measures show a continued increasing link between educational qualifications and employment stability for females over time, as reflected by employment and unemployment rates for each educational level.⁹ The increased participation in the labour force by women with higher education is especially marked.¹⁰

In the next section we consider the regression function estimates of the private rates of return to educational qualifications in 1996, and comparisons will be made to the earlier census year results.

III. Regression Function Estimates

The model tested is semi-logarithmic with binary variables for educational qualifications (see for example, Heckman and Polacheck, 1974; and Dougherty and Jimenez, 1991):¹¹

$$\ln Y_i = a + b_1 \text{School Cert}_i (\text{Year 11}) + b_2 \text{Sixth Form Cert}_i (\text{Year 12}) + b_3 \text{Bursary}_i (\text{Year 13}) + b_4 \text{Diploma}_i + b_5 \text{Bachelor's Degree}_i + b_6 \text{Postgrad. Degree}_i + b_7 \text{AGE}_i + b_8 \text{AGE}_i^2 + u_i \quad (1)$$

⁹ Tables 2 and 3 also indicate that those with Bursary as their highest degree had generally lower labour force participation rates. Additional statistics based on the census further indicate that, for example, 50.5% of the males and 37.8% of the females who were out of the labour force in this group were receiving student allowances in 1991.

¹⁰ For example, only 14.98% of females with Postgraduate qualifications were not in the labour force in 1996, compared to 44.72% of the female sample with no qualifications (In 1991 these measures were 15.19% and 50.5% respectively).

¹¹ Heckman and Polachek (1974) and Dougherty and Jimenez (1991) have provided tests of the functional form for the earnings function, and they support the semi-log specification as the most appropriate of the conventional transformations. Heckman et al. (1996) have provided further evidence that educational degrees have the most effect once they are completed. This, referred to as the 'sheepskin effect', is consistent with the specification adopted here.

where the dependent variable is the natural logarithm of annual income in current dollars. The model incorporates *after-tax* measures of income, but estimates based on *before-tax* income have also been provided for comparison.¹² The excluded educational qualification level is 'with no school qualifications'. Variable AGE is included as a proxy for years of experience in the usual quadratic form.¹³ In the New Zealand institutional setting, age has traditionally had prominence in determining earnings as a measure of overall personal experience. It may be noted that although earnings functions in the Labour Economics field generally include a number of variables such as race, family status, union membership, occupation, firm size, etc., in this study the interest is in the overall rates of return to an educational degree.

The 1996 cross-section results of Model (1) for the two groups of employed, and full-time employed males, are presented in Table 4 and for females in Table 5. The differences between the *before tax* and *after tax* columns reflect the effect of progressive income taxation. Tables 6-9, in turn, provide the above 1996 estimates along with comparable results for 1981, 1986 and 1991. An extended version of Model (1) above is also tested with a pooled 10% sample of population over the four census years of 1996,

12 The income information in the New Zealand census (similar to Australia) is reported in 13 categories, based on an annual gross income. The mid-point of these categories has been used as a measure of income throughout the study. The lowest income category in the census is nil income or loss for which income of zero is designated. The rest of the annual categories were \$2,500 or less, \$2,501-\$5,000, up to \$100,000 or more, for which based on Statistics New Zealand estimate a mid-point of \$130,960 was assumed.

13 The New Zealand Census does not provide information on the actual years of (potential) experience. In the original human capital models, variables for experience and experience squared are included instead of age, where experience is specified as 'age - years of schooling - 7'. Using a specification as above instead of age results in returns to education that are higher, especially at higher levels of education. Using age compares two individuals of the same age but varying years of education and potential job experience. Using experience specified as above compares individuals of different age but similar potential years of work experience. In the New Zealand setting a specification of 'Age-years of schooling-5' is relevant, since school starts at the age of 5. The model above was also tested with a specification in which 'potential years of experience' was included instead of 'age'. These results for the years 1981-1996 are presented in Tables C1 and C2 of Appendix C to provide a comparison. As expected, the estimated coefficients in the models in relation to potential years of experience are larger, especially in relation to tertiary degrees which require more years of study and allowing fewer years of work experience in a given age. However, the overall findings of the study regarding relative returns to degrees, and increases over time remain regardless of this specification.

1991, 1986 and 1981 for a formal stability test of changes in returns to education over time. These results are summarised in Tables 10 and 11.

The results in Tables 4 and 5 indicate positive and significant returns to educational investments in 1996. In addition, the results in Tables 6-9 indicate that the returns to all qualification levels have increased significantly over the 1981-1996 period, in comparison to the base group with school qualifications below School Certificate. In addition, the returns in 1996 have generally stabilised around 1991 levels or increased, except in the case of a Bachelor's Degree which has decreased slightly in 1996, in comparison to 1991 for both males and females. This particular result will be examined more closely through formal stability tests and further extensions to the model which adjust for the immigrant composition of the New Zealand population since 1991.

Since model (1) has a semi-logarithmic functional form, the coefficients for continuous variables, such as age, may be interpreted as a proportional change in income (or a percentage change when multiplied by 100) due to an increase in age by one year. Likewise, the coefficients for educational qualifications may be interpreted as the change in the natural logarithm of income in relation to the education level. However, since the educational qualification variables are dichotomous (binary) variables, in order to interpret these coefficients as a percentage gain in income, an adjustment may be used in relation to the estimated coefficients. The adjustment requires that the anti-logarithm of the coefficient is taken and the value one is subtracted (see, e.g., Halvorsen and Palmquist, 1980). For example, the *percentage* gain in income from School Certificate in relation to no school qualifications in equation (1) is derived as: $gj = [\exp(bj) - 1]$ times 100, where gj reflects the percentage gain relating to this education level, and bj is the regression coefficient (in Tables 4 - 9). Although for small coefficients below 0.15 or 0.20 the coefficients and adjusted percentages are very similar, for larger coefficients the adjustments are more significant.

For example, in percentage terms (gj), the bj coefficient of 0.495 in column seven of Table 6 for 'all employed' males indicates that a Bachelor's degree was associated with after-tax incomes that were 64.0 per cent higher than for those with no school

qualifications in 1996, compared to 39.8 per cent higher in 1981, and 67.5 per cent higher in 1991.¹⁴

A Postgraduate degree was also associated with an *after-tax* return of 81.8 per cent (a coefficient of 0.598) compared to those with no school qualifications in 1996 (79.1 per cent higher in 1991, and 53.1 per cent in 1981). The *marginal* percentage return to a Postgraduate degree *over a Bachelor's degree* was in turn higher at 10.8 per cent in 1996 (compared to returns of 6.9 per cent in 1991, and 9.5 per cent in 1981). These results for 1996 further indicate that for the sample of all employed males, the returns to a Bachelor's degree decreased slightly since 1991, but that the returns to a Postgraduate degree have increased since 1991. These results are consistent with the earlier finding that the returns to higher education for males have been significant and variable over time.¹⁵

The rates of return for females in Tables 5 and 8-9 are generally compatible with the results for males. The rates of return for females are generally higher than for males for most educational qualifications in 1996, despite their generally lower earnings. This result is consistent with the findings for 1981-1991 (Maani, 1996a, 1997), and results based on the IRR method, of Ogilvy (1970) and Hunt and Hicks (1985) for New Zealand, and Miller (1982) and Chia (1990) for Australia. These results tend to reflect the relative advantage of females with educational qualifications over other females engaged in jobs which require lower qualifications and have lower pay.¹⁶

It may also be noted in Tables 4-9 that the regressions for males have higher R^2 's than those for females. This reflects the effect of greater dispersion of hours of work and pay

¹⁴ Respectively, with coefficients of 0.335 in column 1 for 1981, and 0.516 in column 5 for 1991.

¹⁵ Likewise, compared to the control group, Sixth Form Certificate (Year 12) was associated with incomes that were 31.4 per cent higher in 1996, compared to 25.6 percent higher in 1991, and 12.2 per cent higher in 1981.

¹⁶ The results also confirm the flatter age-incomes profiles for females in the four census years. For example, slopes for before-tax incomes were 0.070-0.095 with age in 1996, compared to 0.126-0.143 for males.

levels, especially in the sample of all employed females, compared to the other three samples which represent more homogeneous hours of work.

The results for females in Tables 5 and 8-9 also indicate that the returns to a Bachelor's degree have decreased between 1991 and 1996, but that the returns to a Postgraduate degree have continued to increase. As the coefficient of 0.515 in column one of Table 5 for all employed females indicates, a Bachelor's degree was associated with after tax incomes that were 67.4 per cent higher than the control group in 1996 (compared to 77.7 per cent higher in 1991, and 54.7 per cent higher in 1981). The returns to a Postgraduate degree over a Bachelor's degree were, in turn, 17.8 per cent in 1996 (11.5 per cent higher in 1991, and 13.3 per cent in 1981). These results are also examined more closely through stability tests below.

It may be noted that throughout the four census years the returns to Bursary are unusually low, and at negative rates when compared to U.E. or Sixth Form Certificate. This may be partly due to the fact that younger individuals with Bursary are more likely to be enrolled in tertiary education, thereby having less time for market work.¹⁷ In the sample of the full-time employed, which eliminates this group (e.g. in column 4 of Table 4), the rates of return to Bursary are generally higher than those with School Certificate (22.3 per cent higher compared to the control group for Bursary and 16.9 per cent higher than the control group for the School Certificate), but still lower than those with Sixth Form Certificate, as reported in Tables 4 - 9. This raises questions as to whether those with a Bursary for their highest qualification are at a disadvantage in comparison to those who commence work after the Sixth Form (Year 12), since the Seventh Form (Year 13) Bursary degree is designed as preparation for higher education. This indicates that the returns to the Seventh Form may be best reflected as a year in preparation for a Bachelor's degree rather than a separate degree.¹⁸

¹⁷ For example, in the sub-sample of employed with Bursary as their highest educational qualification, 9.3 per cent of the males and 15 per cent of the females in 1991 were also receiving student allowances.

¹⁸ In terms of career paths, the Sixth Form (Year 12) is generally considered to be the completion point at secondary school for those who do not intend to pursue tertiary education. In addition, since the lower income levels for the Bursary sample noted above could also result from some anomalies (such as fewer weeks

It may be noted that since the above measures of returns to higher education over time are based on annual income levels available in the Census, these income gains would include the combined effects of changes in hours of work per week, weeks of available work and changes in hourly wages. Since the period of study is characterised by increases in demand for new skills, and given that acquiring higher education requires time, these results are consistent with the hypothesis that those with higher education have responded to the increased demand during this time period through more hours of work, and that they have experienced more job stability.

In addition, it may be noted that the analyses of the returns to education are compatible with both ‘human capital’ theory, adopted here, and ‘screening’ or ‘signalling’ models, in that in either type of model a person is expected to invest in education up to the point where the marginal benefits of investment are equal to marginal costs. While human capital theory emphasises the role of increased productivity due to increased education, screening hypotheses emphasise the role of education as a positional good. Signalling models further emphasise the role of educational qualifications as a signal of individual ability. The distinction is less significant in relation to personal investments in education, but more so in interpreting the social value of education in producing increased labour productivity and economic growth. (The reader may also refer to the new growth models and the link between educational investments and increased productivity and economic growth).

It may further be noted that since the models do not directly control for innate academic ability of individuals, these returns to educational qualifications may be best interpreted as the combined effect of educational qualifications and academic ability on income levels. One of the implications of this is that if the distribution of innate ability remains unchanged in a population, during periods of rapid increase in participation rates in

of employment due to education or overseas travel or work experience during a part of the Census year common to this group after completion of secondary studies), the use of Bursary income levels as a base could result in overestimates of returns to tertiary education. Therefore, comparisons of tertiary income levels in comparison to the Sixth Form (Year 12) income levels should be given more emphasis when analysing the results.

higher education it is plausible that the average level of innate ability of university graduates decreases. To the extent that innate ability can influence income levels when combined with education, increased participation can place a negative effect on observed income returns to education over time. However, an increase in the supply of graduates, even when keeping ability constant, is expected to exert an effect on the earnings of graduates in combination with demand effects. In this case, the forces of increased demand for post-compulsory education have obviously been greater than the effect of supply increases in the post reforms period. A stabilisation, or a relative decrease in the returns to a Bachelor's degree since 1991 are, in turn, consistent with the increased number of graduates in the 1990s. This is not an undesirable result, and in fact an indefinite increase in returns to higher education is not likely if supply of graduates can respond to increases in demand over time. In the following analysis the changes in the returns to educational degrees over time is examined through formal stability tests.

Stability Tests of Returns Over Time:

As the regression results of Tables 6-9 indicate, the returns to post-compulsory education have been significant and changing since 1981. The trends between 1981 and 1991 show increases in returns to post-compulsory education at all levels. The 1996 returns, in turn, show a stabilisation of returns around the 1991 levels, with minor decreases for males and more significant decreases for females in returns to a Bachelor's degree. In general, it is desirable to formally test the changes in the income returns to various educational degrees over the four census years. It is also useful to further examine the sources of the decline in the returns to tertiary education in 1996 compared to 1991. These questions are examined in this section.

For the stability tests over the four census years, restricted and unrestricted models, the binary variable technique and the Wald test are performed.¹⁹ The tests involve pooling together the 10 per cent samples for the four census years. The stability of each coefficient is tested through t-tests relating to interaction effects for all coefficients over the four census years. The results of the non-restricted regressions for all employed and

¹⁹ For more details on the tests, the reader may refer to Ramanathan (1992), pp. 171-172, and 274-276.

full-time employed males and females are summarised in columns 1-4 of Tables 10 and 11 respectively.

Figure 5 provides a summary of percentage income returns to various degree levels over the four Census years, based on Tables 6-10. Figure 5 shows the increase in post-compulsory secondary and tertiary income returns over the 15 year period, where the solid lines represent the overall population and the broken line segment shows returns for the 1996 population excluding recent immigrants since 1991. Also, implicit in these results are the lower relative income levels with no school qualifications over the time period, indicating that, in relative terms, the opportunity cost of not having school qualifications has increased.²⁰

As shown in Figure 5, the results in columns one and three of Tables 10 and 11 show that the returns to all educational degrees were significantly higher in both 1996 and 1991 compared to the base year of 1981. These tests also indicate that the returns to most educational qualifications had increased at statistically significant levels over the 1981-1996 period. For example, the results for the sample of *full-time employed males* in column three of Table 10 indicate that, compared to those without school qualifications, the returns to School Certificate were 6.1 per cent higher in 1996 compared to 1981, the returns to Sixth Form Certificate were 15.1 per cent higher, and the returns to Bursary were 9.1 per cent higher.²¹

The returns to a Diploma were 6.9 per cent higher, a Bachelor's degree 20.3 per cent higher, and the returns to a Postgraduate degree 20.0 per cent higher in 1996 than in 1981. The Wald test for the stability of all coefficients was also conducted based on the restricted and unrestricted models spanning the four census years. The results further

²⁰ Also implicit in Figure 5 is that while income returns to both secondary and tertiary qualifications have increased over the four Census years, there has been a relatively greater rate of growth of income returns to Year 12 compared to tertiary education, as may be reflected by the marginal income returns to tertiary education compared to Year 12 education.

²¹ Respectively, with coefficients of 0.059, 0.141, and 0.087.

support the hypothesis, at the 0.01 level of significance, that overall the coefficients have changed over the four census years, but most significantly between 1981 and 1991.²²

A comparison of the results for males and females further confirms that the returns to higher education have been higher for females since 1981. However, the relative increases in the rates of return for females were more modest than they were for males over the 1981-1996 period. Most significantly, in 1996 and compared to 1981 the returns to a Bachelor's degree for the sample of full-time employed females had increased by 10.5 per cent (a coefficient of 0.10 in 1996, in column three of Table 11), compared to an increase of 20.3 per cent for males (a coefficient of 0.185). For a Postgraduate degree the returns for females had increased by 10.0 per cent between 1981 and 1996, compared to 20.0 per cent higher for males.²³

In addition, a comparison of the coefficients for 1996 and 1991 indicates that while for males the returns to all educational degrees, including a Postgraduate degree, continued to increase between 1991 and 1996, the returns to a Bachelor's degree had decreased in 1996 relative to 1991. For example, for the sample of all employed males in column 1 of Table 10 the coefficient reflecting the gain in returns to a Bachelor's degree in 1996 relative to 1981 was 0.154 (indicating a percentage income increase relative to the control group since 1981 of 16.6%) but the coefficient for the 1991 gain was 0.181 (indicating a percentage income increase of 19.8% relative to the control group since 1981). For the full-time employed sample of males the drop in the returns to a Bachelor's degree between 1991 and 1996 was more modest, as reflected by coefficients of 0.182 in 1996 and 0.197 in 1991. The results for females, in turn, indicate drops in returns to a Bachelor's degree in 1996 relative to 1991 and stable returns to a Postgraduate degree.

²² The reader may refer to Moulton (1986, 1991) in relation to using OLS estimation with *grouped data*. Moulton shows that when individuals within a group are affected by a third omitted factors such as characteristics of a locality, or the state of the economy, the assumption that the error terms across individuals, in different groups, are independent is no longer valid. Moulton's analysis shows that under these conditions the *standard errors* of the coefficients are underestimated, and the *statistical significance* of the differences between groups will be overstated. Two solutions are available. One is the introduction of dummy variables for each category, such as the educational qualifications and Census year dummy variables included in this study. When the introduction of dummy variables is not possible due to limited variation within groups (for estimation purposes) an adjustment in the standard errors or GLS are recommended.

²³ Respectively, with coefficients of 0.096 and 0.182.

