THE APPROACH TO MEASURING THE RETURNS TO SECONDARY AND TERTIARY QUALIFICATIONS IN NEW ZEALAND: AN INVESTIGATION AND UPDATE USING DATA FROM THE 2001 CENSUS

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Abstract

This study investigates the approaches to measuring the returns to secondary and tertiary qualifications in New Zealand using the latest Census of Population and Dwellings data from 2001. It calculates the returns to qualifications using income function analysis, elaborate analysis and also extends the elaborate analysis by using the quantile regression technique. It reports returns within a narrow band for both methods and at a similar or higher magnitude to previous years. However, the results reported using the net present value (NPV) criteria reveal higher social returns to qualifications than private returns. This contradicts previous literature. In the policy implications section, the study recommends policies focus more on reducing the level of forgone earnings. Also, the study finds that income function analysis is better suited to measuring income inequality and its link with education. Furthermore, the study concludes that elaborate analysis, using the NPV criteria, allows better comparison of the marginal returns to educational investments of varying scale and duration. Finally, the quantile regression estimates show that point estimates of the mean return give a poor indication of the distribution of returns.

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1 Introduction

1.1 Background

In 1984, the newly-elected Labour government embarked on a period of groundbreaking reform. The reforms changed the political, social and economic landscape of New Zealand. The government targeted all sectors of the economy. Previously sacred New Zealand institutions such as farming subsidies, state-owned monopolies, and shopping-free Saturdays were all in the firing line. The list eventually extended to include free education. Tertiary tuition fees were introduced, universal student allowances abolished and a student loan scheme initiated. The education sector like most other sectors would never be the same.

While the move to user-pays in education may not have been welcomed by all, most people certainly welcomed the increase in tertiary education participation that followed. The once elite-dominated tertiary institutions ushered in a new wave of students from different ethnic backgrounds. Also female participation in tertiary education quickly overtook male participation. The increase in enrolments saw numbers double before the turn of the century.

The reforms have led to an increase in both private and social expenditure on tertiary education. Now, more so than ever, government, tertiary institutions, students and stakeholders require timely information as to the viability of their investments in education. This means that researchers must ensure that the research is up to date and provides the most relevant information using the most appropriate techniques. With that in mind, this study seeks to meet these needs.

1.1.1 Previous Studies

The New Zealand returns to education literature has been dominated by Maani (1994, 1996b, 1997, 1999 and 2000). Her major piece of work in 1997 used both the elaborate and regression analysis methodologies. She used these techniques to explore the effect of major policy changes on the rates of return to the investment in higher education. The policy changes analysed included the introduction of the student loan programme, the tightening of student allowance eligibility criteria, and the introduction of higher tuition fees. The higher education policy overhaul occurred concurrently with significant increases in participation in higher education and Maani also discusses the combined effects.

She analysed census data from 1981 to 1991 and over this period she found that the returns to higher education increased despite the large increases in participation. The analysis of the effect of tuition fees showed that the private internal rates of returns for all levels of tertiary qualifications have decreased relative to the no fees scenario which existed in the 1980s. Maani updated her analysis in 1999 with data from the 1996 census and reaffirmed her original results. The only result that showed a new trend was a decline in returns for females at the Bachelor's degree level.

1.2 Research Aims and Objectives

This study aims to add to the academic literature and enhance the knowledge base for tertiary sector policy-making. The first basic objective is to update Maani's 1999 study with the latest Census data from 2001. The 2001 data reflects, to a greater extent than previous years, the rapid increase in tertiary education participation, and the overhaul of higher education policies during the 1990s (explained in chapter 4). Accordingly, analysis of the returns to higher education using 2001 data may capture some of the effects of these changes. Therefore, comparisons of this

study's results with the previous ones are highly valuable in the context of tertiary education sector policy choices.

The second objective is to evaluate the methods used in the study and then suggest the most appropriate use of each method. Income function analysis and elaborate analysis, including quantiles estimates, provide different measures of the returns to education. Moreover, they have different strengths and weaknesses. As a result, this study aims to point out the most applicable setting for each of the methods given the framework and strengths and weaknesses of each approach.

Finally, with the results from the two approaches in hand, this study aims to critique the tertiary education reforms of the 1980s and 1990s. Furthermore, it then aims to offer pertinent advice based on these critiques and new updated returns to education results.

1.3 Data and Methodology

1.3.1 Data and Sample Characteristics

The data sets for the study consist of four twenty percent samples of the New Zealand Census of Population and Dwellings. There are two female samples, one for each of the years 1996 and 2001, and likewise for two male samples. The samples contain observations from the age of 16 up to 65[1]. Analysis on the 2001 data set updates previous analysis by Maani (1999). The two methods of analysis make use of the same data sets.

1.3.2 Income Function Analysis

This study uses a modified income function (Mincer, 1974), called an "extended" income function (Psacharopoulos, 1994), as the basis of the first part of the analysis. The "extended" income function is used to estimate returns to education at different levels by converting the continuous years

[1] Data from individuals aged over 65 is omitted from the study even though some individuals continue to work beyond the age of 65. This is done to simplify the analysis.

of schooling variable into a series of dummy variables referring to separate levels of education or even different fields of study. The model used in this study focuses on separate levels of education represented by the highest level of qualification in the Stats New Zealand data.

The results from the income function analysis are used in two ways. Firstly, the income effects (Maani, 1991) of secondary and tertiary qualifications are compared with the group with No Qualifications. Secondly, marginal percentage income effects of qualifications are calculated using the results from a qualification and that of the qualification immediately below it. Subsequently, testing on the robustness of the results is performed. The study also examines various function specifications. Finally, the study compares the results over time, between genders, and by qualification.

1.3.3 Elaborate Analysis

The second method, referred to as elaborate analysis in the literature (Psacharopoulos, 1994), calculates the rates of return to investments in secondary and tertiary education. Firstly, it estimates the discount rate[2] where the stream of lifetime gains from educational qualifications and the costs of acquiring the educational qualifications are equated. Secondly, using the same general framework, it calculates the discounted sum of the returns[3] to secondary and tertiary educational qualifications. The two approaches both calculate the private and social returns to education.

With the results in hand, the analysis then proceeds to check that the results correspond to that of previous studies. Also, the analysis compares the difference between the returns for 1996 and 2001 as well as the difference between the private and social returns. The analysis then compares the results calculated in the rates of return (IRR) framework to the results calculated in the discounted sums of return (NPV) framework. Finally, the study performs sensitivity analysis on key parameters, for example, the level of tuition fees, length of study, the level of forgone earnings, and the timing of study.

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[2] This technique uses the internal rate (IRR) of return criteria.
[3] Alternatively, this technique uses the net present value (NPV) criteria.

The quantile estimates (Koenker & Bassett, 1978) of the returns to education extend the elaborate analysis. Both of the previous methods, income function analysis and elaborate analysis, gave point estimates of the returns using based on the median or mean. The quantile estimates of the returns to education allow exploration of the returns at different points on the distribution and therefore give an indication of the level of risk associated with a particular investment in education.

1.4 Chapter Outline

Chapters two and three set the context within which this study falls. The literature review chapter introduces the reader to human capital theory and the subsequent returns to education literature. It then outlines the previous research upon which this study builds. The following chapter describes the reforms of the New Zealand education sector during the 1980s and 1990s. At the same time, it presents the trends in tertiary education participation, government funding and tuition fees.

Chapters four through eight present the main part of the analysis. Chapter four discusses the data and sample characteristics. Chapter five outlines the income function analysis methodology and then chapter six reports and discusses the income function analysis results. Similarly, chapter seven outlines the elaborate analysis methodology and then chapter eight reports and discusses the results.

Chapter nine evaluates the results from chapters six and eight. It then discusses the policy implications of the results and also offers some policy advice. Finally, chapter ten summarises the findings and offers suggestions for further research.

2 Literature Review

2.1 Human Capital Theory

In the 1950s, economists began to try to explain the gap between the increases in national income and the increases in measured resources or inputs. The increases in traditional inputs, such as hours of work; capital, for example, machinery; raw materials; and other natural resources could not fully explain the increases in output across the industrialised economies of the time. Fabricant (1959) found that output for the United States economy rose by an average of 3.5 percent from 1889 to 1957, whereas total inputs increased only at an average rate of 1.7 percent. What was it that could explain this sustained gap between input and output for over sixty years?

The answer that was put forward came to be termed *human capital*. Becker (1965) explains what distinguishes human capital from other types of capital:

> To most of you, capital means a bank account, 100 shares of IBM, assembly lines or steel plants. These are all forms of capital in the sense that they yield income and other useful outputs over a long period of time. But I'm talking about a different sort of capital. Schooling, a computer training course, expenditures on medical care and lectures on the virtues of punctuality and honesty are capital too, in the sense that they improve health, raise earnings or add to a person's appreciation of literature over much of his or her lifetime. Consequently, it is fully in keeping with the capital concept as traditionally defined to say that expenditures on education, training, medical care, etc. are investments in capital[1].

[1] This quote is taken from a lecture Becker presented in 1989.

Becker along with Schultz (1960) started the human capital revolution. Their ideas built on earlier ones discussed by Walsh (1935), Mincer (1958), and Friedman and Kuznets (1945). Schultz postulated that there were five broad kinds of human capital:

(1) Health facilities and services, broadly conceived to include all expenditures that affect the life expectancy, strength and stamina, and the vigour and vitality of a people;

(2) On-the-job training, including old-style apprenticeship organised by firms;

(3) Formally organised education at the elementary, secondary, and higher levels;

(4) Study programmes for adults that are not organised by firms, including extension programmes notably in agriculture;

(5) Migration of individuals and families to adjust to changing job opportunities.[2]

This study focuses on the third type of human capital in Schultz's list, namely, formal schooling or education. He and Becker further postulated that education should be seen as an investment by individuals in their individual human capital. The process could be viewed much the same as investment in physical capital by companies. Companies invested in capital, foregoing current profits, in the belief that future profits would increase. Whereas, individuals invested in education, foregoing current earnings (salaries and wages), for the prospect of higher earnings in the future.

With the theoretical framework established, these researchers, with others in tow, moved to empirically ratify the assertion that investment in education was privately and socially desirable. Investments, including

[2] Taken from: Schultz, T.W (1961) Investment in Human Capital. *The American Economic Review,* 51, 1, p.9.

education, to be desirable must have a positive return. Moreover, the return must be favourable when compared to alternative investments. To examine the rate of returns to the investment in education researchers explored the relationship between the level of education and earnings.

2.2 Returns to Education

2.2.1 Returns to Schooling

Mincer (1974) pioneered the use of econometric techniques in identifying the link between earnings and years of schooling. The Human Capital Earnings Function (HCEF) or "Mincerian" equation utilises a semi-log ordinary least squares regression. The natural logarithm of earnings is fitted as the dependent variable with years of schooling, years of labour market experience and its square used as independent variables. It is represented mathematically as follows:

$$\ln Y_i = \ln Y_0 + aYearsofSchooling_i + bAGE_i + c(AGE_i)^2 \qquad (2.1)$$

2.2.2 The Extended Earnings Function

Psacharopoulos (1994) classifies equation 2.1 as the "basic" earnings function. He introduces a second equation, termed the "extended" earnings function. The "extended" earnings function can be used to estimate returns to education at different levels by converting the continuous years of schooling variable into a series of dummy variables, referring to separate levels of education or even different fields of study. An example[3] is given below:

$$\begin{aligned}\ln Y_i = {} & a + b_1 HighSchoolDiploma_i + b_2 Diploma_i \\ & + b_3 Bachelor'sDegree_i + b_4 Postgrad.Degree_i \\ & + b_7 AGE_i + b_8 AGE_i^2 + u_i \end{aligned} \qquad (2.2)$$

[3] This is a generic example. An example relating specifically to New Zealand is shown in Chapter 4.

The dummy variables, b_1 through b_4, refer to levels of education or qualifications. Econometric estimates of the returns associated for each level (and the omitted level of no qualification) can be found using the simple ordinary least squares method. The returns of each subsequent level of qualification can then be compared as opposed to the analysis of the continuous variable of years of schooling in equation 2.1.

2.2.3 The Elaborate Method

A second complementary method, often used in conjunction with regression analysis, Psacharopoulos (1994) refers to as the "elaborate" method. This method calculates an internal rate of return by equating the lifetime stream of educational benefits to a stream of educational costs. The benefits accrue as higher income for individuals with higher education. The costs include those associated with obtaining the higher education such as tuition or school fees and forgone income. Equation 2.3 represents this mathematically[4]:

$$\sum_{t=S+1}^{n} \frac{\left[Yh_i(1-x) - Ys_i(1-x)\right]_t}{(1+r)^t} = \sum_{t=1}^{S} \frac{\left[Ys_i(1-x) + P_i\right]_t}{(1+r)^t} \qquad (2.3)$$

where *Yh* and *Ys* represent the before-tax incomes with the higher and the lower levels of education respectively, x is the income tax rate, P_i represents the personal expenditures on education per year, $t=1$ is the first period of study for the qualification, r is the discount rate, and S is the number of years required for the qualification.

The major advantage of this method is that it incorporates educational costs, and in particular forgone earnings, into the analysis. Given this, estimates of the rate of return to education calculated using this method are expected to be lower, but still similar, than those calculated using earnings function analysis.

[4] Equation 2.3 calculates the private rates of return to education.

2.3 The Returns to Education Literature

The relationship between earnings and education levels has received broad coverage in the literature. The majority of the early studies chose earnings function analysis as the framework for investigation of the returns to education. A sample of studies includes: Miller (1982), McNabb and Richardson (1989) for Australia; Rumberger (1987) and Raymond and Sesnowitz (1983) for U.S.; and Vaillancourt (1986) for Canada. Psacharopoulos (1985, 1994) and Psacharopoulos and Patrinos (2002) give excellent summaries of the most prominent international studies.

The returns to education literature has put forward a number of conclusions consistent across the majority of studies. A sample of these include: primary or elementary education exhibits the highest social profitability in all world regions; higher private returns than social returns; diminishing returns to education at all levels; higher returns for females than for males; lower returns to vocational education; higher returns to education in developing countries; and an overall average private world return of ten percent to an additional year of schooling.

2.3.1 The New Zealand Returns to Education Literature

The New Zealand literature, for so long dormant, has recently received renewed interest. The first study by Ogilvy (1970) performed cost benefit analysis using the elaborate method. Ogilvy analysed the private and social rates of return for educational qualifications at the secondary and tertiary levels using data from 1966. The returns for secondary school qualifications[5] ranged from a high of 36.9 percent to a low of 14.7 percent. For the tertiary level qualifications[6], the returns ranged from 6.2 percent to 17.2 percent, significantly lower than the secondary qualification returns. Ogilvy concluded that the private returns generally were higher than the

[5] Secondary school qualifications were broken down into unqualified secondary school leavers (with two years of secondary schooling), School Certificate and University Entrance.
[6] Tertiary level qualifications analysed were teaching certificates, Bachelor's degrees, Master's degrees and Doctorate degrees.

public returns. However, it was noticeable that Ogilvy was unable to conclude that the returns to females were higher than males.

Hunt and Hicks (1985) employed a similar methodology using 1981 Census of Population and Dwellings data. Their study focussed on higher education qualifications[7] only. Their results contrasted Ogilvy's in two main ways. Firstly, the calculated returns for females were markedly higher than for males. Moreover, the differential they found was large by international standards. Secondly, the overall returns were generally much lower. The two studies agreed on the point that private returns on average were higher than the social returns.