It is of interest to examine the causes of the lower returns to a Bachelor's degree in the 1996 compared to the 1991 census results. For example, as noted above, it is expected that the returns to higher education would not increase indefinitely, and that when demand for new skills increases educational institutions and students would respond to the increased demand, such that the supply of graduates responds to demand. This scenario, for example, is consistent with the finding that the returns to a Bachelor's degree have decreased slightly since 1991 for males, but that returns to a Postgraduate degree have continued to increase, suggesting that the supply of Postgraduate degree holders has continued to be smaller than demand.

However, it is important to note that the composition of the New Zealand population has also been significantly affected through immigration since 1991. This is important to the question of returns to higher education in 1996 relative to 1991, since changes in the New Zealand immigration law and resulting immigration trends since 1991 have increased the relative number of immigrants with higher education from non-English speaking countries in the recent past. Fortunately, the 1996 census includes information on whether or not those in the census were born overseas, and the year in which an immigrant had migrated to New Zealand.²⁴

To adjust for the immigrant component of the 1996 census, since 1991, the models in Tables 10 and 11 were expanded to adjust for returns to all educational degrees also controlling for whether or not a respondent had immigrated since 1991. These results are summarised in columns 2 and 4 of Tables 10 and 11 for males and females respectively. These models allow the separate estimation of the returns to various educational degrees in 1996 relative to the previous census years for the general population as opposed to recent immigrants since 1991.

The results in columns 2 and 4 of Tables 10 and 11, also shown by the broken lines in Figure 5, which control for the new immigrant population, show an important finding

²⁴ The census also includes information on whether or not an immigrant had deficiencies in speaking English.

that the results in columns 1 and 3, of a decline in the returns to a Bachelor's degree in 1996 are actually reflecting the immigrant group results. This result is noteworthy, as immigrants since 1991, who have by design of the immigration policy tended to have higher education, and more significantly representative of non-English speaking countries, are receiving lower returns to higher education, decreasing the average estimated returns to Bachelor's and Postgraduate degrees. The inclusion of the immigrant population in the sample influences the estimates for the male sample to a greater extent, but to a lesser degree for females. This is expected to reflect higher male tertiary educational qualifications and labour force participation rates among certain immigrant groups.

It can be noted in columns 2 and 4 that once the recent immigrant group is accounted for, the results show that the male New Zealand population has received returns to a Bachelor's degree which have generally stabilised between 1991 and 1996. For example, the coefficient of the income gain pertaining to a Bachelor's degree in 1996, compared to 1981, in column 4 of Table 10 for full-time employed males changes to 0.202 compared to 0.197 for 1991. Likewise, the gain in the returns to a Postgraduate degree in 1996, compared to 1981, changes to 0.200 compared to 0.167 in 1991). This reverses the results in columns 1 and 3 for males and it indicates that the demand for Post-graduate degrees has continued to increase relative to the supply of graduates (when excluding immigrants since 1991).

For females, in turn, the inclusion of the immigrant variable results in minor changes in the coefficients, indicating that the returns to a Bachelor's degree had decreased between 1991 and 1996, but that the returns to a Postgraduate degree also increased during that time period. The results for a Bachelor's degree reflect the relatively larger size of the male immigrants with higher education in the labour force, and possibly other characteristics of the samples of male and female immigrants in the labour force, such as the country of origin of immigrants or language proficiency.

Although outside the scope of the current study, the labour market experience and the relative earnings of recent immigrants are worthy of closer consideration in future studies. For example, further tests of the returns to higher education based on the 1996 census for the immigrant population since 1991 (not presented here) confirm that the lack

of language proficiency is a significant factor which tends to decrease the returns to higher education for this group. In addition, 'years since migration' are associated with increased income and improved returns to a tertiary degree.

The analysis of this section has, however, shown that the returns to various education levels have continued to be significant in 1996, and that between 1981 and 1996, and also 1986 and 1996 the returns have increased significantly.

IV. 'Internal Rate of Return' (IRR) Method

In this section private and social rates of return to post-compulsory education are estimated using the Internal Rate of Return method, and comparisons are made to returns based on the 1981, 1986 and the 1991 census years.

Estimates of private rates of return based on the IRR method estimate the discount rate which equates the stream of lifetime gains from additional years of education to the total personal costs of acquiring the additional education (see, for example, Psacharopoulos, 1981). The major strength of this method is that it can incorporate the effect of personal costs of acquiring education such as student fees, and means of financing education plus foregone earnings towards estimation of rates of return for various levels of education. This is also true in the case of social rates of return, which incorporates public expenditures on education.

Estimates of private rates of return to education generally incorporate the effect of income gains in the form of lifetime *after-tax* incomes at a higher education level, in relation to personal costs of education such as foregone earnings.

The IRR method assumes that the age-income profiles at a given time also reflect how an individual may expect to earn income over his or her lifetime (see Psacharopoulos, 1981, 1985; Miller, 1982; and Behrman & Birdsall 1987). This rather restrictive assumption is also implicit in the regression function method based on cross section data. The alternative method of using longitudinal data sets has advantages for estimating ex-post rates of return. However, for estimating ex-ante estimations a longitudinal data set has

the disadvantage of applying data over the previous half a century or so when the economic conditions are likely to have been different as well. Therefore, the use of cross section data, although not ideal, may best explain the returns expected by individuals based on observable income gains at a given time.

The use of data from the four Census years has, however, allowed the creation of pseudo panels of age income profiles as shown in Figures D1 to D4 in Appendix D. The panels demonstrate the profiles for three age group cohorts followed through the four Census years, such that the first cohort, for example, was 21-25 years old in 1981, 26-30 in 1986, 31-35 in 1991 and 36-40 in 1996. Age income profiles created on the basis of these cohorts and the four Census years in real terms (with incomes in 1996 dollars) for Bachelor's degrees and Year 12, for males and females and 3 age cohorts are available in the Appendix. It is interesting to note that these constructed age-income profiles follow the shape of the portions of the cross-section profiles.²⁵

Private Rates of Return

This method, which is referred to as the 'elaborate method' (see, for example, Psacharopoulos, 1981, and 1994), involves in the first step deriving age-income profiles through equations of the form:

$$Y_i = a + bAGE_i + c(AGE_i)^2 \quad (2)$$

for each of the relevant education levels, and for the eight samples of males and females in the categories of all employed, employed full-time, employed and unemployed, and employed and out of the labour force.²⁶

²⁵ These age-income profiles use the 10% samples of the All Employed and before tax income levels.

²⁶ It may be noted that equation (2) assumes a linear form as opposed to the semi-log functional form of equation (1) (in relation to the dependent variable). The linear functional form is used in the IRR literature for the convenience of using estimated income levels in solving equations (3) and (4). The test of comparative semi-log functions, however, resulted in similar results for the rates of return based on the linear function at the mean.

In the second step, the estimated values of lifetime income (Y) are predicted for each education level, and these predicted returns are used in solving equation (3) in deriving the private rates of return to education (r):

$$\sum_{t=S+1}^n \frac{[Yh_i(1-x) - Ys_i(1-x)]_t}{(1+r)^t} = \sum_{t=1}^S \frac{[Ys_i(1-x) + P_i]_t}{(1+r)^t} \quad (3)$$

where Yh and Ys respectively represent before-tax incomes with the higher and the lower levels of education, and x is the income tax rate for the income level, such that *after-tax* incomes are incorporated. P_i represents personal expenditures on education per year, $t = 1$ is the first time period of study for each degree, r is the discount rate, and S is the number of years required for an educational qualification.²⁷

In examining the private returns to education based on the 1996 census it is important to note that to realistically reflect personal costs in estimating the net personal returns to tertiary education, P_i in 1996 includes fees. For this, a weighted average of university fees in New Zealand was estimated and included in the analyses. To provide results that are updated and are most relevant, throughout this section the 1996 returns are based on income levels and costs that are adjusted to 1998 dollars. The analysis also uses 1998 tertiary fees. The weighted average of university fees in New Zealand was estimated at \$2,877 in 1998. This weighted average was based on measures of the average fee charged by each university in 1998 weighted by the number of each university's Equivalent Full-Time Student (EFTS) funded places for 1998. The details of the calculation of the average fee are also presented in Appendix E.

In addition to the IRR estimations, discounted private sums of net returns for the relevant degree are calculated by taking the net present value of all lifetime private income gains discounted at a five per cent real discount rate minus the discounted sum of costs. Expressed algebraically, this becomes:

²⁷ A qualification enters the analysis once it is fully completed, and foregone earnings are based on the most recently completed qualification.

$$(4) \quad N(pvt)_i = \sum_{t=S+1}^n \frac{[Yh_i(1-x) - Ys_i(1-x)]_t}{1.05^t} - \sum_{t=1}^S \frac{[Ys_i(1-x) + P_i]_t}{1.05^t}$$

These sums are adjusted to 1998 dollars across the four census years for the convenience in comparisons. It may be noted that in cases in which a private rate of return is less than 5 per cent, the corresponding sum of return which is discounted at the 5 per cent level will be negative.

The private rates of return estimated for the census years of 1981, 1986 and 1991 and 1996 respectively use the marginal tax rates of the 1980-81, 1985-86 and 1990-91, and 1995-1996 tax years for calculating after-tax income.²⁸ These estimates are based on individual level data.²⁹

In estimating lifetime earnings, it was assumed that, after completing their degree, individuals work to the age of 65, and forgone earnings were estimated based on the required number of years for completing a degree. It was assumed that a Bachelor's degree requires three years, a Postgraduate degree two years, and a Diploma two years for completion. These are the general time requirements in New Zealand. Any individuals taking longer than usual to complete a degree, or studying at advanced ages, will face lower rates of return than those estimated in this study.

For example, to calculate the 1996 private rate of return for females with Postgraduate qualifications compared to no secondary qualifications, there are eight years of foregone earnings. Personal expenditures on education include tertiary fees in 1996, fees are not included in the estimations for 1981 to 1991 census years since in those years tertiary students were not subject to tuition fees, and student allowances also covered

²⁸ Similar to the regression function method, the marginal tax schedules for a single person without deductions have been used for calculations of after-tax income.

²⁹ As noted earlier, the income information in the New Zealand census is reported in 13 categories, based on annual gross income. The midpoint of these categories has been used as a measure of income throughout the study. Age in the census is measured in actual years (rather than categories) and the analyses throughout the book incorporate actual years.

expenditures on text books. Therefore, the expected effect of tertiary fees is a decreasing effect on the private rates of return for tertiary education in 1996, compared to 1991.

The left hand side of equation (3), or lifetime gains from education, are the higher yearly net incomes (at 1996 tax rates) that a full-time female with a Postgraduate qualification can earn on average above a full-time female with no secondary qualification, from the time of completion of studies to age 65. The sum of benefits is set equal to the costs of the foregone earnings to solve for the private rate of return (r).

The results for the *private* rates of return for all employed, and employed full-time, males and females are presented in Table 12. Comparable private rate of return estimates over the 1981-1996 census years are presented in Tables 13 and 14 for males and females respectively. The results of age-income regressions for the seven education levels based on equation (2) for 1996 are, in turn, presented in Tables D1 to D4 in Appendix D. These equations provide average before-tax income levels for each education category by age and gender based on the 1996 census. Since such results based on individual level data and in a compatible form over time have not previously been available in New Zealand, these results are provided to facilitate further research and analysis in this area. Comparable results for the 1981-1991 census years may be found in Maani (1994 and 1997). The IRR method utilises the overall 1996 samples of New Zealand population including immigrants since 1991, and therefore includes the combined effects of change over time.

The results in Table 12 are compatible with the earnings function estimates in indicating that education is a profitable investment for both males and females, although the magnitude of these estimates is not identical to the earnings-function estimates. As expected, the internal rates of return are lower than the regression function estimates, but these differences are significantly larger for higher education levels with higher foregone earnings.

For the sample of all employed, the rates of return from School Certificate to a Diploma, in Table 12, are 6.9 per cent for males and 3.6 per cent for females, and returns to a Bachelor's degree (in relation to Year 12 Sixth Form Certificate) are 9.2 per cent for males and 9.8 per cent for females. These estimates, which incorporate foregone

earnings and tertiary fees are significantly lower than the regression function estimates. This comparison has highlighted the need for caution in comparing rate of return estimates from one method to the other, especially when foregone earnings are important to the analysis.³⁰

Similarly, the IRRs to males for a two-year Postgraduate degree in 1996 are around 5.1 per cent (compared to returns of 10.8 per cent with the earnings-function method, based on a differential coefficient of 0.103 (or the difference: 0.598 - 0.495) from column one of Table 4)). As before, for a Postgraduate degree, the estimated returns for females were higher at rates of 8.00 per cent using the 'elaborate method' (but lower than the estimates of 17.8 per cent with the earnings-function method, based on a differential coefficient of 0.164 (or the difference: 0.679 - 0.515) from column one of Table 5).

Like the regression function results for the 1981, 1986 and 1991 census years, the returns to School Certificate and Sixth Form Certificate are significant and above ten per cent, but the rates of return for each additional year of education beyond the Sixth Form are lower than ten per cent.³¹

The rates of return and the sums of return in Tables 13 and 14 further allow comparisons of private rates of return with the IRR method over the four census years. These results show that the returns for most educational degrees have increased throughout the 1981 - 1996 period, and that only in the case of a Bachelor's degree have the rates of return decreased, by generally less than one percentage point. This result is expected to reflect the effect of fees, increases in returns to year 12 studies over the period, changes in the supply of graduates, and the immigrant composition of the population.

³⁰ When the returns to a Bachelor's degree compared to the sample with Bursary are considered, returns to tertiary education are estimated at higher rates. As noted earlier, this is due to the somewhat lower levels of income for the Bursary sample both as the base for comparison and for foregone earnings. There is also one less year of foregone earnings.

³¹ The rates of return for Sixth Form Certificate to Bursary, and to Diploma, are often negligible, negative or undefined. Undefined rates of return occur where all lifetime income differentials at the higher education level are adverse (and consequently calculation of a rate of return is not possible), or where most of the lifetime income differentials are adverse.

Social Rates of Return

The analysis of the social rates of return to education examines the rate of return associated with lifetime income gains adjusted for all public and private costs of this investment including foregone earnings. The use of lifetime income gains from education is based on one of the underpinnings of micro-economic theory: that in competitive markets the market returns to one's economic activity (or earnings) reflect the value the economy places on one's productivity. Therefore, if on average, income earned due to employment or other market activity reflects the value of one's market productivity, the effect of education on increased productivity should be captured through income gains.

The calculation of the social rates of return (r_s) is in turn based on equation (5) below, incorporating foregone earnings, Y_{Si} and personal expenditures, P_i , as well as government expenditures, G_i , on education at time t :

$$\sum_{t=S+1}^n \frac{[Yh_i - Y_{Si}]_t}{(1+r_s)^t} = \sum_{t=1}^S \frac{[Y_{Si} + P_i + G_i]_t}{(1+r_s)^t} \quad (5)$$

where Yh and Ys respectively represent *before-tax* incomes with the higher and the lower levels of education, in correspondence to their theoretical counterpart of market rewards as a reflection of the value the economy places on the productivity of labour with that qualification level. (The private rates of return in comparison incorporated *after-tax* incomes in correspondence to the returns accruing to the individual).

Government expenditure levels used in the analysis for 1996 are based on the most recent estimates of annual costs of secondary and tertiary education as provided by the Ministry of Education for three levels: Secondary School, Polytechnic and University level. The estimated total annual government expenditures in 1994 per student per year were reported as follows: \$5,030 for the secondary school level, \$9,210 for polytechnics, and \$10,170 for the university level. These per-student expenditures include operating grants, salary costs and external costs including central administration expenditures and support services such as the administration of the student allowance scheme. (In 1990, the per

student expenditures for a university degree were higher at \$11,658).³² Finally, as before, P_i represents personal expenditures on education per year (which again was assumed to be zero in the 1981 - 1991 census analyses, but it takes the estimated value of \$2,877 for the average weighted value of tertiary fees in the 1996 census analysis), $t = 1$ is the first time period of study for the relevant degree, r_s is the discount rate, and S is the number of years required for an educational qualification.³³ Therefore, in comparisons of the 1996 social rates of return to education compared to the earlier census years, the overall expenditures on education includes both the government spending, student fee payments and foregone earnings.

Correspondingly, the net social discounted sums of returns may be expressed algebraically as:

$$N(soc)_i = \sum_{t=S+1}^n \frac{[Yh_i - Ys_i]_t}{1.05^t} - \sum_{t=1}^S \frac{[Ys_i + P_i + G_i]_t}{1.05^t} \quad (6)$$

multiplied by the price level conversion factor. As before, any social rate of return of less than five per cent will have an associated negative sum of return at a five percent discount rate.

It may be noted that, ideally, social rates of return to education must incorporate the externalities of education to include not only returns to education in the form of earnings,

³² (Source: *Education Statistics of New Zealand 1998*). The estimated total annual government expenditures in 1990 per student per year were in turn reported as follows: \$4,596 for the secondary school level, \$9,605 for polytechnics, and \$11,658 for the university level (Source: Horan, R. and N. Pole (1993), *Government Expenditure on Education: 1990*, Report by the New Zealand Ministry of Education, Table 6, p. 18). These expenses were adjusted for inflation in estimates of the 1981 - 1991 social rates of return to education. If capital valuation of educational institutions was added to the costs, they became \$5,367, \$12,583 and \$14,891 respectively. The breakdown of the \$14,891 annual expenditures per student at the university was \$3,513 in salary costs as part of \$8,697 of operations grant, in addition to \$2,961 of external costs (for example, school transport and student allowances), and \$3,233 for capital valuations. The reader may also consult Marais (1992) and Hope and Miller (1988) for further discussions of financing tertiary education.