2.3.2 The Research by Sholeh Maani

In recent years the contributions of Maani (1994, 1996b, 1997, 1999 and 2000) have dominated the New Zealand literature. This has coincided with an upsurge in interest in the field. Her major piece of work in 1997 used both the elaborate and regression analysis methodologies. She used these techniques to explore the effect of major policy changes on the rates of return to the investment in higher education. The policy changes analysed included the introduction of the student loan programme, the tightening of student allowance eligibility criteria, and the introduction of higher tuition fees.[8] The higher education policy overhaul occurred concurrently with significant increases in participation in higher education and Maani also discusses the combined effects.

She analysed census data from 1981 to 1991 and over this period the returns to higher education increased despite the large increases in participation. The analysis of the effect of tuition fees showed that the private internal rates of returns for all levels of tertiary qualifications have decreased relative to the no fees scenario which existed in the 1980s. However, rates of return based on 1995 data were calculated to be still

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[7] The qualifications analysed were undergraduate diplomas, Bachelor's degrees, post graduate diplomas, Masters Degrees and Ph.D's.

[8] The weighted average tertiary education fee was effectively $125 before 1990 and increased to over $1,200 from 1990. For a further breakdown of tuition fee levels see Chapter 3.

above 8.4 percent for a Bachelor's degree and 6.4% for a postgraduate degree. Other general analysis explored in the study showed results consistent to that of the international literature.

Maani updated her analysis in 1999 with data from the 1996 census and reaffirmed her original results. The only result that showed a new trend was a decline in returns for females at the Bachelor's degree level. Later in 2000, Maani explored the educational attainment and income levels for Maori and non-Maori. Her results showed that the Maori population was at a disadvantage in terms of educational attainment, employment and income levels. This was highlighted by the higher returns for educational attainment for Maori compared to non-Maori and reflected the relatively lower income levels for Maori without qualifications.

The most recent study by Maani and Maloney (2004) found slightly lower returns to education than in Maani's previous studies. The core reason for this lay in the use by Maani and Maloney of earnings data in the analysis rather than income data as in Maani's prior work. The 2004 study capitalised on the recently made available income supplement of the Household Labour Force Survey. The income supplement includes data on earnings, hourly wage and hours of work. Maani and Maloney made use of these extra variables by performing regression analysis with not only earnings as the independent variable but also hourly wage as well. By using hourly wage as the independent variable, their study controlled for the number of hours work per week which varies substantially particularly for females. Also, earnings data excludes unearned income such as benefits and interest. For these reasons, the results found in Maani and Maloney's study show that the results from analysis using income data may underestimate the level of returns. However, "the estimates based on the Census (income data) and the Income Supplement (earnings data) with the same modelling approach are generally within a narrow band" (p.3).

2.4 The Returns to Education Literature Critiques

2.4.1 The Screening Hypothesis

The major critique of the human capital approach in the literature came when a number of studies argued that education or qualifications acted as a signalling device to employers of the abilities of job candidates. This became otherwise known as the screening hypothesis (also sometimes referred to as the credentialism hypothesis). The major proponents of this theory included Berg (1970), Arrow (1973), Spence (1973), Taubman and Wales (1973) and Stiglitz (1975).

The human capital approach states that individuals invest in their human capital through education and in doing so raise their productivity. Hence, their higher productivity or marginal product of their labour commands a higher price. This of course is in the form of higher earnings. In contrast, the screening hypothesis approach conjectures that an individual invests in education to signal to employers their higher level of ability or the possession of attributes that are desirable in the labour market place. Individuals achieve this by presenting their qualifications or other educational attainments to employers during the job search process. By comparing the level and quality of qualifications the employer learns of the relative abilities of job candidates. With this information the employer then makes their hiring decision.

The response to the screening hypothesis was swift. Layard and Psacharopoulos (1974) countered that the persistence of the relationship between education and income of the life-cycle of earnings contradicts the screening hypothesis. Furthermore, if the signalling argument were valid, there would surely be a call for the development of a far less expensive means by which ability and other personality traits could be discovered. Becker (1965) sums up the counter-argument against the screening hypothesis succinctly:

> Several major empirical issues must be resolved if screening is to be the primary explanation of earnings differentials. For example,

> college would be a horrendously expensive "employment agency"....My own opinion is that schooling-as-screening must occur in a world with imperfect information, but is a relatively minor influence in determining earnings differentials by education.

2.4.2 The Impact of Ability

Disagreement in the literature has also focussed on the impact of ability on the returns to education. Blackburn and Neumark (1995) for example, conjectured that traditional returns to education estimates that ignore ability may result in a 40 percent upward bias. Studies that have attempted to correct for this have used techniques such as instrumental variable measures (see for example Card, 2001) or have performed analysis on a sample of twins (see for example Ashenfelter and Krueger, 1994; and Miller, Mulvey and Martin, 1995). By using twins, these studies have been able to control for ability as well as family background, which has also been argued to impact on the returns to education. Psacharopoulos and Patrinos (2002) conclude that while these methodologies remain preferable, the estimates, using either methodology, come to the same average rate of return (10 percent) as the rest of the literature.

2.5 The Externalities of Higher Education

So far the analysis has focussed on the benefits to the individual of a higher education. However, better educated individuals may collectively benefit society. The potential social benefits of a better-educated society can readily be identified. The problem, however, from a research point of view is by how much does society gain. And more practically, how does one measure society's gain through education. Friedman (1962) illustrates the point:

> The gain from the education of a child accrues not only to the child or to his parents but also to other members of the society. The education of my child contributes to your welfare by promoting a

> stable and democratic society. It is not feasible to identify the particular individuals (or families) benefited and so to charge for the services rendered. There is therefore a significant "neighbourhood effect."[9]

The extract above highlights the conflicting issues surrounding the externalities or "neighbourhood effect" of education. The logic behind the externalities of education is intuitive and as such economists and non-economists alike immediately embrace it. In conflict with this is the information contained in the sentence prior: "It is not feasible to identify the particular individuals (or families) benefited and so to charge for the services rendered." So here is where the battle begins for economists who endeavour try to prove the intuitive concept of positive externalities of education without the empirical tools to do so. Nevertheless, academics showed high levels of interest in this topic and the literature grew rapidly alongside the returns to education literature.

2.5.1 Education and Crime

The link between the level of education and lower levels of crime has been explored in several studies. Intuitively, this relationship is easy to accept. As one invests in one's own human capital, the returns to honest employment outweigh what could be gained through crime and the associated risk of imprisonment, if caught. Spiegelman (1968) demonstrated in his study a statistical relationship did exist. Phillips, Votey and Mazwell (1972) showed that rising crime rates were explained by labour market status and its relationship with educational background. And, Webb (1997) found lower educational attainment among prison inmates. What these studies fail to consider is that while blue collar crime may show a reduction as the level of education increases, the level of white collar may in fact increase. And, the cost to society in monetary terms may be higher for white collar than for petty crimes.

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[9] Taken from: Friedman, M. (1962) *Capitalism and Freedom.* Chicago: The University of Chicago Press, p.86.

2.5.2 Education and Democratic Values

Other studies have explored the spillover effects of increased levels of education on democratic freedom and in transmitting cultural values (McMahon, 1987). Also, Brennan (1988) explored the role education had in promoting more intelligent voting behaviour. These social goals while worthy of attention, it is debatable whether they are commonly held by all groups in society. West (1965) is particularly critical of what he terms, "the quest for common values."[10] He explains that state intervention in education to promote common values is counterproductive to democracy and any stated goal of transmitting cultural values forces the views of the majority on to all other groups. Furthermore, empirically testing these theories would be at best difficult if not impossible.

2.5.3 Education, Health, Poverty and Social Welfare

A less contentious point is that of the relationship between the level of education and reliance of the social welfare payments for income. The OECD Economic Surveys 1992-1993 showed a negative relationship between educational qualifications and unemployment. In addition, Chia (1990) and Maani (1993) found evidence that those with higher education were less likely to depend on social welfare payments. Other studies in this vein found a strong negative relationship between educational attainment of the father or mother of a household and poverty status and lower welfare and health costs as a result (Garfinkel and Haveman, 1977). Finally, other studies produced evidence that education is a factor in better health and thus lower health costs (Lefocowitz, 1973; Lando, 1975; Orcutt, Franklin, Mendelsohn and Smith, 1977; and Grossman, 1982).

2.5.4 Education and Fertility

Of particular importance for developing countries is the link between fertility and education. Cochrane (1979) found that a negative correlation between education and fertility is more often observed for the education of females than males. Also, Doyle and Weale (1994) demonstrated that there is

[10] Taken from Chapter 6: West, E. G. (1965) *Education and the State: A Study in Political Economy (3rd ed.)* Indianapolis: Liberty Fund.

ample evidence for a link between education and fertility in developing countries. The problem with this assertion is that ultimately in the developed world the link between is so strong that it has reduced the fertility rate to levels below the population replacement rate. Therefore, care must be taken when stating that education affects fertility rates in a beneficial way. That is to say one must qualify this statement by adding for low-income or developing countries only.

2.6 Productivity, Economic Growth and the Investment in Education

While the screening hypothesis is the major the critique of the human capital approach, the major argument in support is the connection between investment in education (human capital) and increased economic growth. Two streams of literature have formed in this context. One formed as an offshoot of the returns to education literature and the other as a result of growth theory and its sibling endogenous growth theory.

2.6.1 Growth Theory and Endogenous Growth Theory

Solow (1956 and 1957) and Swan (1956) pioneered growth theory where the accumulation of capital lead to economic growth. In the theories that they developed labour and particularly human capital were of secondary importance to capital. However, the framework that the theories of Solow and Swan provided led to the development of growth models incorporating human capital and later models that incorporated it endogenously.

Between the original growth model and endogenous models came an intermediate group of models. The best example of this is Mankiw's (1984) augmented Solow model. As the name suggests, Mankiw augmented the Solow growth model by including an extra variable into the model, human capital. This allowed estimates of the contribution of human capital, capital and 'raw' labour to be separated using the established growth accounting techniques. The inclusion of human capital in the model, of which education

makes a substantial contribution, went a long way to explaining the gap between the increase in economic growth and the increase in capital and labour.

The augmented Solow model provided a stepping stone to the next generation of models, endogenous growth models. The major contributors initially were Romer (1986) and Lucas (1988). The endogenous growth models differed to the simpler growth models in that knowledge as a capital or investment good was specifically included. This meant that an increase in the production of knowledge (of which education is a part) not only contributed to the production of more goods and services but also of the production of new knowledge itself. In this way knowledge became endogenous to the model and meant that an increase in saving, for example, lead to persistent economic growth rather than temporary growth as in the Solow model. Furthermore, this challenged the assumption of diminishing returns to capital, and if knowledge is thought of as a capital good, advocates of endogenous growth theory argued that in fact returns to capital could be constant. Other significant empirical studies on this topic include: Mankiw, Romer and Weil (1992); Barro (1991); Barro and Lee (1993 and 1996); Hanushek and Kim (1995); Barro and Sal-i-Martin (1995); Klenow and Rodriguez-Clare (1997); Topel (1999) Hall and Jones (1999); and Krueger and Lindahl (1999 and 2001).

2.6.2 Productivity and the Investment in Education

A number of studies have explored the link between levels of education and higher productivity in much the same way as other authors explored the link between crime rates and levels of education. Chapman and Chia (1989) explored this link and found that higher levels of education resulted in a greater ability to take initiative, develop and adapt to technological change in the workplace. Solomon (1987) showed a link between higher education and important scientific discoveries such as those in the medical field. Denison using US data from 1948 to 1981 (1984) found that tertiary education adds roughly one-third of a percentage point to the growth rate per year. Others to have obtained comparable results include, Schultz

(1963, 1981), Psacharopoulos (1973), Kendrick (1983), and McMahon (1984).

2.7 Quantile Regression Analysis

Until recently, the returns to education literature has focussed on the mean return as calculated using the traditional ordinary least squares model. Researchers have endeavoured to improve the model and compensate for its various shortcomings. However, the focus has largely remained on the mean return which gives no indication of the returns at different levels above or below the mean. Therefore, the distribution of returns around the mean, including shape and scale, remains relatively hidden using the ordinary least squares model.

2.7.1 Quantile Regression

In 1978, Koenker and Bassett developed the quantile regression model. The purpose of the model was to build on the classical ordinary least squares model by incorporating a distributional measure into the estimation. They state: "taken together the ensemble of estimated conditional functions offers a much more complete view of the effect of covariates on the location, scale and shape of the distribution of the response variable" (p.1). Hence, the development of the quantile regression model has provided a powerful new vehicle for analysis beyond the mean.

2.7.2 Quantile Regression Framework

Using the framework taken from Martins and Pereira (2004), the quantile regression model, in a returns to education setting, can be written as:

$$\ln Y_i = x_i\beta_\theta + u_{\theta i} \text{ with } Quant_\theta\left(\ln Y_i | x_i\right) = x_i\beta_\theta \qquad (2.4)$$

where x_i is the vector of exogenous variables and β_θ is the vector of parameters. $Quant_\theta(\ln Y_i|x_i)$ denotes the θth conditional quantile of ln*Y* given *x*. The θth regression quantile, $0<\theta<1$, defined as a solution to the problem:

$$\min_{\beta \in R^k} \sum_i \rho_\theta(\ln Y_i - x_i\beta_\theta) \qquad (2.5)$$

where $\rho_\theta(\varepsilon)$ is the check function defined as $\rho_\theta(\varepsilon)=\theta_{\varepsilon_-}$ if $\varepsilon \geq 0$ or $\rho_\theta(\varepsilon)=(\theta-1)\varepsilon$ if $\varepsilon<0$. This problem does not have an explicit form, but can be solved by linear programming. Standard errors are obtainable by bootstrap methods.

The least absolute deviation (LAD) estimator of β is a particular case within this framework. This is obtained by setting θ=0.5 (the median regression). The 10th quantile is obtained by setting θ=0.1, the 25th quantile by setting θ=0.25, and so on. By increasing θ from zero to one, the solution traces the entire distribution of *y*, conditional on *x*.

2.7.3 Quantile Regression and the Returns to Education

Economics literature has embraced the quantile regression estimation method. In particular, a considerable amount of work has been in the labour economics field: on union wage effects (Chamberlain, 1994), labour market discrimination (Machado & Mata, 2001), and of interest to this study, returns to education.

Buchinsky (2001) estimated the returns to education for women in the US for 1968, 1973, 1979, 1986 and 1990. Using a regression quantile model he found that the returns at the lower quantiles were higher in the early years, but then higher at the higher quantiles in the later years. Martins and Pereira (2004) found that returns to education are higher for the more skilled individuals. They further suggested that education has a positive impact upon within-levels wage inequality. In addition, Arias, Hallock and

Sosa-Escudero (2001), using data on identical twins, found heterogeneity in the estimated return to education over quantiles and surmised that this was due to an interaction between observed educational attainment and unobserved ability.

The quantile regression literature continues to expand both within labour economics and other fields of economics. Likewise, the returns to education literature has found many applications for this model. This study makes use of the quantile regression in conjunction with the elaborate method, explained in section 2.2.2. In chapter seven, the combine elaborate method and quantile regression model is outlined in more detail. At the time of publishing, to the extent of the author's knowledge, this study is the first to utilise a model of this kind.

3 The New Zealand Tertiary Education Sector – An Overview

3.1 Background

In the early 1980s, students received a tertiary education predominantly free of charge; all tertiary students were eligible for student allowances; a student loan programme existed only in the hypothetical discussions of academics; state-run providers held a near monopoly on tertiary education; male students outnumbered females; and, New Zealand European faces dominated the lecture theatres. Come 1984, the newly elected Labour government began an era of fundamental change to the social, political and economic fabric of New Zealand. The tertiary education sector rode this wave of change.