³³ An educational qualification enters the analysis once it is fully completed, and foregone earnings are based on the most recently completed qualification. Degree costs reported in 1990 in real terms were used for the three census years.

but the net pecuniary and non-pecuniary benefits to third parties in an economy. A wide range of benefits associated with education has been identified in the literature. Examples of the spill-over benefits cited include a greater ability to take initiative, develop and adapt to technological change in the workplace (Chapman and Chia, 1989); improved health; a role in preserving democratic freedom, in transmitting cultural values (McMahon, 1987); a role in more intelligent voting behaviour (Brennan, 1988); and a role in lowering criminal behaviour (Webb, 1977). The negative association between educational qualifications and unemployment has been addressed in detail for New Zealand, in the OECD Economic Surveys 1992-1993.³⁴ There is also evidence that those with higher education are less likely to depend on welfare payments (Chia, 1990; Maani, 1994).

Considering such external benefits is obviously relevant to the decision-making process regarding the funding of education. However, the international literature on social rates of return has come to exclude such external benefits, since identifying and measuring these benefits objectively is extremely difficult. As a result, what is referred to as the 'social rates of return' to education in the literature and in this study is not fully equivalent to its theoretical counterpart, since the empirical measure includes the public expenditures on education but not third party benefits such as the advantages of a well trained labour force. In the analysis of this section, the conventional method of estimating social rates of return has been adopted, with zero values assigned to the external benefits of education. Therefore, as with the earlier census estimates, the estimated values are best interpreted as *minimum* social rates of return.

The estimates of the social rates of return to education, for males and females, are presented in Table 15, and comparable returns for 1981-1996 for males and females are presented in Tables 16 and 17. The results indicate that investment in education continues to be socially profitable in 1996 as was estimated for the three previous census

³⁴ A number of monetary and non-monetary externalities of tertiary education are also noted in the New Zealand Vice-Chancellors' Committee Report (1993).

years, and similar to the private rates of return, at rates which diminish for higher levels of education (per year of study).³⁵

An examination of the results for 1996 in Table 15 and over time in Tables 16 and 17 indicates that the social rates of return have been positive and have generally either increased or remained relatively stable over the decade. The social rates of return for all employed, and full-time males in 1996 for completing the Sixth Form Certificate compared to No School Qualifications (in columns one and three of Table 15), are 13.3 to 12.9 per cent, and 14.2 to 13.5 per cent for females. These social rates of return indicate that investment in education is not only privately but also socially desirable, compared to a wide range of investments with lower rates of return. These rates of return are about 1.9 -2.2 per cent lower than the private rates of return for males, and 2.7-3.6 per cent lower for females.³⁶

The social rates of return to a Bachelor's degree, from Year 12 are 8.1 - 8.6 per cent for males, and 7.4 to 7.8 per cent for females. These social rates of return are respectively around 2.4 to 2.6 per cent lower than the private rates of return for males and around 1 percentage point lower than the private rates of return for females. The social returns to a Postgraduate degree have also increased in 1996 for both males and females (at estimated returns of 4.16 to 4.59 per cent), compared to higher returns of 6.38 to 6.49 per cent for females. The relative rates of return to a Bachelor's and a Postgraduate degree again reflect the effect of higher foregone earnings once a Bachelor's degree is obtained. However, consistent with the results for the earlier census years, the 1996 age-income profiles as shown in Figures 1-4 based on annual incomes, and the earnings function method in Tables 5-10 have shown that the market income levels do reward a

³⁵ Considering capital valuations as a part of costs of education is relatively recent in New Zealand and was used in the early 1990s. Incorporating capital valuations in IRR estimations has been examined in detail in Maani (1994) for comparative purposes. This decreases the social rates of return by less than one per cent.

³⁶ Similar to the private rates of return, beyond Sixth Form Certificate, the social rates of return for each additional year of education are lower than ten per cent. The social returns to a Diploma, compared with School Certificate and excluding a seventh form year, are about two per cent lower than the private rates of return for males at 4.4 per cent (compared to 6.93 per cent), and about one and a half per cent lower than the private rates of return for females at 2.18 per cent (and 3.62 per cent).

Postgraduate degree above a Bachelor's degree, as reflected by higher average income levels.

Vaillancourt (1986), who has used similar methods for estimating private and social rates of return to a Bachelor's degree for Canada in 1981, estimates returns of ten per cent for private and six per cent for social rates of return in British Columbia. Private rates of return in other regions are estimated at nine to fourteen per cent, and social rates of return at seven to nine per cent. Miller (1982) had found private returns of twenty-one per cent and social returns of fifteen to sixteen per cent for a Bachelor's degree based on the 1976 Australian census. Private rates of return for Postgraduate degrees were estimated at 14.5 to 14.8 per cent and social rates of return at 10.1 to 10.7 per cent (based on the 1976 Australian census).

In a recent summary of international estimates of private and social rates of return (Psacharopoulos, 1994), the overall private rate of return to secondary education was 17.7 per cent and for higher education 19.0 per cent, compared to social rates of return of 13.5 per cent and 10.7 per cent respectively. In these estimates, the differences between the private and social rates of return (differences of 4.2 per cent for secondary education) are significantly greater than the estimates of this study.

In the 1981-1996 results for New Zealand, the differences in the private and social rates of return to education are, in general, consistently modest at differences of one to four per cent for the three census years. In these differences New Zealand continues to be closer to the group of high income countries (reported in Psacharopoulos (1994) with private rates of return of 12.8 per cent to secondary education and 7.7 per cent to tertiary education, and social rates of 10.3 per cent and 8.2 per cent respectively), than it is to the rest of the world, due to the well-established income tax system in New Zealand and other higher income countries.³⁷

Since virtually all countries subsidise education to some extent, the social rates of return to education (r_s) calculated as above are often lower than the private rates of return (r). In these measures, since the private rates of return are based on after-tax income, and

³⁷ High income countries are specified at income levels of \$7,600 and higher in that study.

social rates of return are based on before-tax income while incorporating public expenditures on education, the differences between the two rates are expected to be affected by the income tax system relative to public expenditures on education. However, it may be noted that the *difference* between the private and social rates of return to education is only a crude measure of government subsidisation of education, since government expenditures and income tax payments are practically discounted at different discount rates in the private and social rate of return estimations.³⁸

Two alternative comparisons to the above differences are also possible. One is to examine the difference between the net sum of the social and private present values for each educational degree. This difference is derived by subtracting equation 4 from equation 6 [$N(soc)_i - N(pvt)_i$], where these equations use a standardised discount rate and are expressed in dollar terms.³⁹ These differences may be derived from the sums of return for each education level in columns 1 and 3 of Tables 15 and 12 for males, and columns 2 and 4 of the same tables for females. These differences are in dollar terms, and they are discounted at a uniform rate of 5 per cent, reported in 1998 dollars for comparison across the years.

These differences are generally positive, indicating that, assuming a forty year working lifetime, additional potential income tax payments are estimated at levels generally greater than the average government subsidy of education.

In interpreting estimates of social rates of return to education it should be recognised that these estimated rates of return are significant, even though a value of zero is assigned to positive externalities of education. Therefore, the estimates in Tables 15-17 may be interpreted as minimum estimates for expected social rates of return.

³⁸ This may be verified algebraically by subtracting equation 3 from equation 5 with different values for the discounting rate for the private and social rates of return .

³⁹ The reader may verify algebraically that the difference is equivalent to:

$$\sum_{t=S+1}^n \frac{[Yh_i(x) - Ys_i(x)]_t}{(1.05)^t} - \sum_{t=1}^S \frac{[G_i]_t}{(1.05)^t} - \sum_{t=1}^S \frac{[Ys_i(x)]_t}{(1.05)^t}$$

or the net present value of the sum of additional income taxes over a working lifetime, minus the present value of government expenditures for the degree and foregone income taxes during the years of education, all discounted at a uniform rate.

Finally, an implication of these results is that individuals and secondary and tertiary teaching institutions are together providing economic value that is reflected by greater access to employment and higher productivity, the value of which may be estimated through market valuations reflected by higher lifetime incomes.

V. Conclusion

This study has provided updated measures of private and social rates of return to education for New Zealand, using unit record data from the 1996 census. The two methods of regression analysis and the Internal Rates of Return (IRR) were employed, and the analysis provided comparable results for both the private and social rates of return to secondary and higher education over the four census years of 1981, 1986, 1991 and 1996. In addition, formal stability tests were conducted, based on the regression method, to examine the potential change in the rates of return between the 1981 and each of the later census years.

A number of results in 1996 are compatible with the results for the earlier census years. However, some unique features of the 1996 results are also significant.

The 1996 results are consistent with the earlier results in confirming that the returns to both secondary and tertiary education are significant and that compared to 1981, returns to all educational qualification levels were significantly higher in 1996. Similar to earlier findings, age-income profiles were flatter for females than for males in 1996, and the private rates of return to education with the 'earnings function' method were higher than the estimates with the IRR method which directly incorporate foregone earnings and other costs of education, especially at the tertiary level due to higher foregone earnings. The private rates of return for females were also higher than for males for various education levels, despite the lower average income levels of females, reflecting an income gain for females with higher education levels compared to other females with less education who are engaged in jobs which pay less.

The results based on the IRR method show that both the private and social rates of return to the various educational degrees have continued to increase throughout the 1991-1996 period. An exception is the private rates of return to a Bachelor's degree, compared to UE or Sixth Form Certificate between 1991 and 1996, which has decreased by less than 1 percentage point for males, and by less than 2 percentage points for females.⁴⁰ This result is consistent with the regression analyses shown in Figure 5. As discussed earlier, this decline reflects the effect of tertiary fees, changes in the supply of graduates and the immigrant composition of the population since 1991.

The social rates of return to all education levels have generally increased between 1991 and 1996, including the returns to a Bachelor's degree. Among the factors contributing to this result are that the government costs of financing a tertiary degree have decreased since 1991, and the introduction of student fees, which affects the private returns to education, does not change the overall cost of education faced by the society.

A result that is prominent in the IRR analyses for both males and females is that the private and social returns to Postgraduate degrees have increased between 1991 and 1996. This is consistent with the hypothesis that the supply of Graduates with Bachelor's degrees has been more elastic than the supply of Postgraduates in meeting the market demand due to the time requirements of the Postgraduate degree. In addition, the increased demand for university graduates and the increased returns to a Bachelor's degree, as reflected by the 1991 Census, have resulted in higher foregone earnings in pursuing Postgraduate studies resulting in a relatively less elastic supply of Postgraduate degree holders, and a greater rise in the Postgraduate labour market income premium by 1996.

The results based on the regression method (which excludes the effect of tertiary fees) are compatible with the IRR results. A result that is consistent throughout the analyses is that the returns to both secondary and tertiary qualifications have increased significantly during the

⁴⁰ For males the return to a Bachelor's degree, compared to the control group, changed from 10.1 - 10.4 % in 1991 to 9.2 - 9.8 % in 1996, in columns 3-4 and 7-8 of Table 13. The comparable decrease for females is from 9.1 - 9.4 % in 1991 to 7.1 - 7.3 %, in columns 3-4 and 7-8 of Table 14.

1981- 1996 and the 1986-1996 periods. For example, the stability test results for 1996 and comparisons to 1981 indicate that the returns to a Bachelor's degree had increased by 22.3% over the 15 year period for the sample of full-time employed males, and they were 8.6% higher for females.⁴¹ The returns to a Postgraduate degree were also 22.1% higher for full-time employed males in 1996 and 8.3% higher for females.

In addition, the regression results show consistent evidence on increases in returns to most educational degrees for both males and females between 1981 - 1996, and between 1981 and 1991, but diverging results for males and females since 1991 as reflected by the 1996 regression analyses.

The returns to a Bachelor's degree, in particular, represent declines between 1991 and 1996 for females and a stabilisation of market income premiums for males. A plausible explanation for this is, of course, the increase in the supply of graduates in response to demand, between 1991 and 1996, in fields of study where there have previously been shortages. These results further suggests that some of the features of the market and the earnings for males and females in 1996 may have been different from the earlier years, such as the composition of the population. This indicates that a more in depth analysis of the 1996 census for males and females over a wider range of variables would be useful.

For example, one of the notable features of the New Zealand population in 1996 is a greater significance of immigrant numbers with higher education since 1991. To adjust for the population's immigrant composition, such that a comparable population was considered in 1991 and 1996, extensions of the stability tests adjusted for immigrant status since 1991. These results highlight the significance of adjusting for the immigrant composition of the population for comparisons of market returns to tertiary education prior to and after 1991. Most significantly, the results indicated that for comparable populations over time, the market returns to a Bachelor's degree have been generally stable between 1991 and 1996 (e.g. showing a small increase of 0.005 %) for full-time employed males, and an increase of 3.3%, for a Postgraduate degree.

⁴¹ These comparisons are based on the regression method for the sample of the full-time employed and compared to the base group with qualifications below a School Certificate.

The results for the sample of full-time employed females, in turn, continued to show a decline in the returns to a Bachelor's degree of 7.2% between 1991 and 1996, and a decrease in the returns to a Postgraduate degree of 1.6% over the same time period. Of course, the income gains to tertiary education may not be expected to increase indefinitely, especially with supply adjustments, and the 1996 evidence indicates that a stabilisation of the market for graduates has been in effect in the 1991-1996 period.

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Table 1: Characteristics of the Samples

Means
(Standard Deviations)

Personal Characteristics	1981		1986		1991		1996	
	Males	Females	Males	Females	Males	Females	Males	Females
Age	37.18 (13.92)	37.46 (14.04)	37.19 (13.65)	37.45 (13.73)	37.13 (13.34)	37.03 (13.20)	38.33 (12.86)	38.27 (12.71)
Ethnic Origin (Percentage of Sample)								
European	84.52%	84.16%	84.59%	84.95%	78.26%	77.08%	79.25%	78.61%
Maori	10.33%	10.60%	9.99%	9.83%	11.44%	12.30%	12.68%	13.29%
Other	5.15%	5.24%	5.42%	5.22%	10.30%	10.62%	8.07%	8.10%
Income								
Current Dollars	12764.72 (8866.46)	5277.36 (5161.39)	18670.45 (11180.80)	9718.79 (7618.66)	25096.17 (18018.10)	15072.55 (12152.60)	31643.78 (26433.75)	18235.17 (16876.39)
1996 Dollars	36280.47 (25200.66)	14999.56 (14669.94)	30674.94 (18369.69)	15967.66 (12517.21)	27502.30 (19745.61)	16517.65 (13317.75)	31643.78 (26433.75)	18235.17 (16876.39)
Highest Qualification (Percentage of Sample)								
No Qualifications	50.08%	54.37%	36.04%	41.41%	33.41%	36.42%	34.06%	34.62%
School Certificate	11.68%	14.71%	12.26%	17.17%	11.17%	15.83%	11.40%	15.59%
U.E./Sixth Form Cert.	8.39%	9.00%	8.02%	9.42%	7.18%	8.68%	8.99%	11.04%
Bursary	2.96%	2.26%	3.95%	3.13%	5.05%	4.40%	7.22%	6.34%
Diploma	21.34%	16.92%	32.19%	24.25%	35.50%	29.47%	25.78%	22.40%
Bachelor's Degree	3.72%	2.11%	4.64%	2.96%	5.11%	3.60%	8.17%	6.87%
Postgraduate Qual.	1.83%	0.63%	2.90%	1.66%	2.58%	1.60%	4.38%	3.14%
Labour Force Status (Percentage of Sample)								
All Employed	88.83%	45.99%	87.07%	62.83%	74.46%	56.36%	80.41%	64.34%
Employed Full-Time	85.91%	37.51%	81.31%	43.74%	69.66%	38.82%	73.62%	43.70%
Unemployed	3.78%	2.72%	3.19%	4.35%	8.29%	6.64%	5.25%	4.89%
Out of Labour Force	7.39%	51.29%	9.74%	32.82%	17.25%	37.00%	14.34%	30.05%
Sample Size	89505	88268	96741	90237	96140	96690	90854	93779

Figure 1: Age-Income Profile by Education Level for All Employed Males in 1996 (Income in 1996 Dollars)