Fast forward to 2005 and the picture of tertiary education in New Zealand is vastly different; the majority of tertiary institutions charge tuition fees; student allowances are income tested based on parental income; approximately 50 percent of students have a student loan; there are over 800 registered Private Training Establishments; female university students outnumber males; and over 100,000 Maori attend tertiary education institutions.

Changes of this magnitude have undoubtedly impacted on the returns to education. Therefore, this chapter aims to outline the shifts in the education sector which are relevant to the calculation of the returns to education. Also, the chapter gives a brief general outline of the New Zealand education system.

3.2 The New Zealand Education System

3.2.1 Primary School and Intermediate

Primary Schooling in New Zealand is compulsory from six years of age. However, children may enrol from the age of five. Primary education starts at Year 1 and continues until Year 8. Depending on the type and location of the school, Years 7 and 8 are offered at a primary school or a separate intermediate school.

3.2.2 Secondary School

Secondary schooling covers Years 9 through 13. Attendance at secondary school is compulsory up until 16 years of age (Year 11). Secondary school qualifications are offered for Years 11, 12 and 13. In the years of interest to this study[1], 1996 and 2001, the qualifications offered for during that time were: School Certificate for Year 11, Sixth Form Certificate for Year 12 and Bursary for Year 13. School Certificate and Sixth Form Certificate and Bursary are nationally administered examinations in up to six subjects.

The traditional pathways from secondary school into paid employment, training or higher education varies according to the level of secondary schooling. For school leavers with School Certificate the options include entering the workforce, attending vocational polytechnic courses or starting apprenticeship training. For school leavers with Sixth Form Certificate, the options extend to include intermediate and advanced polytechnic courses. Bursary holders have the added option of entering university. However, when an individual turns 20 years of age, he or she becomes eligible for the full range of tertiary courses.

3.2.3 Tertiary Institutions

Tertiary institutions in New Zealand include: universities, polytechnics, institutes of technology, colleges of education, Wananga[2], industry training

[1] From 2002 to 2004, the National Certificate of Educational Achievement (NCEA) was progressively implemented replacing School Certificate, Sixth Form Certificate and Bursary.
[2] Maori Tertiary education institutions.

organisations, and private training establishments (PTEs). Bachelor and Postgraduate degrees are mainly offered by universities. However, some polytechnics, institutes of technology, Wananga and colleges of education offer degree programmes. Technical and vocational education is primarily offered at institutes of technology, polytechnics, Wananga and PTEs. For the purpose of this study, the qualification level is the variable of interest in the analysis. Therefore, the type of institution is not modelled directly. However, the trends in participation at various types of tertiary institutions are discussed in this chapter.

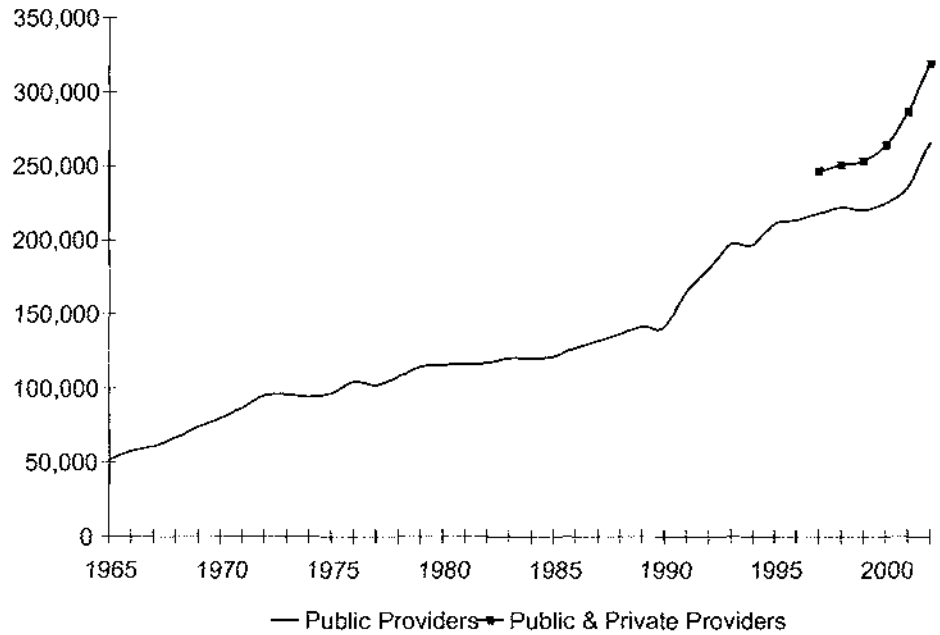
3.3 Trends in Tertiary Education Enrolments[3]

3.3.1 Overall Enrolments

Figure 4.1 below shows the number of tertiary education enrolments from 1965 to 2002. The first major movement in tertiary enrolments came during 1990 to 1993 where numbers jumped by more than 50,000 over the three-year span. The jump in numbers occurred during the period of economic reform and, importantly for tertiary education, labour market reform. As a result, the labour market began to place a premium on skilled workers. In response, more students entered into tertiary education courses to increase their marketability in the new labour market. A second major movement has occurred with the creation of Wananga. The surge in growth of enrolments from 2001 to 2002 can be mainly explained by an increase in the number Maori attending Wananga during this time. Enrolments jumped at Wananga jumped from 16,000 in 2001 to 42,000 in 2002. Also from 1997, data became available on enrolments at PTEs. By comparing the two trend lines we can see that the number of enrolments at PTEs makes up a small but significant amount of the overall total.

[3] Trends in secondary enrolments are not discussed in detail as the focus is more on the discretionary enrolments in tertiary education.

Figure 3.1: Formal Enrolments in Tertiary Education



(Ministry of Education, 2003)

3.3.2 Enrolments by Type of Tertiary Institution

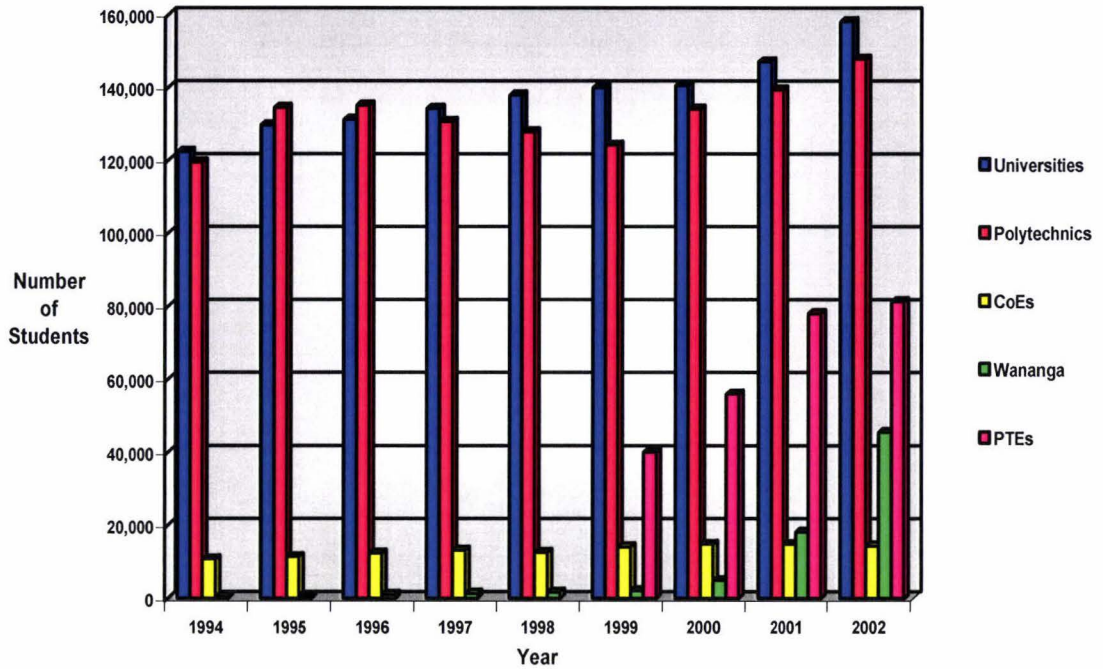
Tertiary student enrolments, shown in Figure 3.2, have increased for all types of tertiary institutions from 1994 to 2002. PTEs[4] and Wananga reported the largest increases. Furthermore, the increase in tertiary enrolments overall has been steady since the initial surge in numbers in the late 1980s. This can be interpreted as a large supply response to changing labour market as whole which has placed a greater emphasis on skilled labour since the economic reforms carried out over the 1980s and 1990s. University is still the most popular place for tertiary education study.

3.3.3 The Breakdown of Enrolments by Gender

Figure 3.3 shows that the number of enrolments in tertiary education for females exceeds males for all the years from 1994 through 2002. Also, the average rate of growth of female enrolments from 1994 to 2002 was 8.5 percent. This compared to 5.6 percent for male enrolments.

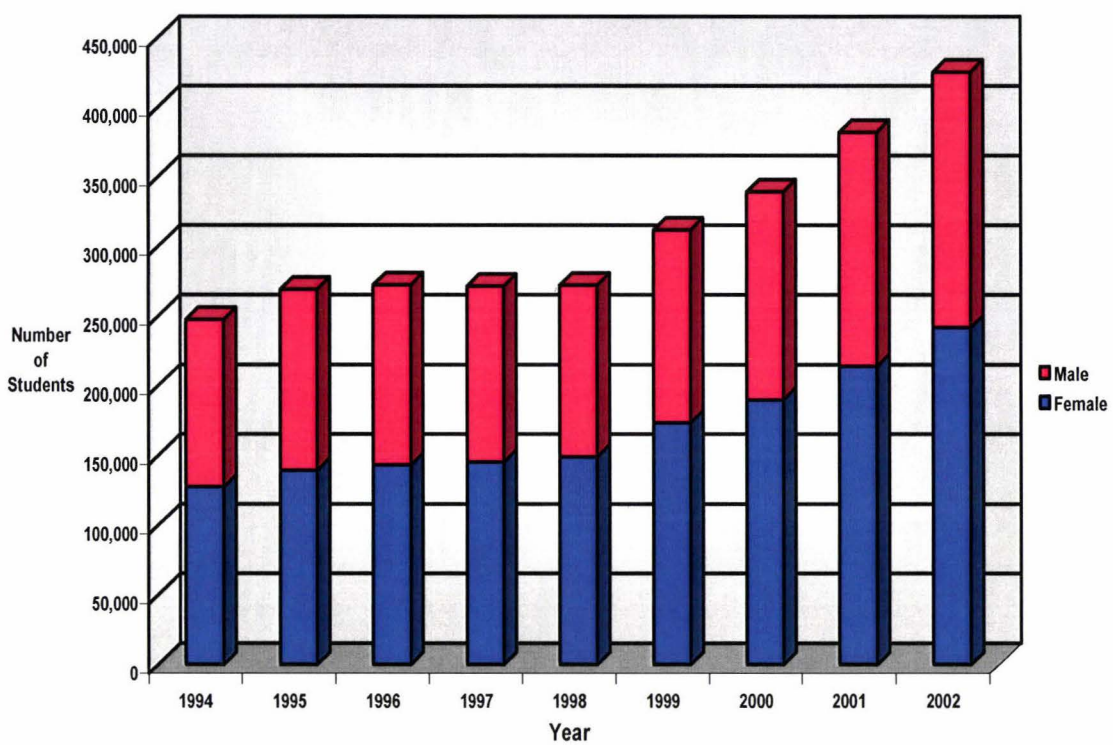
[4] Data for PTEs prior to 1999 was not collected by the Ministry of Education.

Figure 3.2
Tertiary Education Participation by Type of Institution



(Ministry of Education, 2003)

Figure 3.3: Tertiary Education Enrolments by Gender

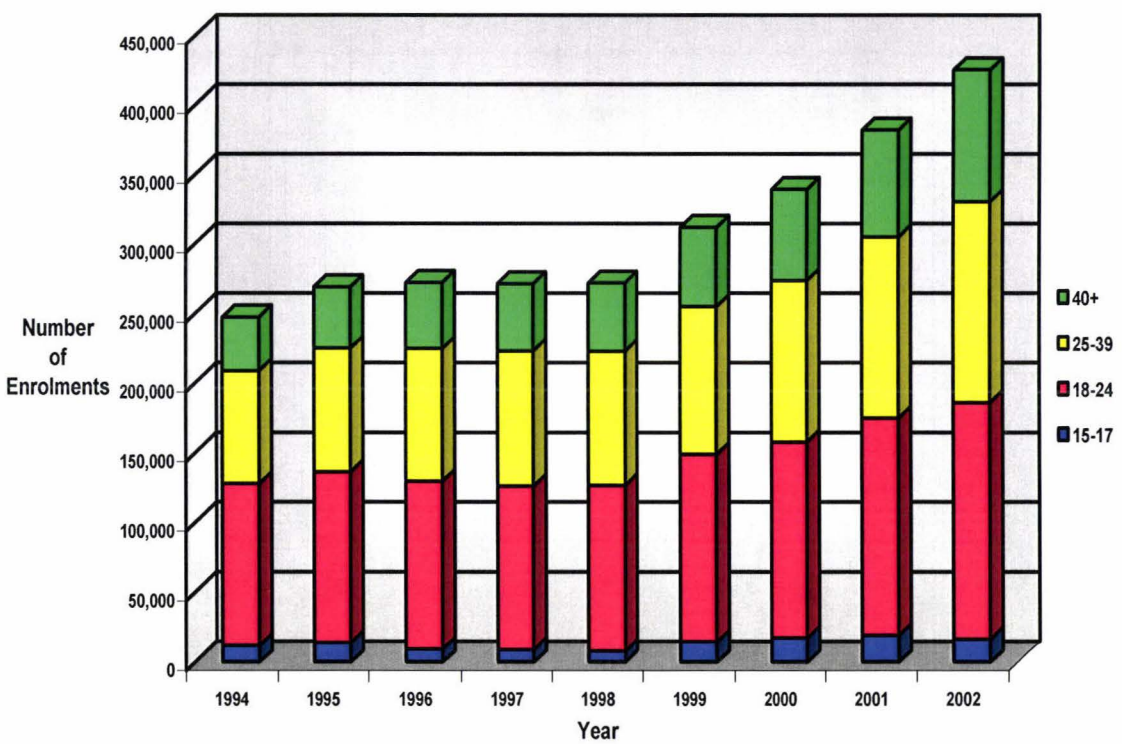


(Ministry of Education, 2003)

3.3.4 The Age Structure of Enrolments

The number of enrolments for each of the age-groups, 15-17, 18-24, 25-39 and 40+ increased from 1994 to 2002 (see Figure 3.4). The growth rates for the 26-39 and 40+ age-groups, 7.6 and 12.1 percent respectively, exceeded the growth rate of the 18-24 age-group of 5 percent. Between the ages of 18 and 24 is the traditional time for tertiary education study, so the increase in numbers and higher growth rates of the two older age-groups indicates a move towards greater adult-learning.