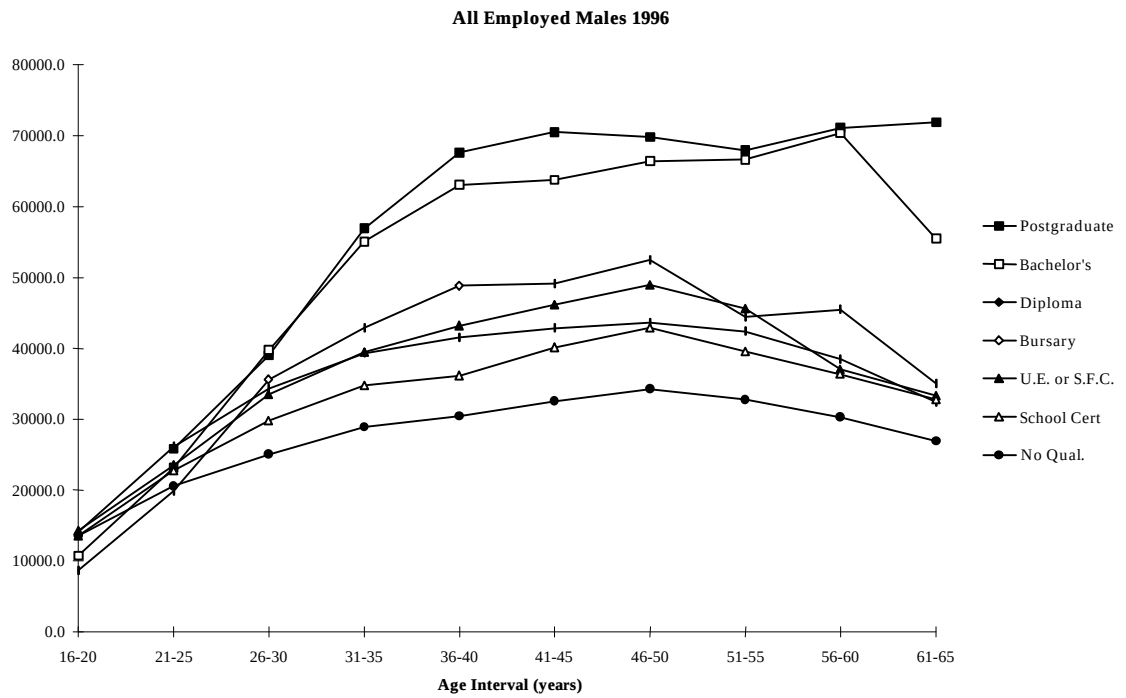
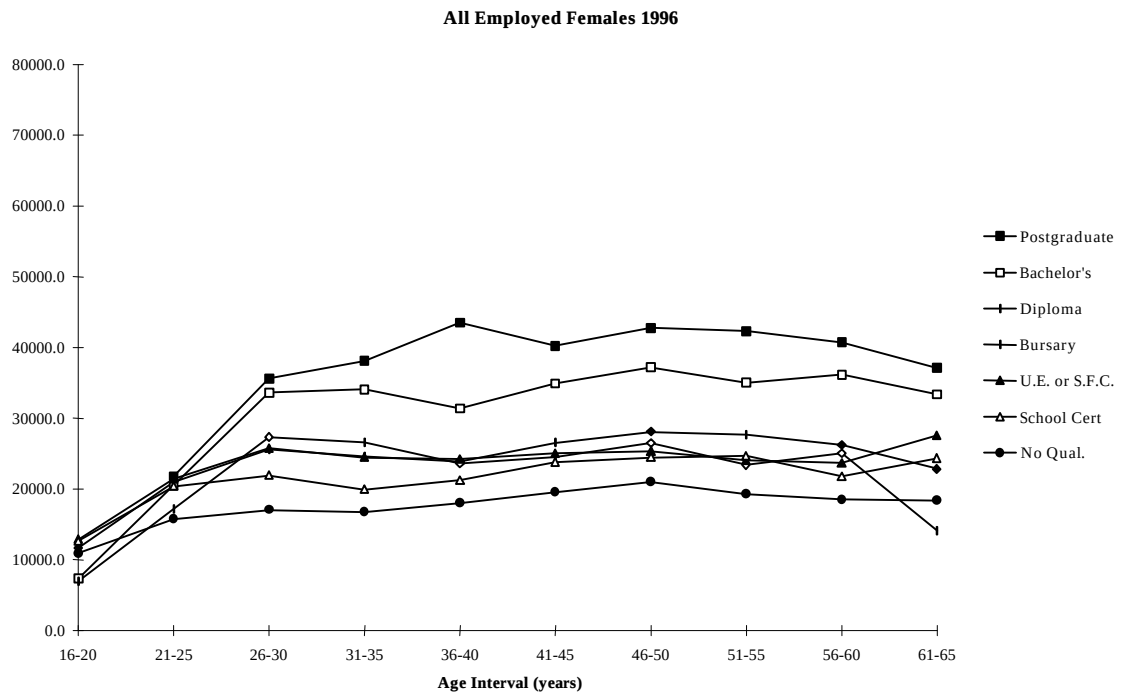


Figure 2: Age-Income Profile by Education Level for Employed Full-Time Males in 1996 (Income in 1996 Dollars)



Figure 3: Age-Income Profile by Education Level for All Employed Females in 1996 (Income in 1996 Dollars)



**Figure 4: Age-Income Profile by Education Level for
Employed Full-Time Females in 1996 (Income in 1996 Dollars)**



**Table 2: Labour Force Status and Income of Males in 1996
by Highest Educational Qualification**

Personal Characteristics	No Qual.	School Cert.	UE or SFC	Bursary	Diploma	Bachelor's Qual.	Postgrad. Qual.
Age	41.60 (13.23)	36.21 (12.41)	33.14 (11.44)	27.24 (11.45)	39.76 (11.82)	37.29 (10.90)	40.92 (10.59)
Ethnic Origin (%)							
European	70.02%	81.75%	82.48%	77.91%	87.91%	82.19%	83.71%
Maori	20.36%	13.16%	11.12%	10.18%	8.00%	3.92%	2.84%
Other	9.61%	5.09%	6.40%	11.91%	4.09%	13.89%	13.45%
Income (1996 dollars)	24,069.29 (19,709.96)	29,828.78 (22,816.49)	31,752.53 (24,551.72)	21,099.43 (24,889.13)	35,443.38 (23,953.94)	48,448.70 (36,824.28)	56,059.41 (38,307.88)
Labour Force Status							
Employed	70.54%	85.80%	87.40%	69.15%	88.25%	87.80%	87.47%
Employed Full-Time	64.28%	80.21%	81.84%	51.63%	82.76%	81.06%	80.76%
Unemployed	7.40%	4.64%	4.30%	6.60%	3.10%	4.18%	4.50%
Out of the Labour Force	22.06%	9.56%	8.30%	24.25%	8.65%	8.03%	8.02%
Sample Size	30,952	10,354	8,166	6,560	23,421	7,424	3,977

**Table 3: Labour Force Status and Income of Females in 1996
by Highest Educational Qualification**

Personal Characteristics	No Qual.	School Cert.	UE or SFC	Bursary	Diploma	Bachelor' s Qual.	Postgrad. Qual.
Age	43.24 (12.77)	37.39 (11.43)	32.51 (10.28)	25.66 (10.98)	38.70 (11.87)	34.60 (10.31)	38.43 (10.15)
Ethnic Origin (%)							
European	69.89%	82.15%	82.73%	76.97%	86.35%	81.28%	85.05%
Maori	19.79%	13.70%	11.80%	11.21%	8.43%	4.34%	3.33%
Other	10.32%	4.15%	5.47%	11.82%	5.22%	14.38%	11.62%
Income (1996 dollars)	13,887.49 (12,966.68)	18,047.89 (16,116.13)	19,287.27 (16,268.67)	11,989.30 (13,916.32)	21,359.05 (16,827.23)	26,218.53 (22,090.11)	33,645.21 (26,782.11)
Labour Force Status							
Employed	49.51%	69.57%	72.99%	62.42%	76.41%	78.32%	81.49%
Employed Full-Time	31.51%	46.29%	51.63%	29.84%	23.96%	19.13%	18.07%
Unemployed	5.77%	4.43%	3.96%	8.10%	3.68%	4.56%	3.53%
Out of the Labour Force	44.72%	26.00%	23.05%	29.47%	19.90%	17.12%	14.98%
Sample Size	32,466	14,620	10,349	5,948	21,005	6,447	2,944

**Table 4: Income Effects of Secondary and Tertiary Education of Males:
1996**

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	All Employed Males		Employed Full-Time Males	
	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income
Intercept	7.059 (291.23)	7.112 (274.07)	7.418 (311.09)	7.493 (292.96)
School Certificate	0.174 (21.63)	0.187 (21.79)	0.156 (20.40)	0.169 (20.56)
UE or Sixth Form Cert.	0.273 (31.18)	0.295 (31.42)	0.256 (30.68)	0.277 (30.90)
Bursary	0.021 (2.01)	0.030 (2.62)	0.204 (18.67)	0.223 (18.93)
Diploma	0.261 (42.27)	0.282 (42.76)	0.255 (43.18)	0.276 (43.62)
Bachelor's Degree	0.495 (55.44)	0.534 (52.93)	0.521 (60.90)	0.562 (61.30)
Postgraduate Qualification	0.598 (52.29)	0.646 (52.70)	0.628 (57.25)	0.678 (57.58)
Age	0.133 (104.07)	0.143 (104.51)	0.117 (92.18)	0.126 (92.59)
Age ²	-0.002 (91.70)	-0.002 (92.10)	-0.001 (79.74)	-0.001 (80.10)
F	3073.27	3096.86	2685.55	2711.41
$\bar{R}^2$	0.26	0.26	0.25	0.25
Sample Size	70,481	70,481	64,633	64,633

Table 5: Income Effects of Secondary and Tertiary Education of Females: 1996

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	All Employed Females		Employed Full-Time Females	
	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income
Intercept	7.926 (228.59)	8.052 (218.83)	7.714 (233.51)	7.819 (221.66)
School Certificate	0.191 (19.04)	0.205 (19.28)	0.205 (21.08)	0.221 (21.29)
UE or Sixth Form Cert.	0.319 (28.24)	0.343 (28.62)	0.335 (31.04)	0.361 (31.37)
Bursary	-0.074 (4.84)	-0.069 (4.28)	0.205 (13.06)	0.225 (13.39)
Diploma	0.322 (36.55)	0.346 (37.05)	0.321 (37.66)	0.347 (38.14)
Bachelor's Degree	0.515 (40.42)	0.555 (41.06)	0.502 (42.60)	0.544 (43.19)
Postgraduate Qualification	0.679 (40.05)	0.732 (40.70)	0.645 (41.99)	0.698 (42.57)
Age	0.065 (35.66)	0.070 (35.96)	0.089 (49.88)	0.095 (50.90)
Age ²	-0.001 (30.07)	-0.001 (30.35)	-0.001 (42.77)	-0.001 (42.92)
F	823.20	834.97	898.83	913.66
$\bar{R}^2$	0.10	0.10	0.15	0.16
Sample Size	58,493	58,493	39,404	39,404

**Table 6: Regression Results for Income Effects of Education
for All Employed Males: 1981-1996**

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1981		1986		1991		1996	
	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income
Intercept	7.131 (424.89)	7.099 (365.64)	7.623 (512.44)	7.763 (468.26)	7.581 (376.66)	7.631 (354.07)	7.059 (291.23)	7.112 (274.07)
School Certificate	0.088 (14.39)	0.116 (16.28)	0.088 (16.51)	0.102 (17.13)	0.145 (20.47)	0.160 (20.99)	0.174 (21.63)	0.187 (21.79)
U.E. or Sixth Form Certificate	0.115 (16.26)	0.150 (18.39)	0.160 (25.04)	0.186 (26.11)	0.228 (27.19)	0.253 (28.01)	0.273 (31.18)	0.295 (31.42)
Bursary	0.084 (7.61)	0.115 (8.99)	0.062 (6.20)	0.083 (7.46)	0.103 (9.14)	0.120 (9.96)	0.021 (2.01)	0.030 (2.62)
Diploma	0.177 (37.16)	0.221 (40.09)	0.205 (52.06)	0.230 (52.53)	0.231 (46.17)	0.253 (47.02)	0.261 (42.27)	0.282 (42.76)
Bachelor's Degree	0.335 (34.52)	0.442 (39.34)	0.394 (50.02)	0.470 (53.48)	0.516 (56.08)	0.562 (56.83)	0.495 (55.44)	0.534 (52.93)
Postgraduate Qualification	0.426 (31.41)	0.572 (36.48)	0.439 (45.54)	0.534 (49.65)	0.583 (48.43)	0.635 (49.02)	0.598 (52.29)	0.646 (52.70)
Age	0.089 (95.99)	0.106 (98.57)	0.083 (101.68)	0.092 (101.31)	0.105 (97.43)	0.115 (99.30)	0.133 (104.07)	0.143 (104.51)
Age²	-0.001 (81.59)	-0.001 (83.43)	-0.001 (87.33)	-0.001 (86.72)	-0.001 (97.34)	-0.001 (87.22)	-0.002 (91.70)	-0.002 (92.10)
F	2537.74	2796.70	3170.39	3274.48	2549.91	2640.63	3073.27	3096.86
$\bar{R}^2$	0.21	0.22	0.23	0.24	0.22	0.23	0.26	0.26
Sample Size	77,658	77,658	83,520	83,520	70,136	70,136	70,481	70,481

**Table 7: Regression Results for Income Effects of Education for
Employed Full-Time Males: 1981-1996**

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1981		1986		1991		1996	
	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income
Intercept	7.155 (431.25)	7.125 (369.83)	7.652 (514.87)	7.795 (469.14)	7.767 (385.75)	7.840 (362.75)	7.418 (311.09)	7.493 (292.96)
School Certificate	0.087 (14.46)	0.115 (16.37)	0.088 (16.63)	0.102 (17.21)	0.145 (20.98)	0.159 (21.33)	0.156 (20.40)	0.169 (20.56)
U.E. or Sixth Form Certificate	0.115 (16.64)	0.152 (18.84)	0.163 (25.78)	0.189 (26.79)	0.244 (29.68)	0.267 (30.22)	0.256 (30.68)	0.277 (30.90)
Bursary	0.097 (8.86)	0.130 (10.22)	0.126 (12.35)	0.152 (13.34)	0.200 (29.68)	0.222 (18.02)	0.204 (18.67)	0.223 (18.93)
Diploma	0.177 (37.72)	0.221 (40.61)	0.207 (52.70)	0.232 (53.00)	0.233 (47.73)	0.254 (48.34)	0.255 (43.18)	0.276 (43.62)
Bachelor's Degree	0.338 (35.38)	0.447 (40.26)	0.413 (52.95)	0.491 (56.32)	0.535 (59.64)	0.582 (60.25)	0.521 (60.90)	0.562 (61.30)
Postgraduate Qualification	0.432 (32.32)	0.579 (37.35)	0.449 (47.03)	0.545 (51.12)	0.599 (51.01)	0.652 (51.51)	0.628 (57.25)	0.678 (57.58)
Age	0.088 (95.81)	0.104 (98.14)	0.082 (99.67)	0.091 (98.94)	0.096 (88.84)	0.105 (90.14)	0.117 (92.18)	0.126 (92.59)
Age²	-0.001 (81.08)	-0.001 (82.68)	-0.001 (84.58)	-0.001 (83.61)	-0.001 (77.00)	-0.001 (78.10)	-0.001 (79.74)	-0.001 (80.10)
F	2598.87	2855.23	3272.69	3370.50	2400.70	2467.21	2685.55	2711.41
$\bar{R}^2$	0.21	0.23	0.25	0.26	0.23	0.23	0.25	0.25
Sample Size	75,660	75,660	78,004	78,004	65,664	65,664	64,633	64,633

**Table 8: Regression Results for Income Effects of Education for
All Employed Females: 1981-1996**

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1981		1986		1991		1996	
	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income
Intercept	7.618 (263.41)	7.736 (245.49)	8.714 (309.02)	8.973 (299.32)	8.654 (265.04)	8.788 (255.68)	7.926 (228.59)	8.052 (218.83)
School Certificate	0.142 (14.49)	0.165 (15.39)	0.119 (13.36)	0.130 (13.66)	0.149 (14.78)	0.164 (15.36)	0.191 (19.04)	0.205 (19.28)
U.E. or Sixth Form Certificate	0.164 (14.37)	0.194 (15.59)	0.204 (18.34)	0.224 (18.95)	0.255 (20.60)	0.281 (21.50)	0.319 (28.24)	0.343 (28.62)
Bursary	0.102 (4.93)	0.130 (5.80)	0.058 (2.78)	0.070 (3.136)	0.020 (1.08)	0.035 (1.75)	-0.074 (4.84)	-0.069 (4.28)
Diploma	0.293 (32.88)	0.344 (35.44)	0.264 (34.04)	0.287 (34.85)	0.297 (36.05)	0.324 (37.22)	0.322 (36.55)	0.346 (37.05)
Bachelor's Degree	0.436 (21.37)	0.523 (25.53)	0.442 (25.42)	0.483 (26.18)	0.575 (35.77)	0.624 (36.80)	0.515 (40.42)	0.555 (41.06)
Postgraduate Qualification	0.561 (15.62)	0.688 (17.58)	0.590 (27.37)	0.651 (28.40)	0.684 (31.46)	0.743 (32.34)	0.679 (40.05)	0.732 (40.70)
Age	0.043 (26.22)	0.049 (27.17)	-0.002 (1.15)	-0.001 (0.50)	0.026 (14.58)	0.030 (15.88)	0.065 (35.66)	0.070 (35.96)
Age²	-0.0001 (21.48)	-0.0001 (22.19)	-0.001 (3.08)	-0.0001 (2.51)	-0.0002 (11.37)	-0.0002 (12.54)	-0.001 (30.07)	-0.001 (30.35)
F	339.34	386.62	259.78	275.41	388.47	413.99	823.20	834.97
R²	0.06	0.07	0.03	0.04	0.05	0.06	0.10	0.10
Sample Size	39,747	39,747	56,475	56,475	53,257	53,257	58,493	58,493

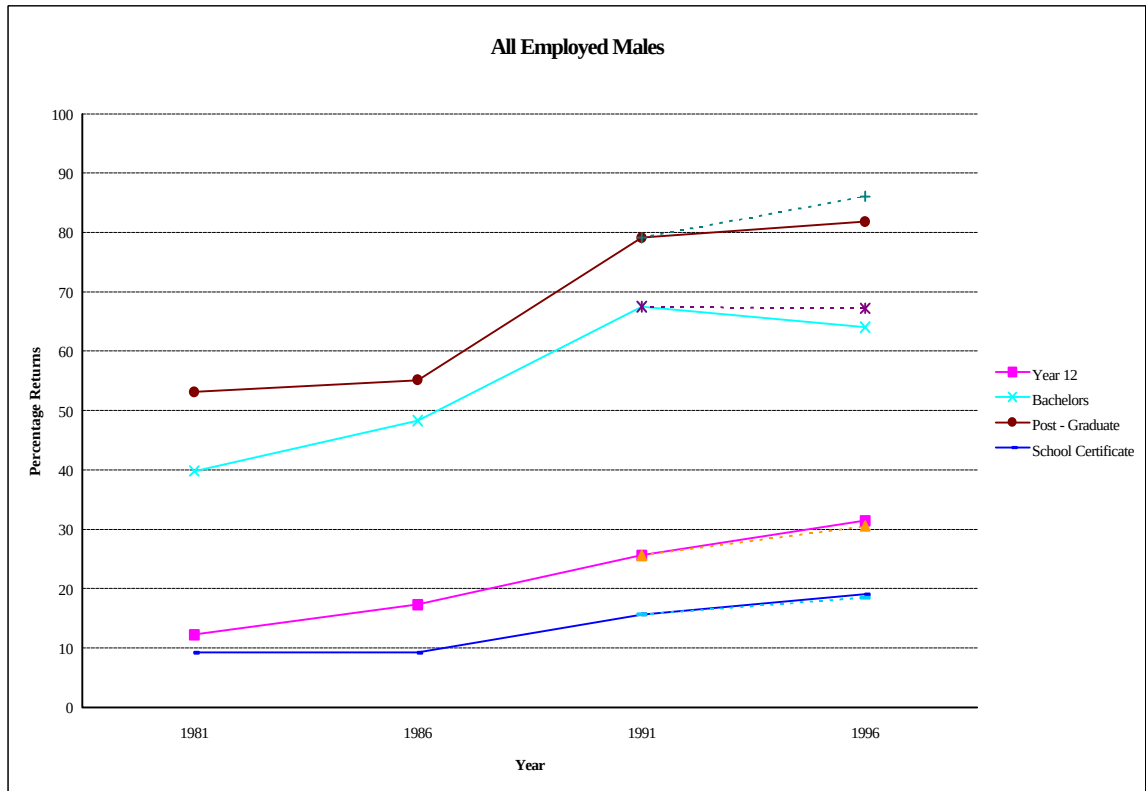
**Table 9: Regression Results for Income Effects of Education for
Employed Full-Time Females: 1981-1996**

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1981		1986		1991		1996	
	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income	After Tax Income	Before Tax Income
Intercept	7.347 (248.11)	7.421 (230.06)	8.023 (323.21)	8.229 (309.27)	8.303 (277.81)	8.422 (265.29)	7.714 (233.51)	7.819 (221.66)
School Certificate	0.147 (14.52)	0.171 (15.58)	0.145 (17.75)	0.157 (18.03)	0.171 (18.14)	0.186 (18.58)	0.205 (21.08)	0.221 (21.29)
U.E. or Sixth Form Certificate	0.169 (14.70)	0.201 (16.07)	0.209 (21.57)	0.230 (22.17)	0.293 (25.87)	0.320 (26.57)	0.335 (31.04)	0.361 (31.37)
Bursary	0.127 (5.99)	0.160 (6.92)	0.152 (7.96)	0.169 (8.28)	0.142 (8.10)	0.161 (8.60)	0.205 (13.06)	0.225 (13.39)
Diploma	0.281 (30.33)	0.332 (32.99)	0.276 (38.65)	0.302 (39.34)	0.297 (38.29)	0.324 (39.25)	0.321 (37.66)	0.347 (38.14)
Bachelor's Degree	0.407 (20.00)	0.494 (22.29)	0.444 (29.93)	0.488 (29.66)	0.561 (39.15)	0.611 (40.02)	0.502 (42.60)	0.544 (43.19)
Postgraduate Qualification	0.549 (15.17)	0.676 (17.15)	0.547 (28.75)	0.610 (29.88)	0.645 (33.52)	0.702 (34.24)	0.645 (41.99)	0.698 (42.57)
Age	0.063 (36.59)	0.072 (38.14)	0.048 (33.57)	0.053 (34.32)	0.057 (34.30)	0.062 (35.34)	0.089 (49.88)	0.095 (50.90)
Age²	-0.001 (30.46)	-0.001 (31.65)	-0.001 (27.82)	-0.001 (28.40)	-0.001 (29.27)	-0.001 (30.16)	-0.001 (42.77)	-0.001 (42.92)
F	460.43	523.43	584.80	592.60	581.18	611.35	898.83	913.66
R²	0.10	0.11	0.10	0.11	0.11	0.12	0.15	0.16
Sample Size	32,538	32,538	39,311	39,311	36,738	36,738	39,404	39,404

Figure 5: Income Returns to Tertiary Education over time (Regression Method)
Comparison to the Base Group With No Qualifications
 — represents overall population ---- represents population excluding immigrants since 1991



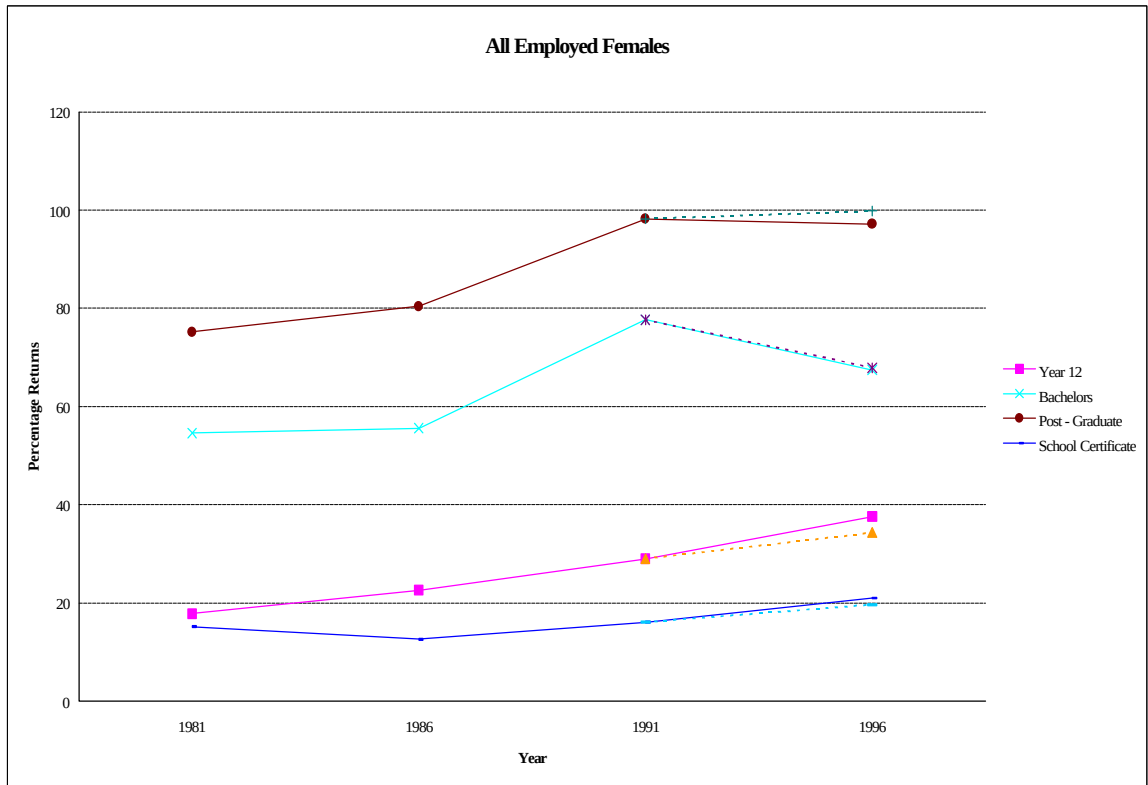


Table 10: Stability Test of Income Effects of Secondary and Higher Education for Males: 1981-1996

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients (t-ratios)

Explanatory Variables	All Employed		Employed Full-Time	
	No Control for Immigration	Control for Immigration	No Control for Immigration	Control for Immigration
Intercept	7.131 (410.43)	7.131 (410.43)	7.156 (427.25)	7.156 (427.25)
School Certificate	0.089 (13.90)	0.089 (13.90)	0.087 (14.32)	0.087 (14.32)
UE or Sixth Form Cert.	0.115 (15.71)	0.115 (15.71)	0.115 (16.48)	0.115 (16.48)
Bursary	0.084 (7.35)	0.084 (7.35)	0.097 (8.78)	0.097 (8.78)
Diploma	0.177 (35.90)	0.177 (35.90)	0.177 (37.38)	0.177 (37.38)
Bachelor's Degree	0.335 (33.44)	0.335 (33.44)	0.338 (35.05)	0.338 (35.05)
Postgraduate Qualification	0.426 (30.34)	0.426 (30.34)	0.432 (32.02)	0.432 (32.02)
Age	0.089 (92.72)	0.089 (92.72)	0.088 (94.92)	0.088 (94.92)
Age ²	-0.001 (79.15)	-0.001 (79.15)	-0.001 (80.33)	-0.001 (80.33)
Year 96	-0.083 (3.05)	-0.091 (3.33)	0.233 (8.67)	0.222 (8.15)
Year 91	0.450 (16.96)	0.450 (16.96)	0.611 (23.36)	0.611 (23.36)
Year 86	0.493 (20.27)	0.493 (20.27)	0.497 (20.99)	0.497 (20.99)
Year 96 x School Certificate	0.079 (8.36)	0.081 (8.57)	0.059 (6.64)	0.064 (7.01)

Table 10 Continued

Year 96 x UE or Sixth Form Cert.	0.151 (14.39)	0.151 (14.33)	0.141 (13.82)	0.132 (12.92)
Year 96 x Bursary	-0.087 (5.88)	-0.079 (5.33)	0.087 (5.812)	0.107 (7.16)
Year 96 x Diploma	0.074 (10.14)	0.075 (10.19)	0.067 (9.46)	0.070 (9.77)
Year 96 x Bachelor's Degree	0.154 (12.21)	0.179 (14.02)	0.185 (15.05)	0.202 (16.33)
Year 96 x Postgraduate Qualification	0.171 (9.95)	0.195 (11.12)	0.182 (10.95)	0.200 (11.79)
Year 96 x Age	0.045 (30.82)	0.045 (30.68)	0.030 (21.05)	0.031 (21.10)
Year 96 x Age ²	-0.0005 (27.38)	-0.0005 (27.44)	-0.0003 (18.17)	-0.0003 (18.39)
Year 91 x School Certificate	0.057 (5.95)	0.057 (5.95)	0.058 (6.30)	0.058 (6.30)
Year 91 x UE or Sixth Form Cert.	0.114 (10.21)	0.114 (10.21)	0.128 (11.90)	0.128 (11.90)
Year 91 x Bursary	0.018 (1.14)	0.018 (1.14)	0.103 (6.50)	0.103 (6.50)
Year 91 x Diploma	0.053 (7.57)	0.053 (7.57)	0.056 (8.27)	0.056 (8.27)
Year 91 x Bachelor's Degree	0.181 (13.28)	0.181 (13.28)	0.197 (14.96)	0.197 (14.96)
Year 91 x Postgraduate Qualification	0.157 (8.51)	0.157 (8.51)	0.167 (9.37)	0.167 (9.37)
Year 91 x Age	0.016 (11.22)	0.016 (11.22)	0.008 (5.91)	0.008 (5.91)
Year 91 x Age ²	-0.0002 (11.22)	-0.0002 (11.22)	-0.0001 (6.22)	-0.0001 (6.22)
Year 86 x School Certificate	-0.0001 (0.01)	-0.0001 (0.01)	0.001 (0.14)	0.001 (0.14)

Table 10 Continued

Year 86 x UE or Sixth Form Cert.	0.045 (4.37)	0.045 (4.37)	0.047 (4.74)	0.047 (4.74)
Year 86 x Bursary	-0.022 (1.37)	-0.022 (1.37)	0.029 (1.81)	0.029 (1.81)
Year 86 x Diploma	0.027 (4.10)	0.027 (4.10)	0.030 (4.61)	0.030 (4.61)
Year 86 x Bachelor's Degree	0.059 (4.36)	0.059 (4.36)	0.074 (5.68)	0.074 (5.68)
Year 86 x Postgraduate Qualification	0.013 (0.73)	0.013 (0.73)	0.017 (0.98)	0.017 (0.98)
Year 86 x Age	-0.006 (4.26)	-0.006 (4.26)	-0.006 (4.47)	-0.006 (4.47)
Year 86 x Age²	0.00005 (3.10)	0.00005 (3.10)	0.0001 (3.44)	0.0001 (3.44)
New Immigrants 96	- -	0.261 (1.23)	- -	-0.089 (0.41)
New Immig. 96 x School Certificate	- -	-0.064 (0.44)	- -	-0.038 (0.26)
New Immigrants 96 x UE or S.F.C.	- -	-0.260 (2.14)	- -	-0.111 (0.88)
New Immigrants 96 x Bursary	- -	-0.652 (5.94)	- -	-0.500 (3.51)
New Immigrants 96 x Diploma	- -	0.214 (4.26)	- -	0.250 (4.96)
New Immig. 96 x Bachelor's Degree	- -	-0.044 (0.88)	- -	0.033 (0.65)
New Immigrants 96 x Postgrad. Qual.	- -	0.121 (2.35)	- -	0.165 (3.17)
New Immigrants 96 x Age	- -	-0.025 (2.15)	- -	-0.007 (0.58)
New Immigrants 96 x Age²	- -	0.0002 (1.45)	- -	-0.000003 (0.02)
F	7146.22	5627.90	7794.33	6143.25
R²	0.45	0.45	0.49	0.49
Sample Size	300,673	300,364	282,854	282,638

Table 11: Stability Test of Income Effects of Secondary and Higher Education for Females: 1981-1996

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients (t-ratios)

Explanatory Variables	All Employed		Employed Full-Time	
	No Control for Immigration	Control for Immigration	No Control for Immigration	Control for Immigration
Intercept	7.618 (237.36)	7.618 (237.36)	7.347 (261.11)	7.347 (261.11)
School Certificate	0.142 (13.06)	0.142 (13.06)	0.147 (15.28)	0.147 (15.28)
UE or Sixth Form Cert.	0.164 (12.95)	0.164 (12.95)	0.169 (15.48)	0.169 (15.48)
Bursary	0.102 (4.45)	0.102 (4.45)	0.127 (6.30)	0.127 (6.30)
Diploma	0.293 (29.63)	0.293 (29.63)	0.281 (31.92)	0.281 (31.92)
Bachelor's Degree	0.436 (19.26)	0.436 (19.26)	0.407 (21.05)	0.407 (21.05)
Postgraduate Qualification	0.561 (14.07)	0.561 (14.07)	0.549 (15.97)	0.549 (15.97)
Age	0.043 (23.65)	0.043 (23.65)	0.063 (38.51)	0.063 (38.51)
Age ²	-0.0005 (19.35)	-0.0005 (19.35)	-0.0007 (32.05)	-0.0007 (32.05)
Year 96	0.292 (6.31)	0.304 (6.55)	0.319 (7.46)	0.417 (9.70)
Year 91	1.036 (22.81)	1.036 (22.81)	0.956 (22.96)	0.956 (22.96)
Year 86	1.095 (25.62)	1.095 (25.62)	0.676 (17.54)	0.676 (17.54)
Year 96 x School Certificate	0.047 (3.25)	0.038 (2.60)	0.050 (3.70)	0.038 (2.81)

Table 11 Continued

Year 96 x UE or Sixth Form Cert.	0.151 (9.07)	0.147 (8.82)	0.150 (9.94)	0.150 (9.91)
Year 96 x Bursary	-0.149 (5.49)	-0.171 (6.29)	0.074 (2.95)	0.048 (1.91)
Year 96 x Diploma	0.036 (2.80)	0.042 (3.22)	0.052 (4.28)	0.045 (3.66)
Year 96 x Bachelor's Degree	0.086 (3.37)	0.082 (3.19)	0.100 (4.47)	0.083 (3.65)
Year 96 x Postgraduate Qualification	0.122 (2.83)	0.131 (3.02)	0.096 (2.55)	0.080 (2.12)
Year 96 x Age	0.022 (8.69)	0.022 (8.66)	0.028 (11.82)	0.024 (10.02)
Year 96 x Age ²	-0.0002 (6.75)	-0.0002 (6.83)	-0.0003 (9.74)	-0.0003 (8.20)
Year 91 x School Certificate	0.007 (0.47)	0.007 (0.47)	0.024 (1.78)	0.024 (1.78)
Year 91 x UE or Sixth Form Cert.	0.091 (5.19)	0.091 (5.19)	0.124 (7.79)	0.124 (7.79)
Year 91 x Bursary	-0.081 (2.77)	-0.081 (2.77)	0.016 (0.58)	0.016 (0.58)
Year 91 x Diploma	0.004 (0.33)	0.004 (0.33)	0.016 (1.36)	0.016 (1.36)
Year 91 x Bachelor's Degree	0.139 (5.03)	0.139 (5.03)	0.155 (6.36)	0.155 (6.36)
Year 91 x Postgraduate Qualification	0.123 (2.72)	0.123 (2.72)	0.096 (2.43)	0.096 (2.43)
Year 91 x Age	-0.017 (6.91)	-0.017 (6.91)	-0.006 (2.54)	-0.006 (2.54)
Year 91 x Age ²	0.0002 (6.28)	0.0002 (6.28)	0.0001 (1.86)	0.0001 (1.86)
Year 86 x School Certificate	-0.023 (1.61)	-0.023 (1.61)	-0.002 (0.16)	-0.002 (0.16)