Figure 3.4: Participation by Age-Group



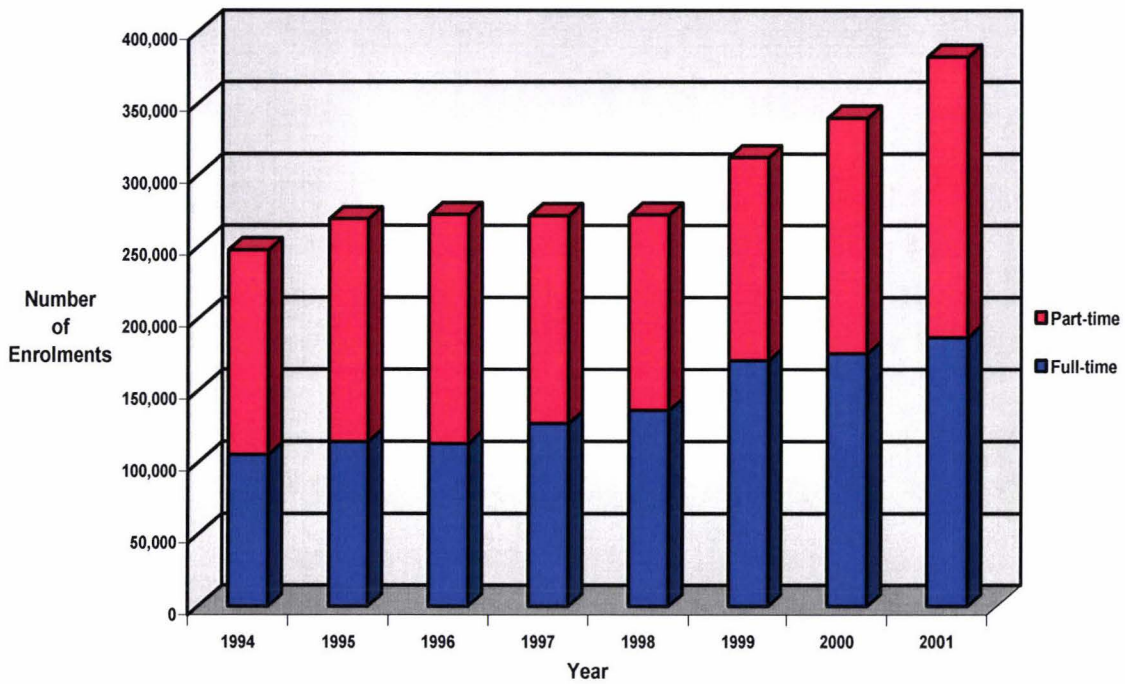
(Ministry of Education, 2003)

3.3.5 Full-Time and Part-Time Enrolments

From Figure 3.5, it is apparent that part-time student enrolments make up a large proportion of the total enrolments. For the period from 1994 to 2001, part-time student enrolments average over 52 percent of the total number of enrolments. Examination of both Figures 3.4 and 3.5 provides a reason for the high proportion of part-time students. Figure 3.4 shows the

largest proportion of tertiary education participants are aged 25+. Many students of this age work full-time, therefore they accompany this with part-time study.

Figure 3.5: Participation by Full-time/ Part-time Status

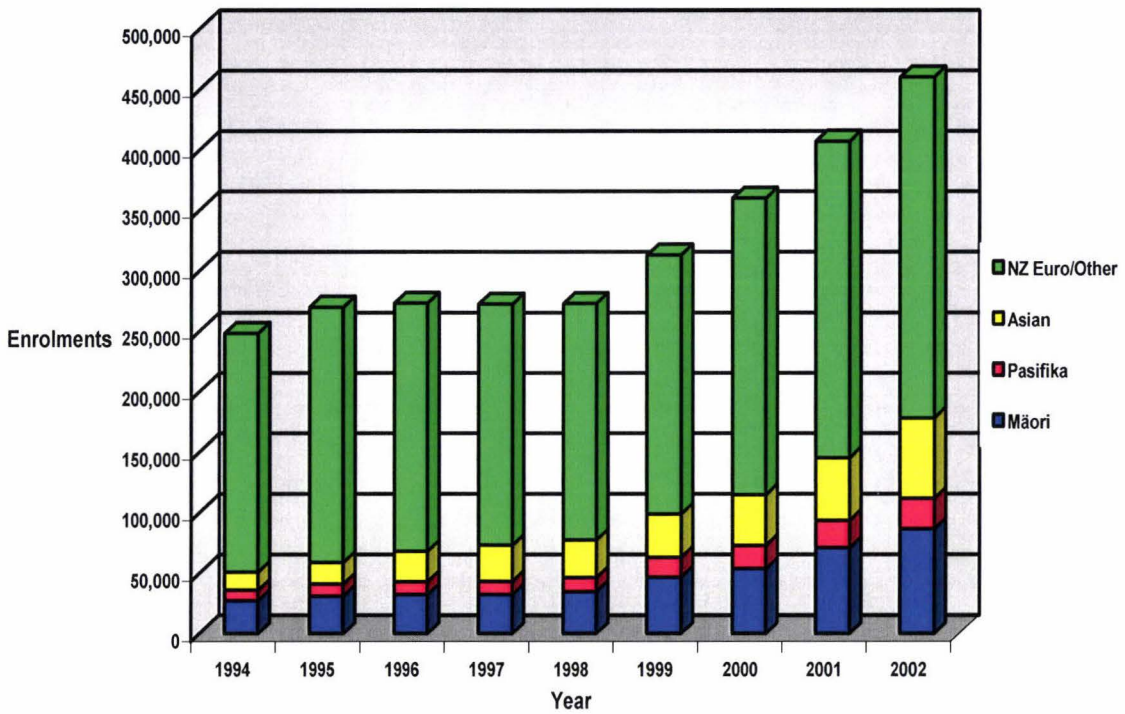


(Ministry of Education, 2003)

3.3.6 Enrolments by Ethnicity

Figure 3.6 shows that the number of enrolments of all ethnicities has increased from 1994 to 2002. The fastest growth rate has been for Asian student enrolments which grew at an average rate of 20.9 percent over the period. Maori enrolments grew almost as quickly at 16 percent. Pasifika enrolments grew at 14.9 percent while NZ European and Other Ethnicities grew at 4.8 percent. Therefore, while still dominated by the NZ European group enrolments in tertiary education have become more ethnically diverse.

Figure 3.6: Participation by Ethnic Group 1994-2002



(Ministry of Education, 2003)

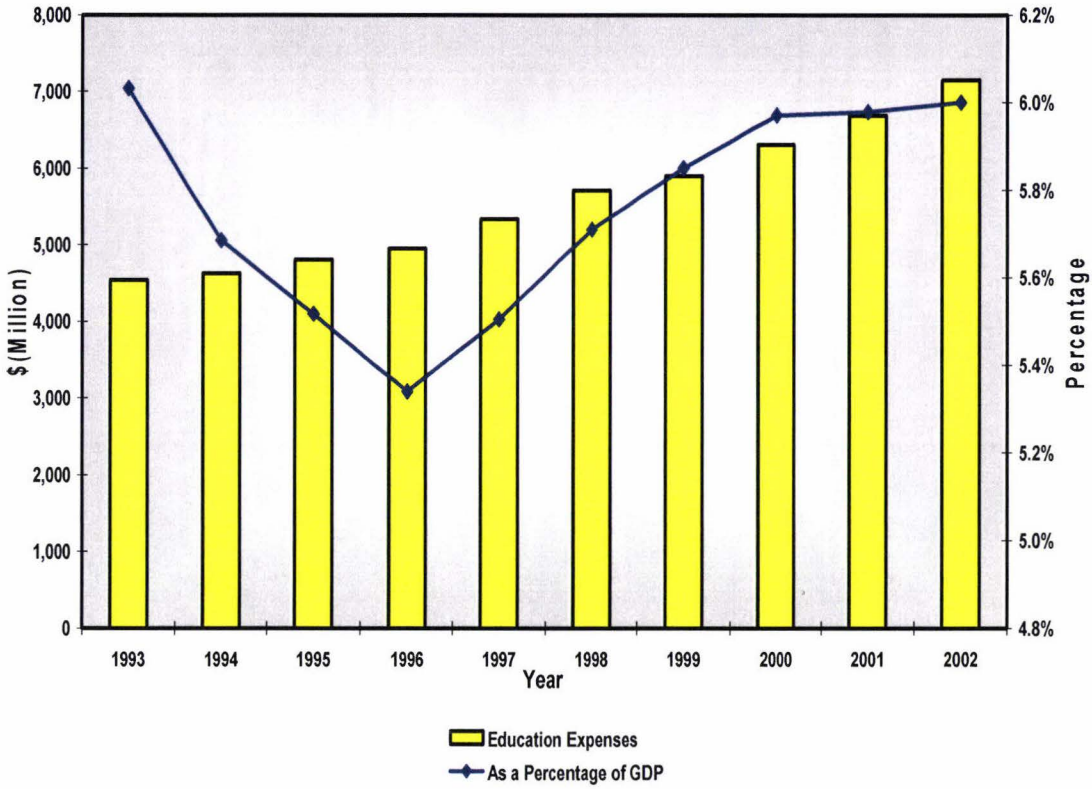
3.4 Tertiary Education Funding

3.4.1 Government Education Expenditure

The overall government expenditure on education, shown in Figure 3.7[5], has been rising steadily from 1993 to 2002. However, as a percentage of Gross Domestic Product (GDP) it fell from six percent in 1993 to 5.4 percent in 1996, and then recovered back to six percent by 2002. New Zealand compares favourably with other OECD countries; the OECD mean expenditure on education in 1998 as a percentage of GDP was 4.5 percent (in 1998 government expenditure in New Zealand as a percentage of GDP was 5.7 percent).

[5] This includes expenditure on both primary, secondary and tertiary education.

Figure 3.7: Government Expenditure on Education



(Statistics New Zealand, 2003)

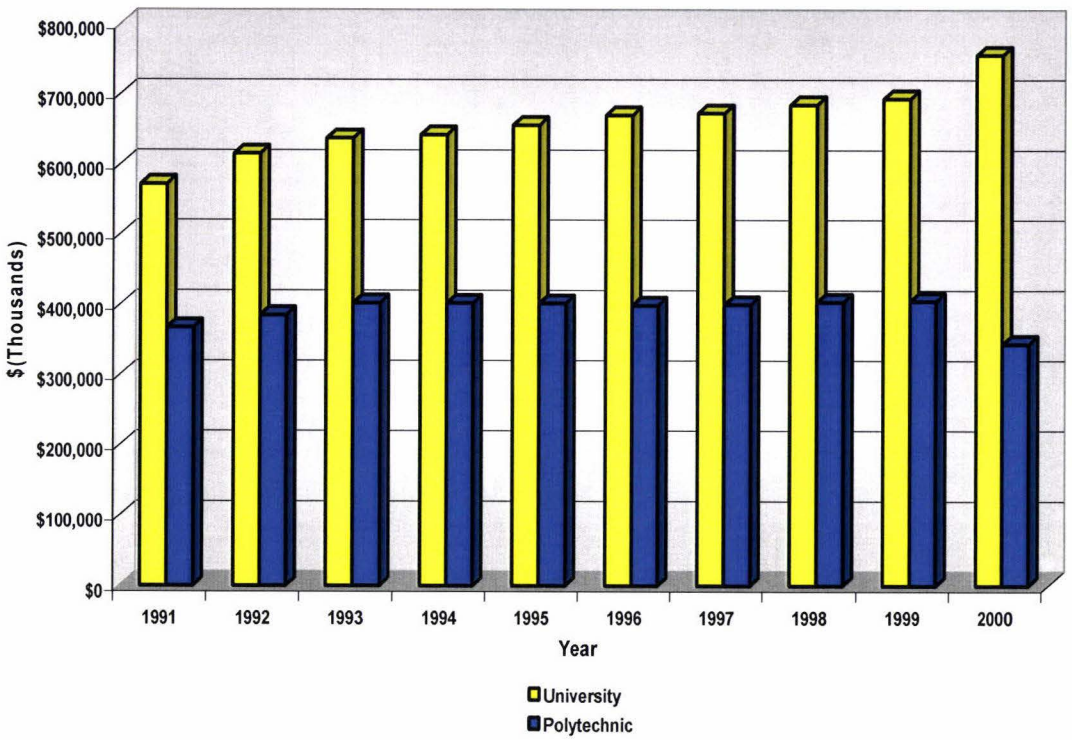
3.4.2 Tertiary Education Tuition Subsidies

Figure 3.8 below shows that government expenditure on university subsidies rose slowly from 1991 to 2000 while expenditure on polytechnic subsidies remained relatively flat. When compared with the large increase in enrolments over the same period, shown in Figure 3.2 above, it must mean that either subsidy per student fell or the actual tuition fell. From Figure 3.9 below shows that in fact the government contribution[6] to university tuition as a percentage of the average university tuition fell. At the same time, the private contribution[7] increased to make up the balance. In 1991, the private contribution was 12.6 percent of the total tuition. By 1999, it reached over 30 percent. The relative private and government contributions to polytechnic tuition display tell a similar story over the same period.

---

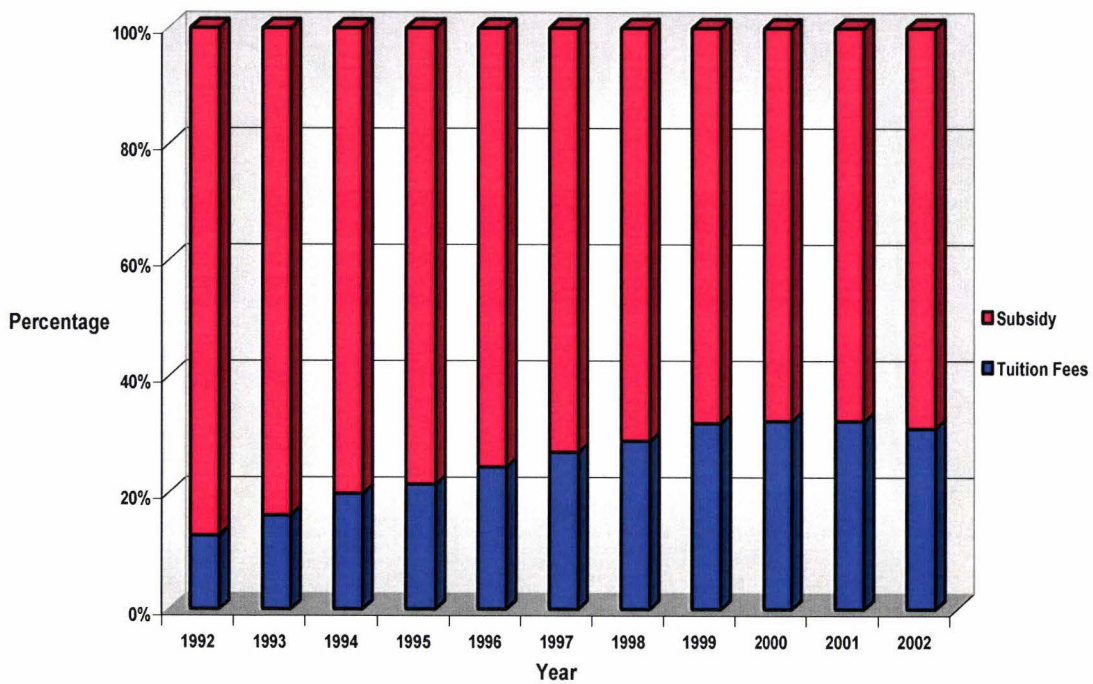
[6] The government contribution is the tuition subsidy per subsidised EFTS place.
[7] The private contribution is the estimated average tuition fee per full-time student.

Figure 3.8: Government Expenditure on University and Polytechnic Tuition Subsidies



(Ministry of Education, 2001)

Figure 3.9: Government and Private Contributions as a Percentage of the Average Universtiy Tuition

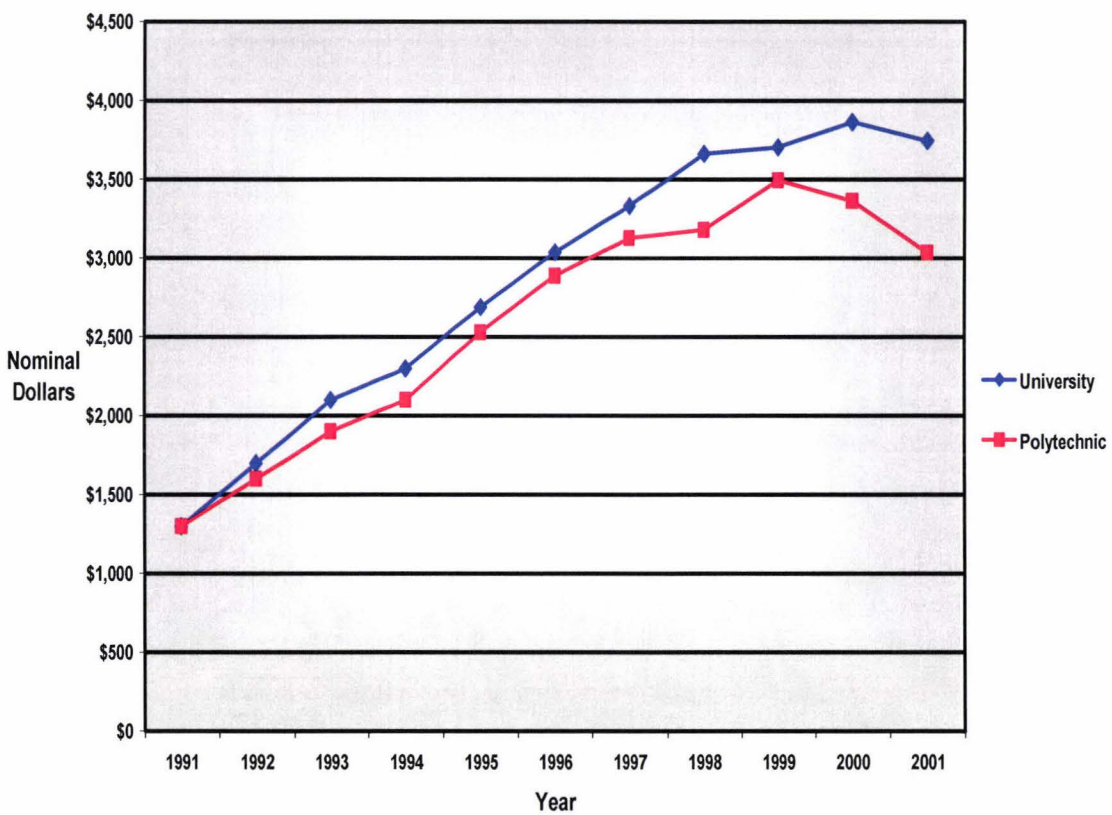


(Ministry of Education, 2003)

3.4.3 Tertiary Education Tuition Fees

In line with the lower government contribution and hence higher private contribution to university and polytechnic, the average tuition fee increased steadily from 1991 to 1997. From 1998, the increase slowed and growth in the average tuition fee per student at both university and polytechnic stabilised. This coincides with an average private contribution from 1998 to 2001 of around 32 percent.

Figure 3.10: Estimated Average Tuition Fee per EFTS



(Ministry of Education, 2003)

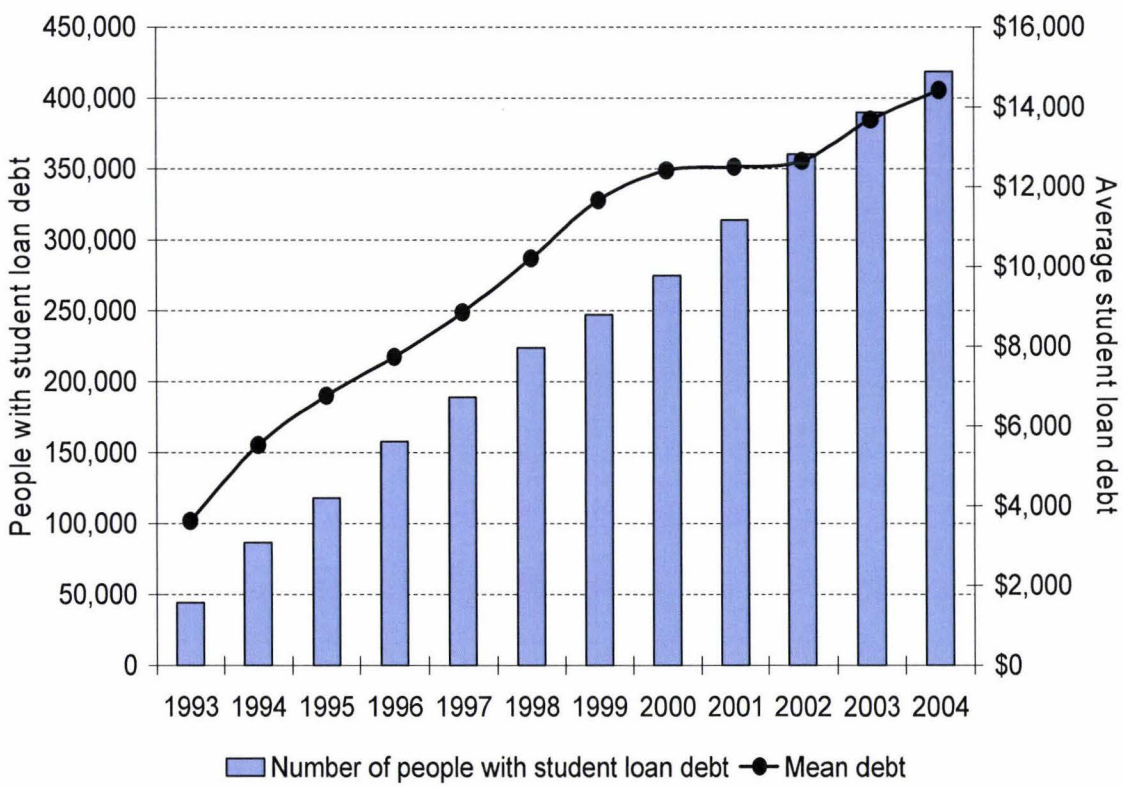
3.4.4 Student Loans

With the government increasing the emphasis on private contributions to the cost of higher education, it introduced the student loan programme in 1992 to help students finance their contribution. Eligible students could use a student loan to pay their tuition fees, cover course related costs and help towards living costs while studying. The scheme now is administered by StudyLink and at the end of each academic year the loan balance is

transferred to the Inland Revenue Department (IRD). Student Loan borrowers then pay the student loan back through the tax system. The minimum amount is 10 percent of all income over the student loan income repayment threshold[8].

Since the establishment of the student loan programme, tertiary students have utilised this facility greatly. The number of students accessing student loans has increased steadily from 1993 to 2004 as shown in Figure 3.11 below. At the same time, the average debt has increased in line with the increase in the private contribution to university and polytechnic tuition over the same period.

Figure 3.11: Number of People with Student Loan Debt and Average Debt 1993-2004



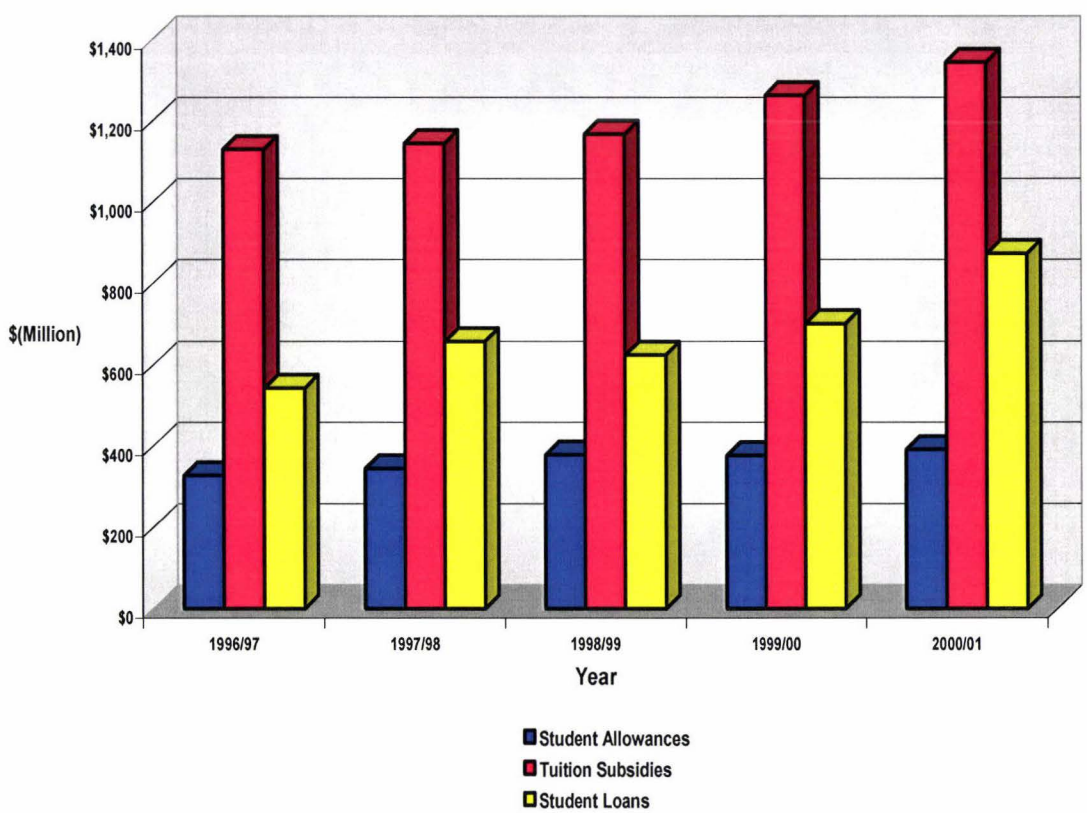
(Ministry of Education, 2003)

[8] For example the student loan repayment threshold for the 2004/2004 tax year is $16,588.

3.4.5 Student Allowances

The Student Allowances Scheme has provided a subsidy towards the living costs of students who meet certain income and age criteria. The scheme is targeted towards students from low-income families whose situation might otherwise make tertiary education unaffordable (Ministry of Education, 2005). Between 1996 and 2001 (the periods of analysis in this study), the eligibility criteria remained unchanged. Of more interest to this study, however, is the part-time income threshold for student allowances. As it currently stands, students may only earn up to $135.13 per week before they become ineligible for a student allowance. Figure 3.12 below shows government expenditure (capital contributions[9]) on student allowances, tuition subsidies and student loans.

Figure 3.12: Government Financial Support for Tertiary Study



(Ministry of Education, 2003)

[9] Student loans are considered capital contributions instead of expenditure as the intention is that the government will recover some or all of the amount spent.

3.5 Summary

The late 1980s and 1990s saw a remarkable transition in the New Zealand secondary and tertiary education sectors. The financing of tertiary education moved from being entirely tax-payer funded to a combination of private and state funding. The student loan programme was established. And, the most remarkable transformation came in the scale and make-up of participation in tertiary education: enrolments more than doubled over the period of reforms; the number of female students surpassed males; the student mix became more ethnically diverse; and more adult and part-time students enrolled. Such wide-ranging reform has undoubtedly altered the structure of the tertiary education sector and the labour market which in turn impact on the measurement and analysis of the returns to education.

4 Data and Characteristics of the Sample

4.1 The New Zealand Census of Population and Dwellings Sample

The data sets for the study consist of four twenty percent samples of the New Zealand Census of Population and Dwellings. There are two female samples, one for each of the years 1996 and 2001, and likewise for two male samples. The samples contain observations from the age of 16 up to 65[1]. The observations include variables relating to income, educational attainment, labour force status, ethnic background and a variety of other demographic information.

Of the potential New Zealand data sets, the census provides the most suitable option by: representing the overall New Zealand population; providing comparable time series data; including information on educational attainment data and having sufficient observations at each education level (Maani, 1999). Furthermore, the use of the New Zealand Census of Population and Dwellings data maintains the consistency of this study with the international literature and previous New Zealand studies, allowing for comparison. It also meets the specifications for an appropriate data set as explained by Psacharopoulos and Patrinos (2002). They state that, "ideally, a rate of return to investment in education should be based on a representative sample of the country's population." (p.2)

4.1.1 The 2001 Sample

The 2001 New Zealand Census of Population and Dwellings provides the most recent data. Therefore, by using the 2001 data, this study updates the New Zealand literature. In particular, it updates Maani's work from 1997, 1999 and 2000. The 2001 data reflects, to a greater extent than previous years, the rapid increase in tertiary education participation, and

[1] Data from individuals aged over 65 is omitted from the study even though some individuals continue to work beyond the age of 65. This is done to simplify the analysis.

the overhaul of higher education policies during the 1990s (explained in chapter 3). Accordingly, analysis of the returns to higher education using 2001 data may capture the effects of these changes. Therefore, comparisons of this study's results with the previous ones are highly valuable in the context of tertiary education sector policy choices. The 1996 sample is used for comparison purposes[2] and importantly for statistical testing of changes in the calculated estimates over time.

4.1.2 Sample Size

This study uses a 20 percent sample size. Using a larger sample size (previous studies have used a five or ten percent sample), enables this study to analyse the four sub-qualifications within the Diploma qualification. Moreover, it gives greater representation of minorities, especially at the higher education levels (Maani, 2000). In addition, the larger sample size increases the accuracy and efficiency of the estimated coefficients in the income function section, and the coefficients for the age-income profiles and for the regression quantile estimates in the elaborate method section.

4.2 Sample Age-Income Profiles

Of greatest interest to this study is the relationship between income and level of education. Figures 4.1 through 4.4 demonstrate the difference in mean incomes for each level of qualification at various age cohorts. In general, the age-income profiles show a quadratic-like relationship between age and mean income. Also, the age-income profiles exhibit a positive relationship between the level of education and mean income from the 26-30 age cohort onwards. Noticeably, the Diploma qualification provides the only exception to this general rule.

[2] Comparisons of the 2001 data with the 1996 data may be misleading due to business-cycle effects and other one-off events. However, viewing the 2001 data and results from Maani (2000) allows comparisons to be made over the longer time series.

4.2.1 Female Age-Income Profiles

In 1996, mean female incomes, shown in Figure 4.1, increase for all qualifications from the 16-20 cohort until the 25-29 cohort (See Figure 4.1). From there, the mean incomes plateau for No Qualification, School Certificate, Sixth Form Certificate, Bursary and Diploma while for Bachelors Degree and Postgraduate Degree they keep increasing until the 36-40 cohort. From the 26-30 cohort Bachelors Degree and Postgraduate Degree show substantially higher mean incomes than the other qualifications. The difference between the other qualifications is not great; however, the mean incomes for No Qualification lie noticeably lower than the others. The mean incomes for Bachelors Degree and Postgraduate Degree reach their highest points at the 36-40 cohort, and then generally decrease over the remaining cohorts. From the 36-40 cohort, the mean incomes for Postgraduate Degree are significantly higher than for Bachelors Degree.

In 2001, the female profiles, in Figure 4.2, show similar results with an increase in overall mean incomes. However, the initial increase in mean incomes is sustained over an extra cohort. Also, the mean incomes for School Certificate and No Qualification are relatively lower and in general drop further below the mean incomes for Sixth Form Certificate, Bursary and Diploma.

4.2.2 Male Age-Income Profiles

The male age-income profiles, shown in Figures 4.3 and 4.4, differ in that they show increases until the 46-50 age cohort for all qualifications after which all qualifications show a decreasing trend. Furthermore, the Bachelors Degree and Postgraduate Degree mean incomes move more closely together than in the female profiles. Also, the spread between the lower qualifications is more amplified for males and particularly so for the 2001 sample. Lastly, the overall level of mean incomes in the male samples is significantly higher than in the female samples.