Table 11 Continued

Year 86 x UE or Sixth Form Cert.	0.040 (2.38)	0.040 (2.38)	0.040 (2.68)	0.040 (2.68)
Year 86 x Bursary	-0.043 (1.40)	-0.043 (1.40)	0.025 (0.87)	0.025 (0.87)
Year 86 x Diploma	-0.029 (2.28)	-0.029 (2.28)	-0.004 (0.35)	-0.004 (0.35)
Year 86 x Bachelor's Degree	0.006 (0.20)	0.006 (0.20)	0.037 (1.48)	0.037 (1.48)
Year 86 x Postgraduate Qualification	0.029 (0.63)	0.029 (0.63)	-0.001 (0.04)	-0.001 (0.04)
Year 86 x Age	-0.045 (18.67)	-0.045 (18.67)	-0.015 (6.56)	-0.015 (6.56)
Year 86 x Age²	0.0005 (16.71)	0.0005 (16.71)	0.0002 (5.40)	0.0002 (5.40)
New Immigrants 96	- -	-0.158 (0.48)	- -	-1.117 (3.25)
New Immig. 96 x School Certificate	- -	0.198 (1.20)	- -	0.176 (1.25)
New Immigrants 96 x UE or S.F.C.	- -	-0.360 (2.11)	- -	-0.194 (1.17)
New Immigrants 96 x Bursary	- -	-0.351 (2.57)	- -	0.011 (0.07)
New Immigrants 96 x Diploma	- -	0.125 (1.82)	- -	0.149 (2.25)
New Immig. 96 x Bachelor's Degree	- -	-0.067 (0.93)	- -	-0.010 (0.15)
New Immigrants 96 x Postgrad. Qual.	- -	0.215 (2.80)	- -	0.250 (3.47)
New Immigrants 96 x Age	- -	-0.002 (0.10)	- -	0.052 (2.54)
New Immigrants 96 x Age²	- -	-0.0001 (0.42)	- -	-0.0008 (2.88)
F	1912.58	1528.83	2892.86	2303.73
$\bar{R}^2$	0.25	0.25	0.41	0.41
Sample Size	206,385	206,716	146,816	146,947

**Table 12: Private Rates of Return (and Net Discounted Sums of Returns)
for All Employed and Employed Full-Time Males and Females in 1998**

Qualifications:	All Employed		Employed Full-Time	
	Males	Females	Males	Females
No Qual. to School Cert.	16.79% \$46,443	36.94% \$46,859	14.71% \$43,096	27.02% \$49,184
No Qual. to UE or SFC	15.49% \$75,554	17.80% \$54,837	14.88% \$73,508	16.34% \$59,599
No Qual. to Diploma	11.40% \$55,034	8.18% \$29,365	11.26% \$54,146	8.91% \$38,675
No Qual. to Bachelor's	11.63% \$140,769	9.21% \$69,194	11.90% \$149,348	9.79% \$82,130
No Qual. to Postgraduate	10.50% \$140,810	8.47% \$78,715	10.70% \$149,485	8.83% \$90,183
School Cert. to UE or SFC	13.46% \$29,893	10.10% \$11,569	14.15% \$30,818	10.26% \$12,894
School Cert. to Diploma	6.93% \$8,206	3.62% (\$9,337)	7.35% \$9,637	4.31% (\$4,945)
School Cert. to Bachelor's	10.36% \$99,377	7.63% \$37,676	10.90% \$110,237	8.05% \$44,984
School Cert. to Postgraduate	9.42% \$101,542	7.54% \$52,302	9.79% \$112,146	7.71% \$57,795
UE or SFC to Bachelor's	9.22% \$70,433	7.10% \$27,564	9.79% \$81,480	7.29% \$31,772
UE or SFC to Postgraduate	8.45% \$73,767	7.26% \$44,407	8.87% \$84,862	7.24% \$46,465
Bachelor's to Postgraduate	5.09% \$576	8.00% \$22,662	5.60% \$3,588	7.43% \$19,709

Notes:

1. Rates of return estimates are based on the 0.10 sample of the 1996 New Zealand Census data. Estimates are based on after-tax income.
2. Discounted sums of returns are the net present values of the sums of the lifetime costs and benefits at a 5% real discount rate (expressed in 1998 dollars). Brackets denote negative amounts for returns below the 5% rate.
3. University and Polytechnic returns include 1998 average University fees of \$2,877 and foregone earnings at the SFC level.

Table 13: Private Rates of Return (and Net Discounted Sums of Returns in 1998 Dollars) for All Employed and Employed Full-Time Males: 1981-1998

Qualifications	All Employed				Employed Full-Time			
	1981	1986	1991	1998	1981	1986	1991	1998
No Qual. to School Cert.	9.44% \$20,227	10.93% \$21,655	13.76% \$34,372	16.79% \$46,443	9.25% \$19,682	10.96% \$22,228	13.33% \$34,447	14.71% \$43,096
No Qual. to UE or SFC	8.82% \$26,161	11.99% \$47,682	13.93% \$67,582	15.49% \$75,554	8.85% \$26,926	12.19% \$48,993	14.05% \$69,658	14.88% \$73,508
No Qual. to Diploma	6.02% \$8,647	8.45% \$28,556	9.34% \$36,915	11.40% \$55,034	5.95% \$8,143	8.50% \$28,998	9.19% \$36,668	11.26% \$54,146
No Qual. to Bachelor's	7.49% \$52,361	9.49% \$80,205	11.88% \$128,869	11.63% \$140,769	7.55% \$53,950	9.69% \$83,622	12.02% \$134,079	11.90% \$149,348
No Qual. to Postgraduate	6.59% \$40,779	7.51% \$53,940	9.52% \$106,066	10.50% \$140,810	6.62% \$41,894	7.58% \$55,915	9.48% \$108,766	10.70% \$149,485
School Cert. to UE or SFC	6.13% \$3,603	12.76% \$26,608	13.41% \$33,888	13.46% \$29,893	6.52% \$4,871	13.19% \$27,378	14.12% \$35,847	14.15% \$30,818
School Cert. to Diploma	1.97% (\$17,554)	6.20% \$6,014	5.21% \$1,073	6.93% \$8,206	1.96% (\$17,798)	6.19% \$5,861	5.08% \$387	7.35% \$9,637
School Cert. to Bachelor's	6.47% \$27,867	8.98% \$60,727	11.15% \$98,448	10.36% \$99,377	6.56% \$29,698	9.22% \$63,690	11.38% \$103,369	10.90% \$110,237
School Cert. to Postgrad.	5.71% \$16,941	6.79% \$34,372	8.62% \$76,394	9.42% \$101,542	5.75% \$18,195	6.87% \$35,815	8.60% \$78,620	9.79% \$112,146
UE or SFC to Bachelor's	6.71% \$27,585	7.90% \$36,497	10.14% \$66,658	9.22% \$70,433	6.73% \$28,138	8.14% \$39,180	10.34% \$70,525	9.79% \$81,480
UE or SFC to Postgraduate	5.78% \$16,699	5.62% \$10,327	7.44% \$44,782	8.45% \$73,767	5.78% \$16,706	5.69% \$11,561	7.41% \$46,120	8.87% \$84,862
Bachelor's to Postgraduate	2.69% (\$15,735)	-1.20% (\$30,530)	1.24% (\$23,376)	5.09% \$576	2.65% (\$16,107)	-1.20% (\$31,048)	1.31% (\$24,795)	5.60% \$3,588

Notes:

1. Rates of return estimates are based on the 0.10 sample of the 1981, 1986, 1991 and 1996 New Zealand Census data. Estimates are based on after-tax income.
2. Discounted sums of returns are the net present values of the sums of the lifetime costs and benefits at a 5% real discount rate (expressed in 1998 dollars). Brackets denote negative amounts for returns below the 5% rate.
3. University and Polytechnic returns include 1998 average University fees of \$2,877 and foregone earnings at the SFC level.

Table 14: Private Rates of Return (and Net Discounted Sums of Returns in 1998 Dollars) for All Employed and Employed Full-Time Females: 1981-1998

Qualifications	All Employed				Employed Full-Time			
	1981	1986	1991	1998	1981	1986	1991	1998
No Qual. to School Cert.	10.83% \$17,740	13.83% \$16,408	15.77% \$25,240	36.94% \$46,859	11.36% \$23,161	15.17% \$22,894	15.34% \$29,761	27.02% \$49,184
No Qual. to UE or SFC	9.41% \$28,430	11.75% \$28,784	11.99% \$33,247	17.80% \$54,837	10.18% \$34,836	13.17% \$37,160	13.45% \$45,902	16.34% \$59,599
No Qual. to Diploma	7.38% \$23,515	6.88% \$15,234	7.34% \$21,203	8.18% \$29,365	7.58% \$26,474	8.25% \$27,159	8.15% \$30,460	8.91% \$38,675
No Qual. to Bachelor's	7.98% \$51,229	7.86% \$37,373	9.89% \$74,821	9.21% \$69,194	8.03% \$52,457	8.99% \$56,040	10.38% \$91,241	9.79% \$82,130
No Qual. to Postgraduate	7.06% \$45,285	6.81% \$36,538	7.90% \$64,103	8.47% \$78,715	7.03% \$44,479	7.47% \$51,580	8.23% \$73,120	8.83% \$90,183
School Cert. to UE or SFC	7.84% \$10,880	10.80% \$14,081	9.60% \$9,718	10.10% \$11,569	8.32% \$11,544	11.25% \$15,342	11.91% \$17,474	10.26% \$12,894
School Cert. to Diploma	5.77% \$6,006	5.32% \$2,112	4.97% (\$224)	3.62% (\$9,337)	5.33% \$2,546	5.89% \$6,270	5.41% \$2,981	4.31% (\$4,945)
School Cert. to Bachelor's	7.38% \$36,402	7.42% \$27,668	9.56% \$58,831	7.63% \$37,676	7.05% \$30,883	8.07% \$38,726	9.74% \$69,192	8.05% \$44,984
School Cert. to Postgrad.	6.58% \$32,173	6.54% \$29,093	7.52% \$50,325	7.54% \$52,302	6.23% \$24,481	6.83% \$36,643	7.57% \$53,009	7.71% \$57,795
UE or SFC to Bachelor's	7.16% \$26,243	6.78% \$16,794	9.47% \$51,138	7.10% \$27,564	6.64% \$20,154	7.49% \$26,587	9.14% \$54,491	7.29% \$31,772
UE or SFC to Postgraduate	6.29% \$22,424	6.16% \$20,039	7.26% \$43,658	7.26% \$44,407	5.82% \$14,259	6.41% \$26,038	6.98% \$39,410	7.24% \$46,465
Bachelor's to Postgraduate	5.34% \$1,885	6.30% \$11,270	4.86% (\$1,246)	8.00% \$22,662	4.57% (\$2,323)	5.51% \$4,752	3.40% (\$12,455)	7.43% \$19,709

Notes: 1. Rates of return estimates are based on the 0.10 sample of the 1981, 1986, 1991 and 1996 New Zealand Census data. Estimates are based on after-tax income.

- Discounted sums of returns are the net present values of the sums of the lifetime costs and benefits at a 5% real discount rate (expressed in 1998 dollars). Brackets denote negative amounts for returns below the 5% rate.
- University and Polytechnic returns include 1998 average University fees of \$2,877 and foregone earnings at the SFC level.

Table 15: Social Rates of Return (and Net Discounted Sums of Returns) for All Employed and Employed Full-Time Males and Females in 1998

Qualifications:	All Employed		Employed Full-Time	
	Males	Females	Males	Females
No Qual. to School Cert.	14.19% \$56,418	26.47% \$55,212	12.80% \$53,064	20.99% \$58,155
No Qual. to UE or SFC	13.28% \$94,339	14.18% \$61,403	12.93% \$92,871	13.55% \$67,430
No Qual. to Diploma	8.66% \$53,167	6.10% \$16,133	8.61% \$52,884	6.81% \$27,919
No Qual. to Bachelor's	9.98% \$175,228	7.18% \$55,441	10.26% \$189,084	7.86% \$76,447
No Qual. to Postgraduate	8.94% \$168,035	6.69% \$59,764	9.19% \$182,764	7.20% \$81,655
School Cert. to UE or SFC	11.90% \$38,965	8.26% \$10,541	12.46% \$40,386	8.58% \$12,218
School Cert. to Diploma	4.41% (\$4,445)	2.18% (\$29,600)	4.64% (\$2,676)	2.86% (\$24,040)
School Cert. to Bachelor's	9.04% \$125,174	5.83% \$18,247	9.50% \$141,141	6.40% \$32,359
School Cert. to Postgraduate	8.11% \$120,308	5.89% \$28,644	8.48% \$136,739	6.28% \$43,340
UE or SFC to Bachelor's	8.14% \$87,323	5.41% \$8,283	8.63% \$103,375	5.85% \$18,715
UE or SFC to Postgraduate	7.33% \$83,557	5.68% \$21,081	7.73% \$100,496	5.96% \$31,817
Bachelor's to Postgraduate	4.16% (\$8,978)	6.49% \$18,326	4.59% (\$4,160)	6.38% \$18,266

Notes:

1. Rates of return estimates are based on the 0.10 sample of the 1996 New Zealand Census data. Estimates are based on before-tax income and exclude capital valuations.
2. Discounted sums of returns are the net present values of the sums of the lifetime costs and benefits at a 5% real discount rate (expressed in 1998 dollars). Brackets denote negative amounts for returns below the 5% rate.
3. University and Polytechnic returns include foregone earnings at the SFC level.

Table 16: Social Rates of Return (and Net Discounted Sums of Returns in 1998 Dollars) for All Employed and Employed Full-Time Males: 1981-1998

Qualifications	All Employed				Employed Full-Time			
	1981	1986	1991	1998	1981	1986	1991	1998
No Qual. to School Cert.	10.61% \$45,049	9.93% \$29,441	12.42% \$45,487	14.19% \$56,418	10.43% \$44,399	9.97% \$30,297	12.12% \$45,846	12.80% \$53,064
No Qual. to UE or SFC	9.82% \$58,943	10.89% \$67,075	12.61% \$91,539	13.28% \$94,339	9.88% \$61,010	11.08% \$69,517	12.76% \$94,860	12.93% \$92,871
No Qual. to Diploma	6.21% \$19,262	6.51% \$22,863	7.15% \$32,279	8.66% \$53,167	6.16% \$18,634	6.56% \$23,696	7.09% \$32,226	8.61% \$52,884
No Qual. to Bachelor's	8.30% \$137,898	8.35% \$116,893	9.76% \$156,542	9.98% \$175,228	8.37% \$142,090	8.55% \$124,718	9.92% \$164,651	10.26% \$189,084
No Qual. to Postgraduate	7.35% \$121,694	6.52% \$64,669	7.66% \$110,275	8.94% \$168,035	7.40% \$125,321	6.63% \$70,602	7.70% \$114,955	9.19% \$182,764
School Cert. to UE or SFC	6.89% \$10,815	11.61% \$38,441	12.27% \$46,989	11.90% \$38,965	7.34% \$13,489	12.00% \$40,099	12.88% \$49,904	12.46% \$40,386
School Cert. to Diploma	1.87% (\$35,106)	4.10% (\$8,746)	3.33% (\$16,086)	4.41% (\$4,445)	1.86% (\$35,539)	4.09% (\$8,791)	3.25% (\$17,001)	4.64% (\$2,676)
School Cert. to Bachelor's	7.32% \$88,724	7.93% \$90,704	9.00% \$115,533	9.04% \$125,174	7.41% \$93,164	8.16% \$97,988	9.21% \$123,017	9.50% \$141,141
School Cert. to Postgrad.	6.50% \$73,610	5.96% \$37,696	6.83% \$69,577	8.11% \$120,308	6.56% \$77,337	6.08% \$42,984	6.88% \$73,378	8.48% \$136,739
UE or SFC to Bachelor's	7.53% \$85,047	7.09% \$55,880	7.92% \$70,400	8.14% \$87,323	7.56% \$86,841	7.33% \$62,353	8.11% \$76,251	8.63% \$103,375
UE or SFC to Postgraduate	6.57% \$70,080	5.07% \$2,463	5.71% \$23,925	7.33% \$83,557	6.57% \$71,217	5.20% \$7,061	5.75% \$26,326	7.73% \$100,496
Bachelor's to Postgraduate	3.49% (\$22,044)	-0.89% (\$63,017)	0.33% (\$52,027)	4.16% (\$8,978)	3.48% (\$22,394)	-0.77% (\$63,442)	0.48% (\$53,920)	4.59% (\$4,160)

Notes:

1. Rates of return estimates are based on the 0.10 sample of the 1981, 1986, 1991 and 1996 New Zealand Census data. Estimates are based on before-tax income and exclude capital valuations.
2. Discounted sums of returns are the net present values of the sums of the lifetime costs and benefits at a 5% real discount rate (expressed in 1998 dollars). Brackets denote negative amounts for returns below the 5% rate.
3. University and Polytechnic returns include foregone earnings at the SFC level.