Figure 4.1: Mean Annual Income by Age Cohort Females - 1996

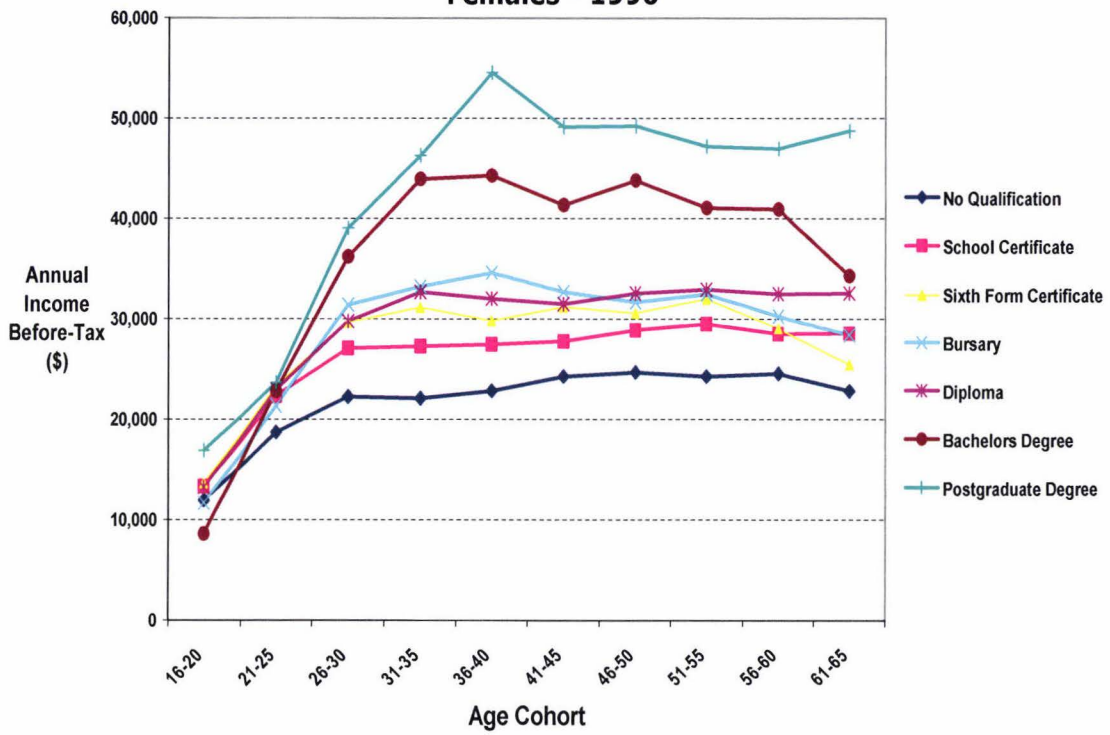


Figure 4.2: Mean Annual Income by Age Cohort Females - 2001

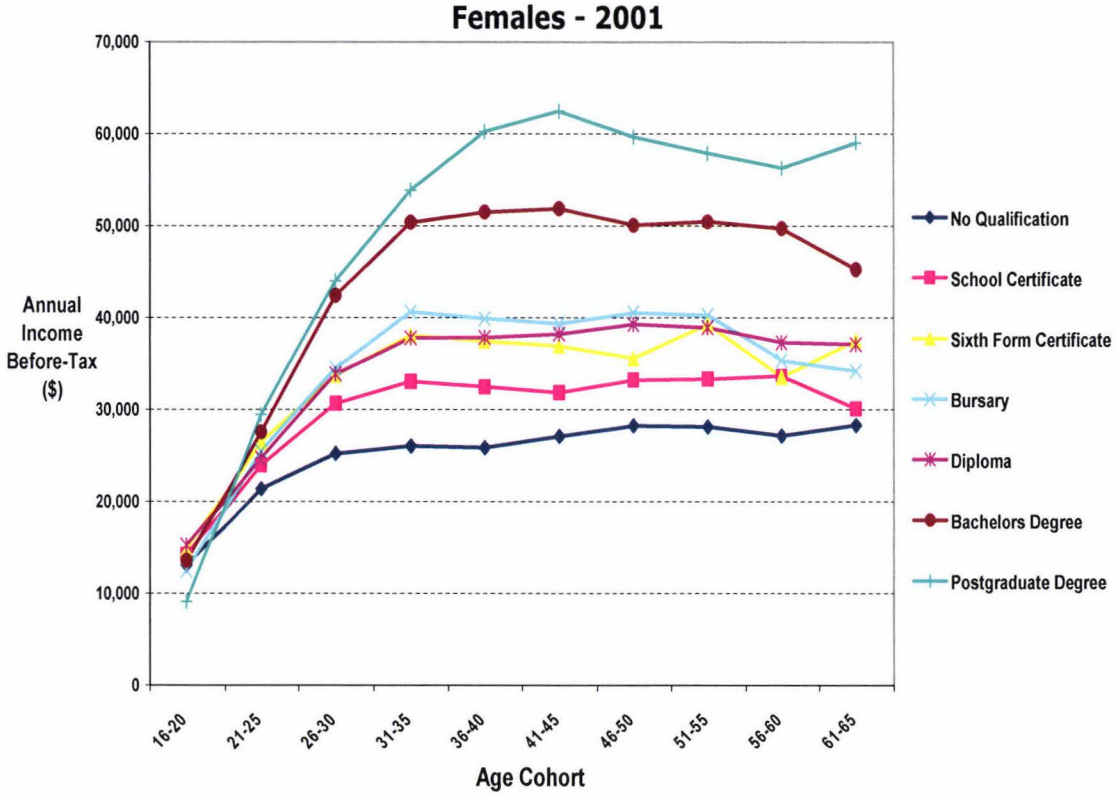


Figure 4.3: Mean Annual Income by Age Cohort
Males - 1996

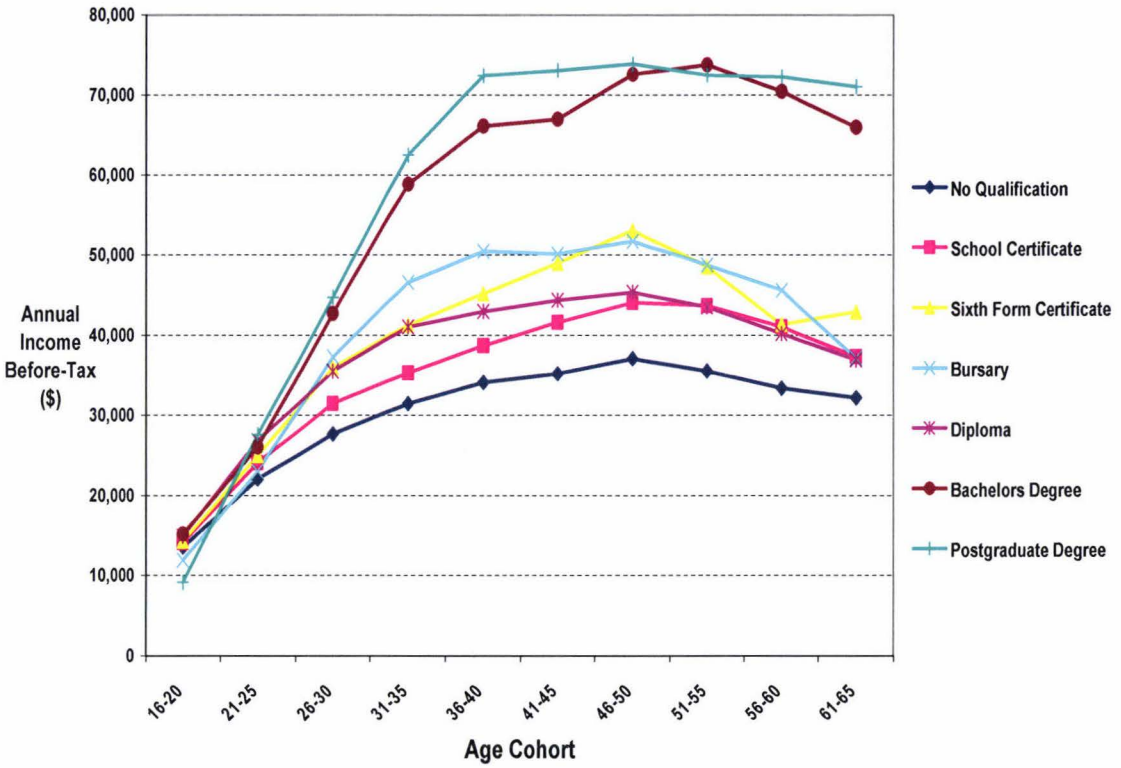
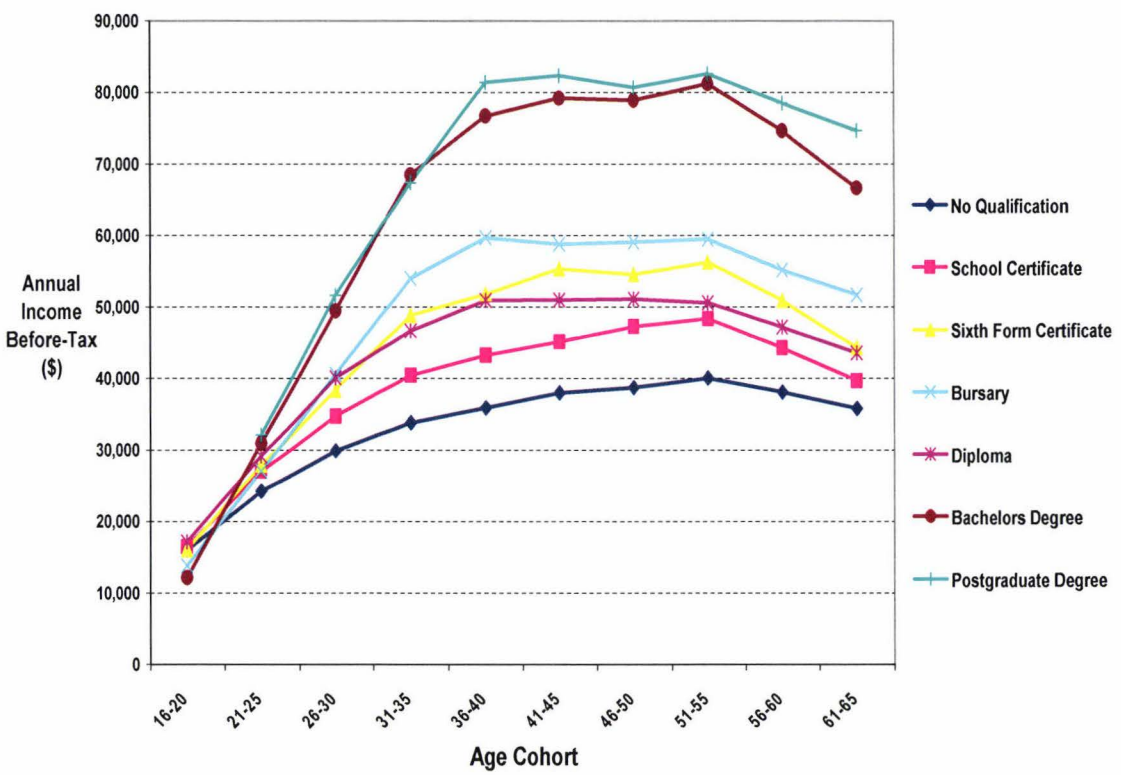


Figure 4.4: Mean Annual Income by Age Cohort
Males - 2001



4.3 Labour Force Status by Highest Qualification

The relationship between income and highest level of education is in turn related with labour supply propensities. Figures 4.5 and 4.6 demonstrate the positive relationship that exists between level of education and the propensity for employment. For females, with the exception of Bursary, as the level of education increases the propensity for employment increases. Correspondingly, there is a decrease in the percentage of those not in the labour force as the level of education increases. The propensity for part-time employment is relatively low for No Qualification, Bachelors Degree and Postgraduate Degree and hence higher for School Certificate, Sixth Form Certificate, Bursary and Diploma. Furthermore, in 2001, the propensity for employment increased for all levels of education over 1996.

For males, the relationship between level of education and propensity for employment is more complex. Diploma, Bachelors Degree and Postgraduate Degree have similarly high levels of propensity for employment. The propensity for employment increases from No Qualification to School Certificate, however, the propensity for employment for Sixth Form Certificate shows no increase above School Certificate. Both Sixth Form Certificate and Bursary show higher propensity for part-time employment than for the other qualifications. Overall, the propensity for employment for males is higher than females for all qualifications. In contrast, the propensity for part-time employment is lower for males than for females for all qualifications.

Figure 4.5: Labour Force Status by Highest Qualification Females

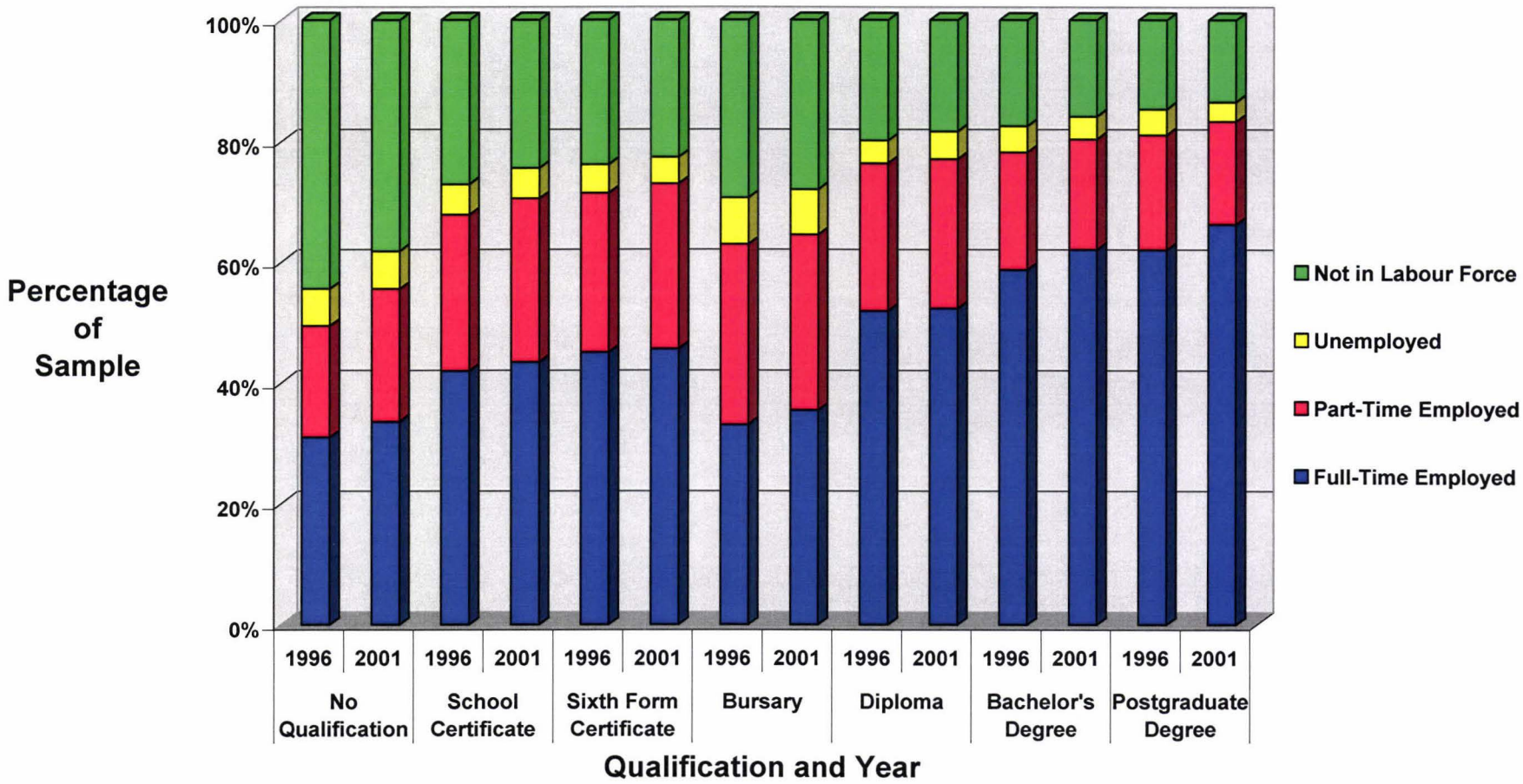
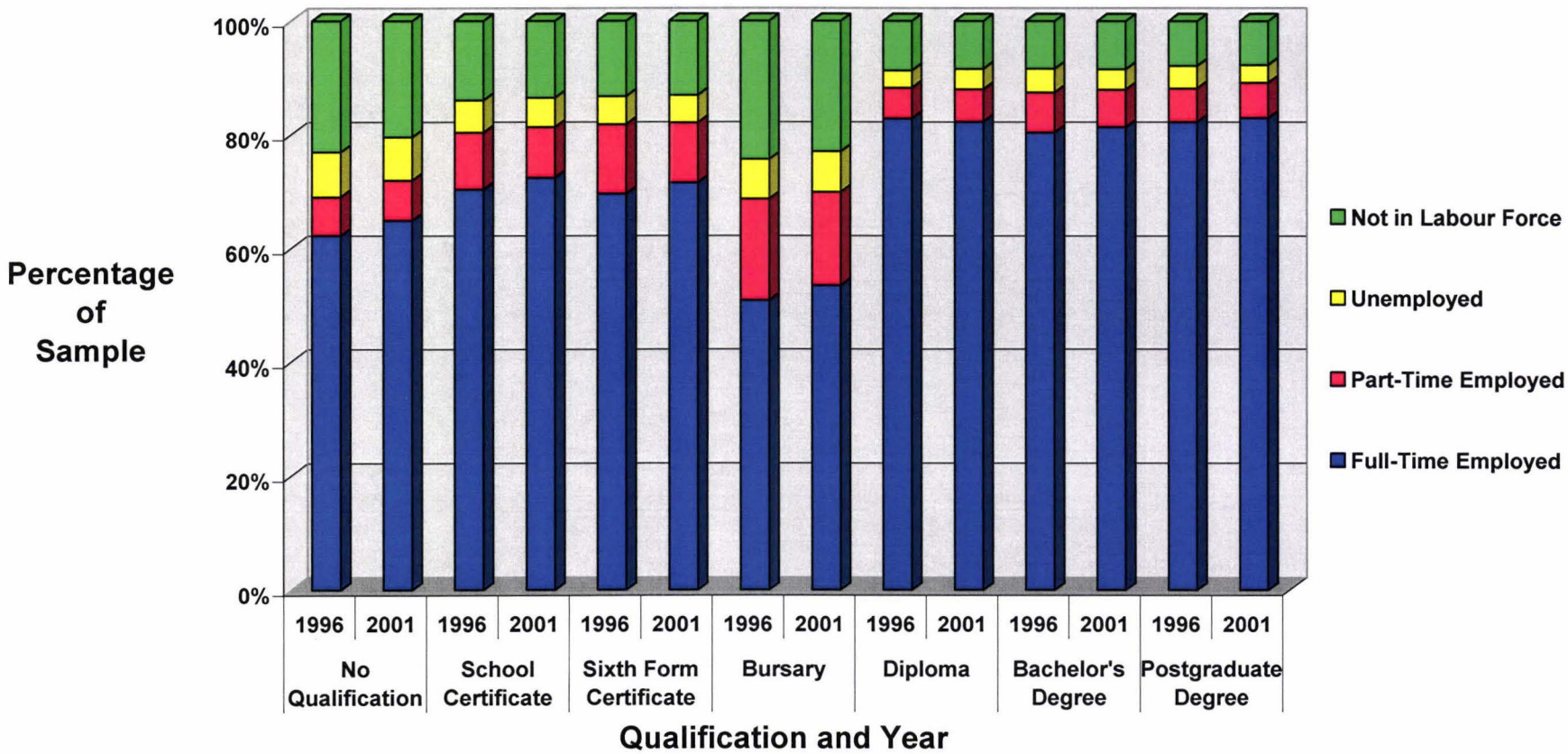


Figure 4.6: Labour Force Status by Highest Qualification Males

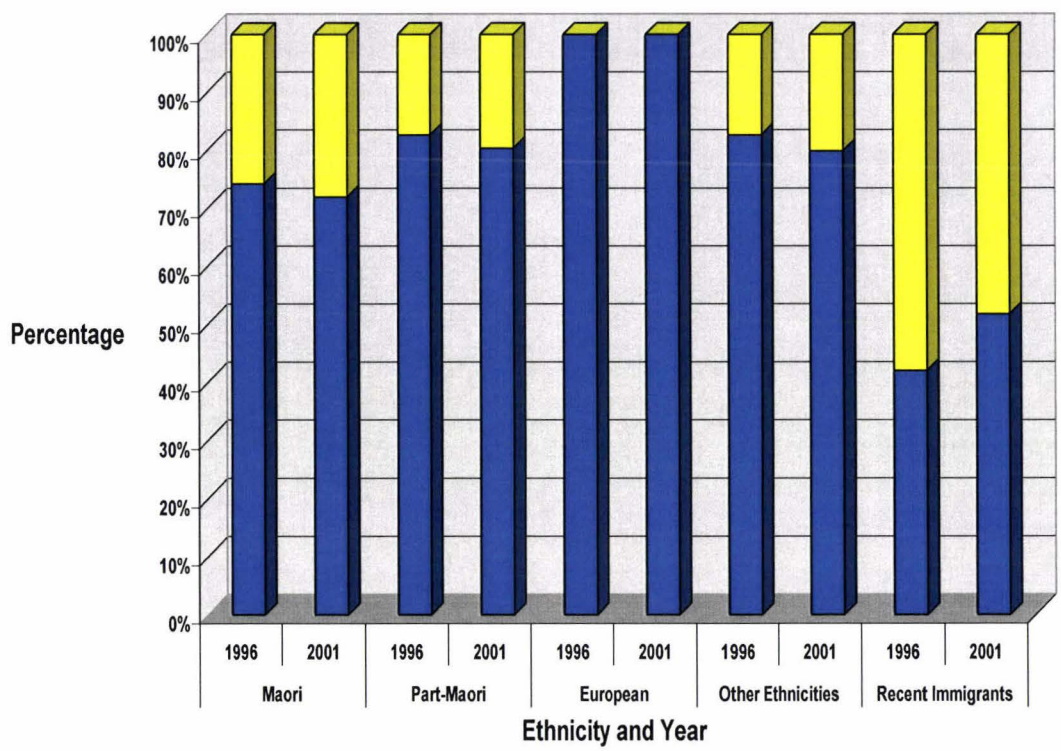


4.4 Other Sample Characteristics

4.4.1 Income Levels and Ethnicity

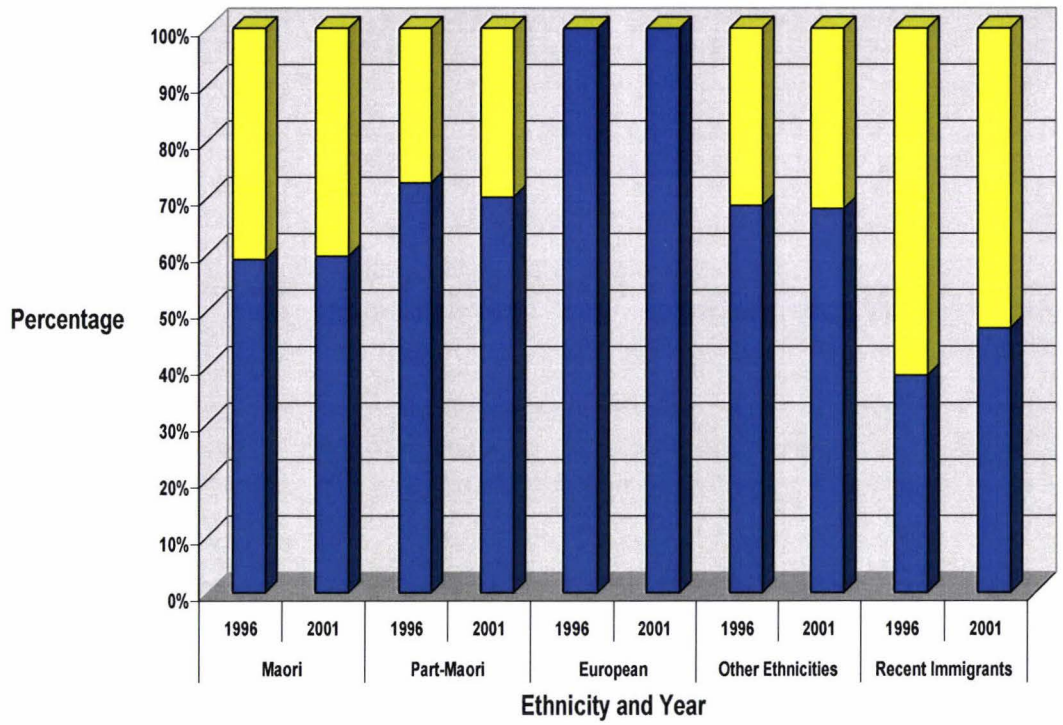
Figures 4.7 and 4.8 show the large gap in income levels between New Zealand (NZ) Europeans and Non-NZ Europeans. The bar graphs show the mean income of the Non-NZ European groups, Maori, Part-Maori, Other Ethnicities and Recent Immigrants[1], as a percentage of the mean NZ European income. Non-NZ European males faired relatively worse than their female counterparts. Also, from 1996 to 2001, the percentages dropped against the NZ European mean income for female Maori; female and male Part-Maori; and, for females and males from Other Ethnicities.

Figure 4.7: Mean Incomes by Ethnicity Relative to NZ European Mean - Females



[1] Recent Immigrants are defined as people who have lived in New Zealand for five years or less.

Figure 4.8: Mean Incomes by Ethnicity Relative to NZ European Mean - Males



4.4.2 Age Profiles

The age profiles by highest level of qualification, displayed in Tables 4.3 through 4.6 in Appendix 4, exhibit two interesting characteristics. Firstly, for the people listing Bursary as their highest qualification, their mean age is substantially lower than the mean age for people with any other qualification[2]. This reflects the fact that high proportion of the people listing Bursary as their highest qualification are students. This has ramifications for propensities of employment and income levels. Chapter six discusses this dynamic. Secondly, the mean age of the No Qualification group is higher than other groups. This reflects that older generations have fewer qualifications and therefore represent a larger proportion of the No Qualification group.

[2] For both the female and male samples, and in both years.

4.4.3 Educational Attainment Levels

The educational attainment of all ethnic groups, shown in Tables 4.1 and 4.2 in Appendix 4, increased from 1996 to 2001. Conversely, the proportion of people in the *No Qualification group fell by at least six percent* for all ethnicities. However, relative to NZ Europeans, non-NZ Europeans report a lower proportion of people holding qualifications. Consequently, the No Qualification group for non-NZ Europeans was proportionally larger. Also, a larger proportion of females held qualifications than males, particularly so in 2001. Interestingly, the group with the largest proportion of Bachelors Degree holders was Recent Immigrants. This reflects the New Zealand government's immigration policy of targeting skilled migrants.

4.4.4 Labour Force Status and Ethnicity

In general, the percentages of people full-time employed and part-time employed, shown in Tables 4.1 and 4.2, increased from 1996 to 2001 for all ethnic groups. In turn, the percentages of unemployed fell over the corresponding period. Labour force status by ethnicity mirrored the patterns of mean income and ethnicity; a greater proportion of NZ Europeans were employed full-time than non-NZ Europeans.

4.5 Chapter 4 - Appendices

Table 4.1: Sample Characteristics - Females by Ethnicity

Full Sample

Means (Standard Deviations)

Personal Characteristics	Maori		Part-Maori		European		Other Ethnicities		Recent Immigrants	
	1996	2001	1996	2001	1996	2001	1996	2001	1996	2001
Age	34.87	36.19	32.01	32.15	38.44	39.39	34.23	34.10	31.54	32.75
	(12.50)	(12.46)	(12.00)	(11.57)	(13.24)	(13.15)	(12.36)	(12.47)	(11.52)	11.90
Annual Income ($)										
Nominal Dollars	13,725	16,907	15,276	18,882	18,481	23,470	15,285	18,760	7,780	12,153
	(11,660)	(14,791)	(14,346)	(17,508)	(17,550)	(22,138)	(14,870)	(18,500)	(12,601)	15,900
Relative to European Mean Income	74.27%	72.04%	82.66%	80.45%	100%	100%	82.71%	79.93%	42.10%	51.78%
Highest Qualification (Percentage of Sample)										
No Qualification	59.43%	45.51%	35.39%	25.67%	29.55%	20.98%	42.96%	26.40%	31.78%	20.32%
School Certificate	14.95%	18.43%	20.09%	21.08%	16.94%	19.01%	12.17%	14.03%	5.40%	5.60%
Sixth Form Certificate	8.61%	10.14%	14.63%	16.43%	12.81%	14.64%	10.36%	12.34%	6.13%	6.60%
Bursary	3.26%	4.34%	6.97%	7.86%	6.01%	6.69%	8.26%	12.52%	9.23%	10.25%
Basic Vocational Diploma	4.47%	6.82%	5.64%	6.98%	4.70%	5.25%	4.58%	5.83%	3.62%	5.42%
Skilled Vocational Diploma	2.38%	2.19%	3.89%	3.02%	5.10%	3.94%	2.71%	1.85%	1.52%	0.96%
Intermediate Vocational Diploma	0.28%	2.75%	0.60%	2.95%	0.78%	1.87%	0.45%	2.58%	0.26%	1.42%
Advanced Vocational Diploma	4.74%	5.44%	7.90%	7.92%	13.72%	13.23%	6.49%	7.22%	9.00%	10.73%
Bachelors Degree	1.29%	3.45%	3.71%	6.34%	7.03%	10.01%	9.01%	13.25%	23.84%	27.58%
Postgraduate Degree	0.58%	0.92%	1.19%	1.74%	3.36%	4.39%	3.00%	3.99%	9.20%	11.11%
Labour Force Status (Percentage of Sample)										
Full-Time Employed	31.52%	37.12%	38.84%	41.34%	44.09%	47.70%	41.21%	43.37%	17.67%	27.44%
Part-Time Employed	13.94%	17.59%	20.47%	21.90%	24.60%	25.95%	15.19%	17.75%	8.62%	13.70%
Unemployed	12.85%	11.96%	9.22%	9.80%	3.86%	3.75%	7.87%	7.93%	11.45%	9.79%
Not in Labour Force	41.69%	33.32%	31.47%	26.96%	27.45%	22.61%	35.73%	30.94%	62.26%	49.06%
Sample Size	13,077	14,188	11,190	10,798	147,271	149,570	11,750	13,248	3,423	5,014
Percentage of Sample	7.00%	7.36%	5.99%	5.60%	78.88%	77.57%	6.29%	6.87%	1.83%	2.60%