Table 17: Social Rates of Return (and Net Discounted Sums of Returns in 1998 Dollars) for All Employed and Employed Full-Time Females: 1981-1998

Qualifications	All Employed				Employed Full-Time			
	1981	1986	1991	1998	1981	1986	1991	1998
No Qual. to School Cert.	10.70% \$26,928	11.83% \$21,609	13.46% \$31,959	26.47% \$55,212	11.23% \$35,267	13.35% \$31,289	13.49% \$38,238	20.99% \$58,155
No Qual. to UE or SFC	9.30% \$43,026	10.23% \$37,338	10.46% \$40,134	14.18% \$61,403	10.12% \$54,132	11.59% \$49,839	11.91% \$57,721	13.55% \$67,430
No Qual. to Diploma	6.57% \$25,949	5.20% \$2,921	5.55% \$8,380	6.10% \$16,133	6.85% \$32,254	6.37% \$20,718	6.31% \$21,236	6.81% \$27,919
No Qual. to Bachelor's	7.36% \$71,626	5.95% \$22,551	7.66% \$69,132	7.18% \$55,441	7.57% \$79,973	6.99% \$50,412	8.31% \$95,364	7.86% \$76,447
No Qual. to Postgraduate	6.58% \$62,774	5.18% \$6,624	6.08% \$40,941	6.69% \$59,764	6.72% \$69,242	5.84% \$32,257	6.46% \$56,466	7.20% \$81,655
School Cert. to UE or SFC	7.75% \$16,373	9.50% \$18,137	8.33% \$10,404	8.26% \$10,541	8.39% \$18,707	9.90% \$20,019	10.55% \$21,189	8.58% \$12,218
School Cert. to Diploma	4.92% (\$1,116)	3.81% (\$14,631)	3.35% (\$19,182)	2.18% (\$29,600)	4.66% (\$4,598)	4.36% (\$8,426)	3.83% (\$14,730)	2.86% (\$24,040)
School Cert. to Bachelor's	6.75% \$48,838	5.44% \$9,428	7.16% \$48,435	5.83% \$18,247	6.69% \$47,129	6.11% \$25,933	7.61% \$66,424	6.40% \$32,359
School Cert. to Postgrad.	6.13% \$42,641	4.89% (\$3,859)	5.65% \$22,652	5.89% \$28,644	6.04% \$38,901	5.29% \$10,751	5.82% \$29,531	6.28% \$43,340
UE or SFC to Bachelor's	6.43% \$33,235	4.71% (\$5,371)	6.89% \$39,335	5.41% \$8,283	6.25% \$29,608	5.46% \$9,245	7.01% \$47,758	5.85% \$18,715
UE or SFC to Postgraduate	5.83% \$27,683	4.48% (\$16,712)	5.42% \$14,277	5.68% \$21,081	5.66% \$22,241	4.88% (\$4,251)	5.33% \$11,674	5.96% \$31,817
Bachelor's to Postgraduate	5.30% \$3,294	4.82% (\$2,852)	3.76% (\$19,560)	6.49% \$18,326	4.86% (\$1,506)	4.53% (\$8,316)	2.38% (\$35,699)	6.38% \$18,266

Notes:

1. Rates of return estimates are based on the 0.10 sample of the 1981, 1986, 1991 and 1996 New Zealand Census data. Estimates are based on before-tax income and exclude capital valuations.
2. Discounted sums of returns are the net present values of the sums of the lifetime costs and benefits at a 5% real discount rate (expressed in 1998 dollars). Brackets denote negative amounts for returns below the 5% rate.
3. University and Polytechnic returns include foregone earnings at the SFC level.

**Appendix A: Age-Income Profile Data by Education Level in 1996
(Before Tax Income)**

Table A1: All Employed Males

Age Interval	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
No Qual.	13581.3	20555.8	25011.7	28886.7	30413.3	32476.8	34269.0	32760.0	30304.1	26917.5
School Cert	13500.0	22772.9	29778.4	34741.8	36110.0	40087.4	42861.2	39543.1	36318.6	32780.0
U.E. or S.F.C.	14317.5	23530.1	33559.6	39479.5	43191.1	46164.7	48937.2	45600.8	36987.1	33318.9
Bursary	8647.7	19872.8	35574.7	42896.9	48846.0	49085.8	52471.8	44440.4	45484.1	35039.2
Diploma	14117.5	26128.6	34328.6	39290.1	41556.2	42812.6	43613.1	42389.9	38417.4	32383.3
Bachelor's	10735.3	23170.6	39740.6	55091.4	63069.8	63703.5	66418.1	66659.5	70391.1	55456.3
Postgraduate		25764.2	39029.8	56904.3	67652.7	70470.0	69790.2	67920.6	71072.5	71894.1

Table A2: Full-Time Males

Age Interval	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
No Qual.	13809.3	21257.3	25767.9	29741.2	31384.3	33357.3	35086.4	33953.9	31759.0	30846.2
School Cert	13719.7	23239.7	30275.4	35539.5	37058.0	41197.5	43811.7	40682.8	37655.7	36730.7
U.E. or S.F.C.	14622.1	24407.5	34519.3	40264.8	44049.6	47141.3	50021.1	46986.5	38083.4	34931.5
Bursary	12745.6	23207.6	36707.4	44018.8	49560.2	50203.6	53804.0	44729.7	46806.1	40727.6
Diploma	14962.5	27097.8	35002.4	39935.6	42254.9	43650.0	44458.8	42995.6	40080.3	37320.2
Bachelor's	14000.0	25569.9	41142.6	56507.2	64506.6	65845.1	67856.7	68920.4	74851.5	64263.2
Postgraduate		29090.9	41807.0	59396.5	69094.4	72857.0	71340.9	69963.0	74934.5	79420.0

Table A3: All Employed Females

Age Interval	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
No Qual.	10920.4	15726.3	17059.9	16696.9	18056.1	19577.3	20985.2	19264.4	18542.2	18374.7
School Cert	12658.4	20352.0	21883.6	19879.6	21224.0	23835.1	24428.5	24699.5	21805.1	24297.4
U.E. or S.F.C.	12837.4	21376.9	25795.6	24402.3	24202.4	25021.6	25372.5	24018.7	23689.6	27572.1
Bursary	6946.9	17172.7	27345.5	26571.1	23606.3	24539.7	26485.8	23355.3	25030.0	14100.0
Diploma	11653.7	21004.9	25582.1	24584.4	23881.9	26506.7	28063.9	27600.5	26186.1	22825.1
Bachelor's	7327.6	20489.9	33651.4	34056.7	31438.9	34898.2	37208.4	34995.0	36178.8	33438.1
Postgraduate		21855.2	35607.2	38118.9	43483.8	40235.5	42776.0	42323.6	40763.4	37115.4

Table A4: Full-Time Females

Age Interval	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
No Qual.	11235.9	17793.0	20569.9	20736.6	22033.2	23077.6	24036.6	23688.5	23179.2	22819.6
School Cert	12990.4	22392.1	26140.3	25728.7	26104.4	28143.3	28268.8	29303.6	26319.3	28946.6
U.E. or S.F.C.	13686.4	23328.2	29255.0	31126.5	30519.3	29284.2	29203.8	28989.0	26699.5	31203.7
Bursary	11145.2	21683.4	30281.4	33506.3	30449.3	31532.2	31594.2	27857.1	30626.2	13750.0
Diploma	12617.2	22663.1	29123.0	30666.7	30362.9	31441.1	32292.8	32064.6	30725.8	29650.0
Bachelor's	8437.5	23311.5	35726.5	40647.4	40857.0	41095.3	42467.2	40121.3	42702.0	42540.0
Postgraduate		24351.0	38719.4	44307.1	52665.3	47390.3	48170.3	47244.5	48430.3	45937.5

Appendix B: Labour Force Status and Income in 1996 by Highest Educational Qualification

Table B1: All Employed Males

Personal Characteristics	No Qual.	School Cert.	UE or SFC	Bursary	Diploma	Bachelor's Qual.	Postgrad. Qual.
Age	40.68 (12.35)	35.73 (11.84)	32.89 (10.86)	28.99 (11.56)	39.08 (11.11)	37.43 (10.48)	40.85 (10.17)
Ethnic Origin (%)							
European	74.23%	83.59%	84.24%	81.86%	89.13%	85.16%	87.07%
Maori	17.41%	11.85%	10.24%	10.19%	7.48%	3.90%	2.76%
Other	8.36%	4.56%	5.52%	7.96%	3.38%	10.94%	10.18%
Income (1996 dollars)	28,915.92 (20,218.46)	32,294.23 (22,901.28)	34,368.49 (24,690.04)	27,462.02 (26,663.38)	38,095.60 (23,634.24)	53,044.13 (36,241.93)	61,257.82 (37,018.20)
Labour Force Status							
Employed	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Employed Full-Time	91.12%	93.48%	93.64%	74.67%	93.78%	92.31%	92.33%
Unemployed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Out of the Labour Force	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sample Size	21,834	8,884	7,137	4,536	20,669	6,518	3,479

Table B2: Employed Full-Time Males

Personal Characteristics	No Qual.	School Cert.	UE or SFC	Bursary	Diploma	Bachelor's Qual.	Postgrad. Qual.
Age	40.40 (12.21)	35.51 (11.69)	32.80 (10.64)	31.39 (11.63)	38.90 (10.89)	37.54 (10.19)	40.89 (9.84)
Ethnic Origin (%)							
European	74.76%	83.97%	84.54%	82.93%	89.64%	85.74%	87.42%
Maori	17.06%	11.56%	10.12%	10.33%	7.17%	3.91%	2.65%
Other	8.18%	4.47%	5.34%	6.73%	3.19%	10.35%	9.93%
Income (1996 dollars)	29,934.23 (20,162.91)	33,089.24 (22,933.72)	35,340.61 (24,582.24)	33,906.22 (27,164.50)	39,098.71 (23,391.46)	55,519.88 (35,876.42)	64,067.75 (36,214.43)
Labour Force Status							
Employed	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Employed Full-Time	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Sample Size	19,896	8,305	6,683	3,387	19,383	6,017	3,212

Table B3: All Employed Females

Personal Characteristics	No Qual.	School Cert.	UE or SFC	Bursary	Diploma	Bachelor's Qual.	Postgrad. Qual.
Age	42.44 (11.04)	37.25 (10.74)	32.00 (9.77)	26.17 (10.50)	38.13 (11.24)	34.29 (10.00)	38.39 (10.00)
Ethnic Origin (%)							
European	76.01%	84.67%	84.52%	80.80%	88.16%	85.30%	88.75%
Maori	15.66%	11.45%	10.68%	10.80%	7.74%	4.56%	3.46%
Other	8.33%	3.87%	4.79%	8.40%	4.10%	10.14%	7.79%
Income (1996 dollars)	18,517.42 (14,682.64)	21,662.29 (16,655.20)	22,914.49 (16,361.66)	15,565.96 (15,055.72)	24,609.72 (16,598.48)	30,685.33 (21,729.49)	38,198.64 (26,289.99)
Labour Force Status							
Employed	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Employed Full-Time	63.64%	66.54%	70.73%	52.19%	68.64%	75.58%	77.82%
Unemployed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Out of the Labour Force	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sample Size	16,076	10,172	7,554	3,713	16,051	5,049	2,399

Table B4: Employed Full-Time Females

Personal Characteristics	No Qual.	School Cert.	UE or SFC	Bursary	Diploma	Bachelor's Qual.	Postgrad. Qual.
Age	41.80 (11.11)	36.44 (11.11)	30.96 (9.81)	27.96 (10.47)	37.27 (11.45)	33.71 (9.85)	38.07 (10.08)
Ethnic Origin (%)							
European	73.10%	83.11%	83.25%	79.57%	87.01%	85.12%	88.59%
Maori	16.90%	12.28%	11.57%	11.76%	8.45%	4.56%	3.86%
Other	10.00%	4.61%	5.18%	8.67%	4.54%	10.32%	7.55%
Income (1996 dollars)	22,027.96 (14,767.17)	25,464.24 (16,167.82)	26,329.09 (15,269.55)	22,763.83 (16,110.03)	28,714.07 (16,105.68)	35,301.35 (21,251.75)	43,735.41 (26,026.87)
Labour Force Status							
Employed	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Employed Full-Time	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Sample Size	10,231	6,768	5,343	1,938	11,018	3,816	1,867

Appendix C: Regression Results for Income Effects of Education 1981-1996

Specified as a Function of 'Potential Years of Experience (Age – years of education – 5) '

Table C1: Regression Results for Income Effects of Education for All Employed Males: 1981-1996

(Dependent Variable: The Natural Logarithm of *After tax* Annual Income)
Least Squares Regression Coefficients (t-ratios)

Explanatory Variables	1981		1986		1991		1996	
	Age	Exp	Age	Exp	Age	Exp	Age	Exp
Intercept	7.131 (424.9)	8.338 (1463.00)	7.623 (512.44)	8.763 (1732.55)	7.581 (376.66)	9.05 (1312.4)	7.059 (291.23)	8.934 (1062.56)
School Certificate	0.088 (14.39)	0.090 (14.55)	0.088 (16.51)	0.088 (16.37)	0.145 (20.47)	0.134 (18.77)	0.174 (21.63)	0.158 (19.44)
U.E. or Sixth Form Certificate	0.115 (16.26)	0.144 (20.16)	0.160 (25.04)	0.182 (28.27)	0.228 (27.19)	0.235 (27.77)	0.273 (31.18)	0.273 (30.91)
Bursary	0.084 (7.61)	0.174 (15.53)	0.062 (6.20)	0.141 (13.85)	0.103 (9.14)	0.170 (14.98)	0.021 (2.01)	0.091 (8.16)
Diploma	0.177 (37.16)	0.248 (51.15)	0.205 (52.06)	0.261 (65.84)	0.231 (46.17)	0.284 (55.41)	0.261 (42.27)	0.310 (48.71)
Bachelor's Degree	0.335 (34.52)	0.468 (47.70)	0.394 (50.02)	0.509 (63.98)	0.516 (56.08)	0.632 (67.62)	0.495 (55.44)	0.615 (67.74)
Postgraduate Qualification	0.426 (31.41)	0.558 (40.91)	0.439 (45.54)	0.559 (57.47)	0.583 (48.43)	0.696 (57.39)	0.598 (52.29)	0.736 (63.00)
Age	0.089 (95.99)		0.083 (101.68)		0.105 (97.43)		0.133 (104.07)	
Age²	-0.001 (81.59)		-0.001 (87.33)		-0.001 (97.34)		-0.002 (91.70)	
Potential Experience		0.053 (102.04)		0.050 (108.17)		0.061 (104.25)		0.078 (112.10)
Potential Experience²		-0.0009 (78.06)		-0.001 (84.36)		-0.001 (84.23)		-0.0014 (91.01)
F							3073.27	3096.86
R²	0.21	0.20	0.23	0.23	0.22	0.22	0.26	0.26
Sample Size	77,658	77,658	83,520	83,520	70,136	70,136	70,481	69,050

**Table C2: Regression Results for Income Effects of Education for All
Employed Females: 1981-1996**

(Dependent Variable: The Natural Logarithm of *After tax* Annual Income)
Least Squares Regression Coefficients (t-ratios)

Explanatory Variables	1981		1986		1991		1996	
	Age	Exp	Age	Exp	Age	Exp	Age	Exp
Intercept	7.618 (263.41)	8.201 (850.80)	8.714 (309.02)	8.691 (908.06)	8.654 (265.04)	9.011 (806.1)	7.926 (228.59)	8.84 (736.72)
School Certificate	0.142 (14.49)	0.143 (14.49)	0.119 (13.36)	0.123 (13.73)	0.149 (14.78)	0.147 (14.460)	0.191 (19.04)	0.178 (17.38)
U.E. or Sixth Form Certificate	0.164 (14.37)	0.180 (15.55)	0.204 (18.34)	0.211 (18.78)	0.255 (20.60)	0.259 (20.69)	0.319 (28.24)	0.315 (27.15)
Bursary	0.102 (4.93)	0.149 (7.15)	0.058 (2.78)	0.069 (3.29)	0.020 (1.08)	0.047 (2.49)	-0.074 (4.84)	-0.024 (1.53)
Diploma	0.293 (32.88)	0.333 (36.46)	0.264 (34.04)	0.275 (34.65)	0.297 (36.05)	0.316 (37.08)	0.322 (36.55)	0.364 (39.48)
Bachelor's Degree	0.436 (21.37)	0.515 (24.96)	0.442 (25.42)	0.456 (25.95)	0.575 (35.77)	0.616 (37.58)	0.515 (40.42)	0.576 (43.26)
Postgraduate Qualification	0.561 (15.62)	0.644 (17.88)	0.590 (27.37)	0.611 (28.20)	0.684 (31.46)	0.732 (33.34)	0.679 (40.05)	0.775 (44.04)
Age	0.043 (26.22)		-0.002 (1.15)		0.026 (14.58)		0.065 (35.66)	
Age ²	-0.0001 (21.48)		-0.001 (3.08)		-0.0002 (11.37)		-0.001 (30.07)	
Potential Experience		0.026 (29.37)		0.001 (1.203)		0.017 (18.68)		0.039 (40.75)
Potential Experience ²		-0.0004 (21.10)		0.00004 (2.38)		-0.0002 (12.86)		-0.0006 (30.564)
F	339.34	337.23	259.78	275.41	388.47	393.257	823.20	810.66
$\bar{R}^2$	0.06	0.06	0.03	0.04	0.05	0.06	0.10	0.10
Sample Size	39,747	39,747	56,475	56,475	53,257	53,257	58,493	57,237

Appendix D: Regression Results for Age-Income Profiles in 1996

Table D1: All Employed Males

(1) No Qualification Sample Size = 20,950	Y= -19223 + 2246.195 AGE -23.9595 AGE ² (13.87) (31.171) (27.185)	Adj. R ² = 0.0685 F= 770.77
(2) School Certificate Sample Size = 8,641	Y= -30834 + 3053.786 AGE -32.4906 AGE ² (14.749) (26.176) (21.393)	Adj. R ² = 0.1391 F= 699.163
(3) U.E. or S.F.C Sample Size = 6,984	Y= -47258 + 4135.773 AGE -45.4068 AGE ² (19.362) (29.158) (23.612)	Adj. R ² = 0.199 F= 868.361
(4) Bursary Sample Size = 4,425	Y= -75256 + 5644.798 AGE -62.583 AGE ² (27.659) (32.672) (25.821)	Adj. R ² = 0.383 F= 1373.892
(5) Diploma Sample Size = 20,222	Y= -33180 + 3426.911 AGE -37.9536 AGE ² (17.61) (35.148) (31.69)	Adj. R ² = 0.0763 F= 835.697
(6) Bachelor's Degree Sample Size = 6,440	Y= -93703 + 6688.324 AGE -68.6033 AGE ² (18.196) (24.707) (20.299)	Adj. R ² = 0.1828 F= 720.953
(7) Postgrad. Qual. Sample Size = 3,447	Y= -88205 + 6456.53 AGE -64.4819 AGE ² (10.265) (15.183) (12.741)	Adj. R ² = 0.13 F= 258.471

Table D2: Employed Full-Time Males

(1) No Qualification Sample Size = 19,115	Y= -17034 + 2140.583 AGE -22.225 AGE ² (11.754) (28.181) (23.714)	Adj. R ² = 0.0744 F= 769.153
(2) School Certificate Sample Size = 8,093	Y= -30367 + 3036.346 AGE -31.7841 AGE ² (14.007) (24.901) (19.84)	Adj. R ² = 0.1506 F= 718.099
(3) U.E. or S.F.C Sample Size = 6,545	Y= -47196 + 4169.943 AGE -45.6729 AGE ² (18.428) (27.775) (22.182)	Adj. R ² = 0.207 F= 855.08
(4) Bursary Sample Size = 3,304	Y= -64324 + 5147.778 AGE -56.6039 AGE ² (17.577) (23.143) (18.522)	Adj. R ² = 0.287 F= 665.749
(5) Diploma Sample Size = 18,975	Y= -28426 + 3193.244 AGE -34.7462 AGE ² (14.365) (31.045) (27.33)	Adj. R ² = 0.0733 F= 751.111
(6) Bachelor's Degree Sample Size = 5,947	Y= -83983 + 6219.285 AGE -62.1155 AGE ² (15.029) (21.19) (16.914)	Adj. R ² = 0.1768 F= 639.681
(7) Postgrad. Qual. Sample Size = 3,183	Y= -74432 + 5872.691 AGE -57.4604 AGE ² (8.004) (12.767) (10.471)	Adj. R ² = 0.1189 F= 215.767

Table D3: All Employed Females

(1) No Qualification Sample Size = 15,284	Y= -280.853 + 829.2505 AGE -8.54541 AGE ² (0.195) (11.469) (9.806)	Adj. R ² = 0.0152 F= 118.857
(2) School Certificate Sample Size = 9,893	Y= 4926.73 + 742.605 AGE -7.28338 AGE ² (2.701) (7.473) (5.656)	Adj. R ² = 0.0175 F= 89.246
(3) U.E. or S.F.C Sample Size = 7,382	Y= -6488.87 + 1579.678 AGE -18.9072 AGE ² (3.471) (14.36) (12.372)	Adj. R ² = 0.04 F= 154.889
(4) Bursary Sample Size = 3,615	Y= -41924 + 3472.865 AGE -42.0305 AGE ² (21.671) (27.224) (23.068)	Adj. R ² = 0.2655 F= 654.286
(5) Diploma Sample Size = 15,702	Y= -1419.41 + 1217.204 AGE -12.9076 AGE ² (0.995) (15.93) (13.327)	Adj. R ² = 0.0312 F= 253.809
(6) Bachelor's Degree Sample Size = 4,961	Y= -26010 + 2829.11 AGE -31.6155 AGE ² (6.948) (13.488) (11.426)	Adj. R ² = 0.0685 F= 183.323
(7) Postgrad. Qual. Sample Size = 2,369	Y= -34488 + 3408.204 AGE -36.9522 AGE ² (4.717) (8.985) (7.844)	Adj. R ² = 0.0546 F= 69.324

Table D4: Employed Full-Time Females

(1) No Qualification Sample Size = 9,711	Y= -1875.92 + 1041.819 AGE -10.5302 AGE ² (1.097) (11.792) (9.64)	Adj. R ² = 0.0313 F= 157.918
(2) School Certificate Sample Size = 6,587	Y= -4483.91 + 1446.587 AGE -15.7097 AGE ² (2.216) (12.696) (10.394)	Adj. R ² = 0.0512 F= 178.644
(3) U.E. or S.F.C Sample Size = 5,219	Y= -21803 + 2659.815 AGE -32.4781 AGE ² (11.106) (22.438) (19.382)	Adj. R ² = 0.1269 F= 380.167
(4) Bursary Sample Size = 1,882	Y= -42028 + 3799.919 AGE -46.5173 AGE ² (13.193) (18.632) (16.03)	Adj. R ² = 0.2403 F= 298.476
(5) Diploma Sample Size = 10,775	Y= -11658 + 1961.532 AGE -21.5428 AGE ² (7.221) (22.025) (18.704)	Adj. R ² = 0.0795 F= 466.148
(6) Bachelor's Degree Sample Size = 3,747	Y= -42257 + 3926.378 AGE -44.4523 AGE ² (9.779) (16.045) (13.669)	Adj. R ² = 0.1239 F= 265.96
(7) Postgrad. Qual. Sample Size = 1,840	Y= -50561 + 4476.563 AGE -49.0823 AGE ² (6.162) (10.393) (9.102)	Adj. R ² = 0.0923 F= 94.508

Appendix D Continued: Panel Age Income Profiles for Three Cohorts and four Census Years

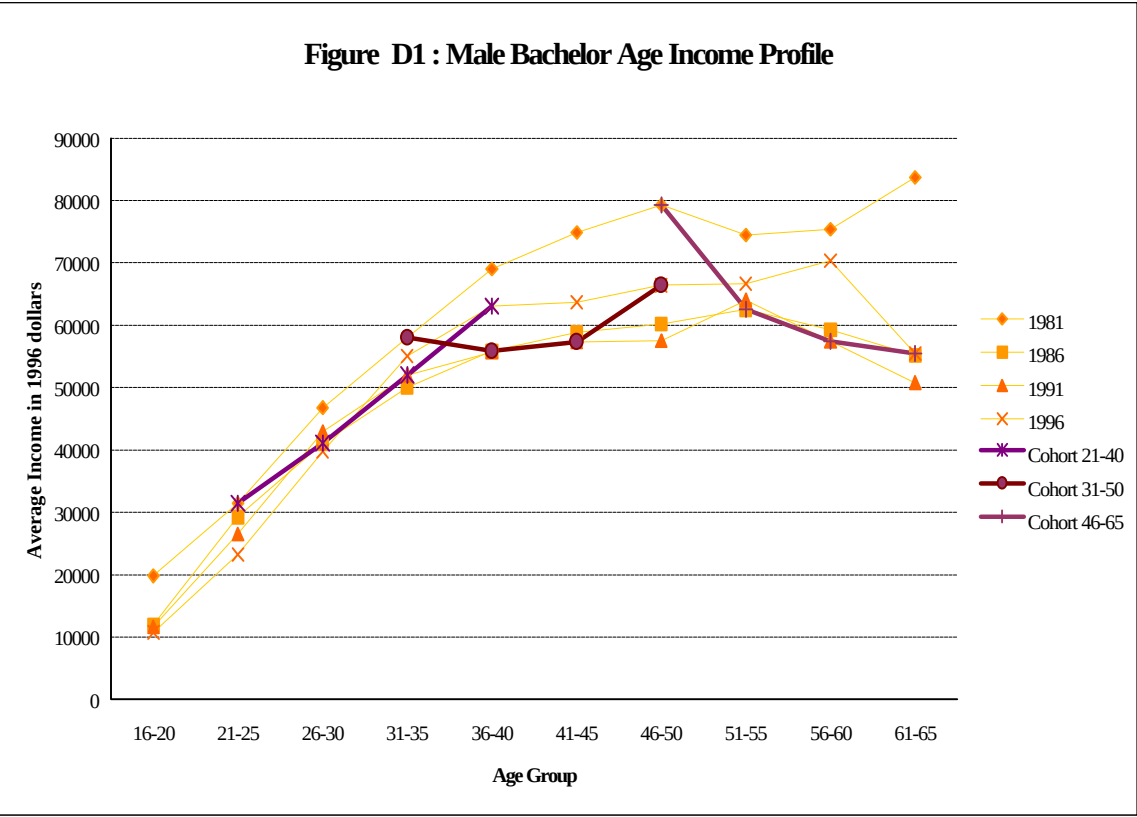


Figure D2 : Female Bachelor Age Income Profile

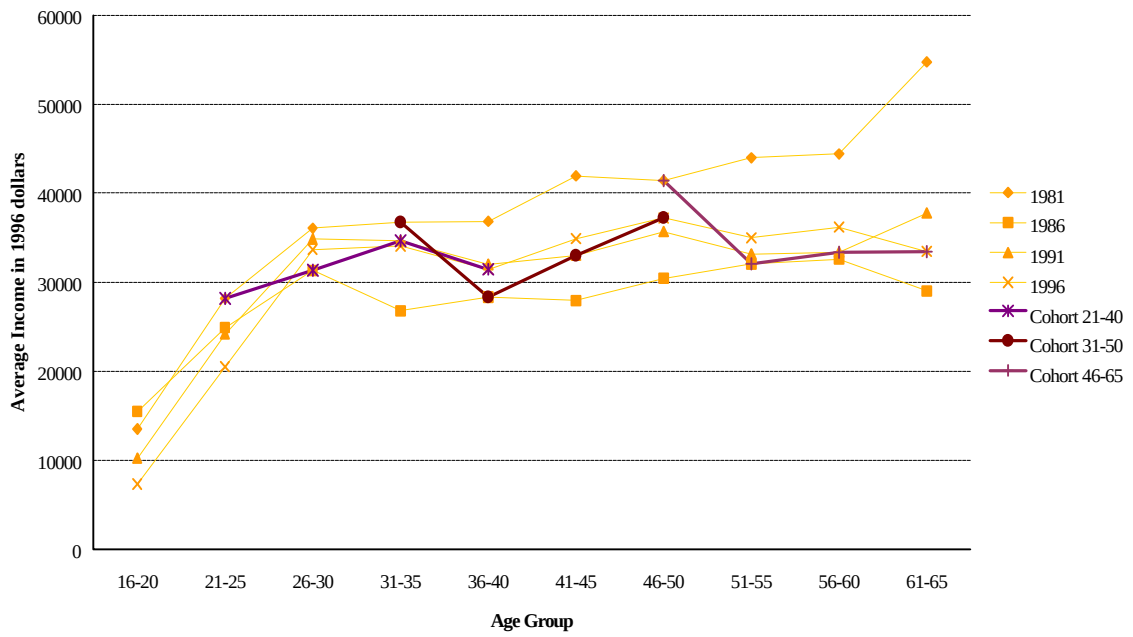


Figure D3 : Male Year 12 Age Income Profile

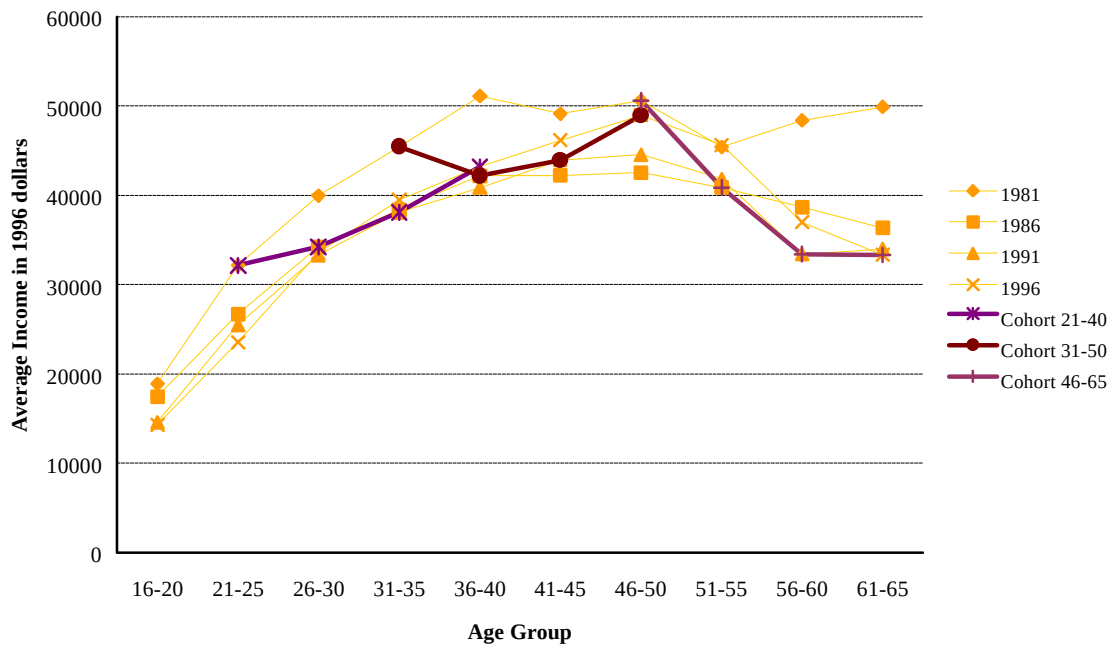
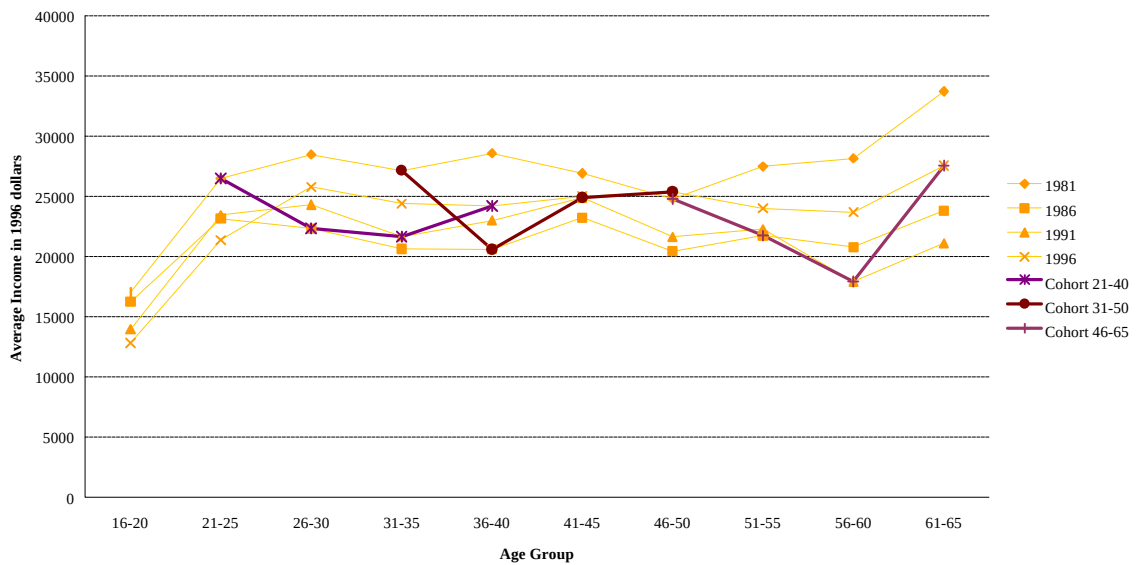


Figure D4 : Female Year 12 Age Income Profile



Appendix E: The Average University Fee for 1998

The average University fee for 1998 in New Zealand is \$2,877. This was calculated by weighting the average fee charged by each University in New Zealand by each University's Equivalent Full-Time Student (EFTS) funded places for 1998. Auckland University has the highest number of EFTS funded places for 1998 and received the highest weighting.

The complication is that only three of the seven Universities in New Zealand have an undifferentiated fee structure (these being Auckland, Victoria and Canterbury University). The rest (Waikato, Massey, Lincoln and Otago University) have a differentiated fee structure.

To derive the average fee for each of the universities which have a differentiated fee structure, the Tertiary Education Statistics for July 1997 were used to weight according to the numbers of part-time and full-time students within each fee category. The categories of student numbers in the Tertiary Education Statistics do not always closely match the fee categories, so a number of reasonable assumptions have to be made. For example, Otago University charges higher fees for year four physiotherapy students than it does for years one to three. The assumption was made that one quarter of physiotherapy students pay the higher fee.

Additional data (1998 EFTS study-right numbers at Waikato University per faculty) was required to calculate the weighted average fee for Waikato University, since Waikato University also differentiates fees according to study-right category.

Even though part-time and full-time student numbers were used to calculate the average fee of those universities with a differentiated fee, each University's average fee was weighted according to funded EFTS places for 1998. The national average university fee of \$2,877 for 1998 can be expected to be reasonably accurate because those universities with an undifferentiated fee contributed a combined weighting of just over 50 per cent.

The average New Zealand University fee for 1998 of \$2,877 is, incidentally, quite close to the average fee charged by Auckland University in 1998 of \$2,884.