Table 4.2: Sample Characteristics - Males by Ethnicity

Full Sample

Means (Standard Deviations)

Personal Characteristics	Maori		Part-Maori		European		Other Ethnicities		Recent Immigrants	
	1996	2001	1996	2001	1996	2001	1996	2001	1996	2001
Age	35.12	36.06	32.03	32.06	38.49	39.50	34.19	34.29	32.07	32.79
	(12.69)	(12.71)	(12.22)	(12.02)	(13.39)	(13.37)	(12.47)	(12.67)	(11.86)	12.02
Annual Income ($)										
Nominal Dollars	19,361	22,992	23,796	27,021	32,794	38,591	22,472	26,230	12,605	18,071
	(16,281)	(20,217)	(21,098)	(24,652)	(27,458)	(32,211)	(21,787)	(26,422)	(18,601)	23,530
Relative to European Mean Income	59.04%	59.58%	72.56%	70.02%	100.00%	100.00%	68.52%	67.97%	38.44%	46.83%
Highest Qualification (Percentage of Sample)										
No Qualification	63.34%	52.18%	38.44%	31.30%	29.05%	23.38%	42.67%	29.24%	24.07%	16.07%
School Certificate	11.93%	16.86%	15.62%	18.81%	12.76%	15.90%	10.43%	13.12%	4.50%	6.53%
Sixth Form Certificate	6.92%	9.00%	12.55%	13.45%	10.55%	12.08%	10.10%	12.05%	6.42%	7.23%
Bursary	3.56%	4.55%	7.44%	8.83%	6.73%	7.38%	9.38%	12.63%	8.40%	12.17%
Basic Vocational Diploma	2.98%	4.49%	4.39%	5.16%	3.71%	4.47%	2.88%	4.19%	3.40%	4.81%
Skilled Vocational Diploma	5.85%	4.73%	9.27%	7.55%	13.40%	10.90%	4.10%	3.29%	2.20%	2.52%
Intermediate Voc. Diploma	0.88%	2.03%	2.11%	3.22%	3.45%	3.60%	1.17%	2.07%	0.47%	1.44%
Advanced Voc. Diploma	2.67%	2.92%	4.54%	4.75%	7.36%	7.53%	5.07%	5.64%	6.67%	8.27%
Bachelor's Degree	1.38%	2.40%	4.11%	5.11%	8.49%	9.72%	9.68%	12.54%	27.97%	26.23%
Postgraduate Degree	0.49%	0.84%	1.53%	1.82%	4.49%	5.05%	4.53%	5.24%	15.89%	14.72%
Labour Force Status (Percentage of Sample)										
Full-Time Employed	53.22%	58.35%	59.26%	52.10%	73.52%	74.59%	58.46%	58.51%	27.23%	38.93%
Part-Time Employed	8.36%	8.30%	8.70%	7.01%	7.82%	7.58%	9.17%	9.49%	7.42%	9.15%
Unemployed	13.39%	12.23%	8.53%	7.26%	4.07%	3.84%	8.59%	8.15%	13.64%	10.55%
Not in Labour Force	24.10%	20.76%	15.74%	13.35%	13.21%	11.50%	21.72%	19.73%	44.55%	35.42%
Sample Size	12,955	14,137	10,321	8,609	145,231	145,845	11,508	12,702	3,178	4,716
Percentage of Sample	7.07%	7.60%	5.63%	4.63%	79.28%	78.41%	6.28%	6.83%	1.73%	2.54%

Table 4.3: Sample Characteristics – Females by Highest Level of Qualification

Full Sample 1996

Personal Characteristics	No Qual.	School Cert.	6th Form Cert.	Bursary	Basic Voc. Dip.	Sk. Voc. Diploma	Int. Voc. Diploma.	Adv. Voc. Diploma	Bach. Degree	Postgrad. Degree
Age (Mean)	42.88	35.55	30.54	25.71	34.88	36.23	33.62	41.06	34.40	38.44
Standard Deviation	(13.32)	(12.52)	(10.98)	(10.96)	(12.52)	(10.59)	(9.68)	(11.69)	(10.27)	(10.49)
Ethnicity										
(Percentage of Sample)										
Maori	59.43%	14.95%	8.61%	3.26%	4.47%	2.38%	0.28%	4.74%	1.29%	0.58%
Part-Maori	35.39%	20.09%	14.63%	6.97%	5.64%	3.89%	0.60%	7.90%	3.71%	1.19%
European	29.55%	16.94%	12.81%	6.01%	4.70%	5.10%	0.78%	13.72%	7.03%	3.36%
Other Ethnicities	42.96%	12.17%	10.36%	8.26%	4.58%	2.71%	0.45%	6.49%	9.01%	3.00%
Recent Immigrants	31.78%	5.40%	6.13%	9.23%	3.62%	1.52%	0.26%	9.00%	23.84%	9.20%
Annual Income ($)										
Mean (Nominal Dollars)	13,465	16,506	16,959	12,131	17,215	18,877	22,666	23,764	26,238	33,256
Standard Deviation	(12,836)	(15,890)	(16,189)	(13,969)	(14,588)	(15,439)	(16,631)	(18,139)	(22,486)	(26,885)
Labour Force Status										
(Percentage of Sample)										
Full-Time Employed	31.10%	41.98%	45.05%	33.14%	48.04%	50.14%	61.05%	53.50%	58.80%	62.03%
Part-Time Employed	18.33%	25.81%	26.40%	29.79%	22.21%	25.49%	19.29%	25.29%	19.43%	19.08%
Unemployed	6.11%	5.11%	4.73%	7.75%	7.26%	4.05%	4.18%	2.44%	4.39%	4.31%
Not in Labour Force	44.46%	27.09%	23.82%	29.32%	22.49%	20.33%	15.49%	18.76%	17.38%	14.58%
Sample Size	61,383	30,771	23,062	11,337	8,799	8,624	1,317	22,782	12,818	5,818

Table 4.4: Sample Characteristics – Females by Highest Level of Qualification

Full Sample 2001

Personal Characteristics	No Qual.	School Cert.	6th Form Cert.	Bursary	Basic Voc. Dip.	Sk. Voc. Diploma	Int. Voc. Diploma.	Adv. Voc. Diploma	Bach. Degree	Postgrad. Degree
Age (Mean)	44.13	38.36	33.37	27.00	35.13	39.02	31.83	42.66	35.74	39.44
Standard Deviation	(13.22)	(13.11)	(11.88)	(11.28)	(12.19)	(10.86)	(10.97)	(11.62)	(10.58)	(10.58)
Ethnicity										
(Percentage of Sample)										
Maori	45.51%	18.43%	10.14%	4.34%	6.82%	2.19%	2.75%	5.44%	3.45%	0.92%
Part-Maori	25.67%	21.08%	16.43%	7.86%	6.98%	3.02%	2.95%	7.92%	6.34%	1.74%
European	20.98%	19.01%	14.64%	6.69%	5.25%	3.94%	1.87%	13.23%	10.01%	4.39%
Other Ethnicities	26.40%	14.03%	12.34%	12.52%	5.83%	1.85%	2.58%	7.22%	13.25%	3.99%
Recent Immigrants	20.32%	5.60%	6.60%	10.25%	5.42%	0.96%	1.42%	10.73%	27.58%	11.11%
Annual Income ($)										
Mean (Nominal Dollars)	15,714	19,904	21,065	15,690	19,736	22,479	19,799	29,282	32,670	40,549
Standard Deviation	(15,153)	(18,973)	(20,636)	(17,783)	(16,705)	(18,830)	(15,828)	(22,640)	(26,352)	(31,170)
Labour Force Status										
(Percentage of Sample)										
Full-Time Employed	33.66%	43.47%	45.62%	35.47%	46.42%	50.24%	52.00%	55.69%	62.08%	66.26%
Part-Time Employed	21.84%	27.06%	27.41%	29.05%	24.88%	27.74%	19.84%	24.70%	18.37%	17.13%
Unemployed	6.30%	5.09%	4.38%	7.54%	7.88%	3.74%	9.28%	2.64%	3.76%	3.15%
Not in Labour Force	38.20%	24.38%	22.59%	27.94%	20.81%	18.28%	18.87%	16.98%	15.79%	13.46%
Sample Size	45,120	35,459	27,074	13,647	10,613	6,823	3,921	22,907	19,279	7,973

Table 4.5: Sample Characteristics – Males by Highest Level of Qualification

Full Sample 1996

Personal Characteristics	No Qual.	School Cert.	6th Form Cert.	Bursary	Basic Voc. Dip.	Sk. Voc. Diploma	Int. Voc. Diploma.	Adv. Voc. Diploma	Bach. Degree	Postgrad. Degree
Age (Mean)	40.97	33.77	30.93	27.21	35.77	40.37	40.21	40.53	37.38	41.14
Standard Deviation	(13.78)	(13.34)	(12.11)	(11.42)	(12.84)	(11.87)	(10.76)	(11.50)	(11.03)	(10.63)
Ethnicity										
(Percentage of Sample)										
Maori	63.34%	11.93%	6.92%	3.56%	2.98%	5.85%	0.88%	2.67%	1.38%	0.49%
Part-Maori	38.44%	15.62%	12.55%	7.44%	4.39%	9.27%	2.11%	4.54%	4.11%	1.53%
European	29.05%	12.76%	10.55%	6.73%	3.71%	13.40%	3.45%	7.36%	8.49%	4.49%
Other Ethnicities	42.67%	10.43%	10.10%	9.38%	2.88%	4.10%	1.17%	5.07%	9.68%	4.53%
Recent Immigrants	24.07%	4.50%	6.42%	8.40%	3.40%	2.20%	0.47%	6.67%	27.97%	15.89%
Annual Income ($)										
Mean (Nominal Dollars)	23,280	26,218	27,647	20,457	28,162	33,632	38,328	40,324	48,008	56,576
Standard Deviation	(19,830)	(23,136)	(25,569)	(24,007)	(21,834)	(21,361)	(22,382)	(28,006)	(36,400)	(38,326)
Labour Force Status										
(Percentage of Sample)										
Full-Time Employed	62.29%	70.32%	69.57%	50.83%	75.75%	84.08%	86.63%	82.82%	80.41%	82.19%
Part-Time Employed	6.74%	10.08%	12.24%	17.81%	7.75%	4.63%	4.71%	5.99%	7.07%	5.99%
Unemployed	7.87%	5.66%	4.96%	6.97%	5.70%	2.45%	2.13%	3.08%	4.19%	3.99%
Not in Labour Force	23.10%	13.94%	13.23%	24.39%	10.80%	8.84%	6.53%	8.10%	8.33%	7.83%
Sample Size	60,041	23,035	18,878	12,354	6,667	21,711	5,498	12,302	14,940	7,767

Table 4.6: Sample Characteristics – Males by Highest Level of Qualification

Full Sample 2001

Personal Characteristics	No Qual.	School Cert.	6th Form Cert.	Bursary	Basic Voc. Dip.	Sk. Voc. Diploma	Int. Voc. Diploma.	Adv. Voc. Diploma	Bach. Degree	Postgrad. Degree
Age (Mean)	42.04	36.38	33.40	28.66	35.77	41.76	39.43	41.46	38.87	42.11
Standard Deviation	(13.80)	(13.73)	(12.82)	(12.13)	(12.94)	(11.34)	(11.87)	(11.55)	(11.36)	(10.86)
Ethnicity										
(Percentage of Sample)										
Maori	52.18%	16.86%	9.00%	4.55%	4.49%	4.73%	2.03%	2.92%	2.40%	0.84%
Part-Maori	31.30%	18.81%	13.45%	8.83%	5.16%	7.55%	3.22%	4.75%	5.11%	1.82%
European	23.38%	15.90%	12.08%	7.38%	4.47%	10.90%	3.60%	7.53%	9.72%	5.05%
Other Ethnicities	29.24%	13.12%	12.05%	12.63%	4.19%	3.29%	2.07%	5.64%	12.54%	5.24%
Recent Immigrants	16.07%	6.53%	7.23%	12.17%	4.81%	2.52%	1.44%	8.27%	26.23%	14.72%
Annual Income ($)										
Mean (Nominal Dollars)	25,759	30,643	33,152	25,660	31,648	38,704	39,157	47,663	55,495	63,211
Standard Deviation	(22,273)	(26,368)	(30,066)	(29,972)	(25,703)	(24,525)	(25,970)	(33,473)	(40,898)	(41,858)
Labour Force Status										
(Percentage of Sample)										
Full-Time Employed	65.00%	72.43%	71.53%	53.48%	73.88%	85.60%	82.64%	83.01%	81.34%	82.92%
Part-Time Employed	6.94%	8.92%	10.58%	16.40%	8.05%	4.43%	5.16%	6.28%	6.64%	6.26%
Unemployed	7.63%	5.15%	4.85%	7.14%	6.28%	2.46%	4.36%	3.15%	3.62%	3.17%
Not in Labour Force	20.43%	13.49%	13.05%	22.98%	11.79%	7.51%	7.83%	7.56%	8.39%	7.66%
Sample Size	48,641	29,163	21,915	14,350	8,357	17,747	6,142	12,904	17,790	9,000

5 Income Function Analysis – Methodology

5.1 Income Function Analysis

The first method utilised in this study, referred to in the literature as earnings function analysis, is based on Mincer's (1974) human capital earnings function (HCEF). Mincer (1974) pioneered the use of econometric techniques in identifying the link between earnings and years of schooling. The Human Capital Earnings Function (HCEF) or "Mincerian" equation involves the fitting of a semi-log ordinary least squares regression using the natural logarithm of earnings as the dependent variable, and years of schooling and potential years of labour market experience and its square as independent variables. In this study, income replaces earnings as the dependent variable. Therefore, this study refers to the model as income function analysis. Mincer's original model is represented mathematically as follows:

$$\ln Y_i = \ln Y_0 + aYearsofSchooling_i + bAGE_i + c(AGE_i)^2 \qquad (5.1)$$

5.1.1 The "Extended" Income Function

This study uses a modified version of the original income function[1] which Psacharopoulos (1994) terms the "extended" income function. The "extended" income function can be used to estimate returns to education at different levels by converting the continuous years of schooling variable into a series of dummy variables referring to separate levels of education or even different fields of study. The model used in this study focuses on separate levels of education represented by the highest level of qualification in the Stats New Zealand data. Equation 5.2 outlines the model mathematically below:

[1] Psacharopoulos (1994) classifies this equation as the "basic" earnings function.

$$\ln Y_i = a + b_1 SchoolCert_i(Year11) + b_2 SixthFormCert_i(Year12) + b_3 Bursary_i(Year13)$$
$$+ b_4 Diploma_i + b_5 Bachelor'sDegree_i + b_6 Postgrad.Degree_i$$
$$+ b_7 AGE_i + b_8 AGE_i^2 + u_i \qquad (5.2)$$

where the dependent variable is the natural logarithm of annual income (Psacharopoulos, 1981 and 1994). These models provide estimates of the market rewards to various educational levels for different age levels. The model estimated and later models utilise the White adjustment to correct for detected heteroskedasticity and for efficient estimators.

5.1.2 The Income Effects of Secondary and Tertiary Qualifications

The six binary variables included in the model estimate the income effects for each education level in comparison to the excluded group with no educational qualifications[2]. This study purposely refers to the results from the income function analysis as the "income effects" of qualifications rather than rates of return (Maani, 1991 & 1999). Later, chapter seven and eight model the costs of educational qualifications directly, therefore, those chapters refer to the results as the rates of return.

The income effects of qualifications calculated in the framework of equation 5.2 allow comparison of the 1996 and 2001 samples. Moreover, the methodology outlined above follows the same approach as Maani (1994 & 1999). Her studies incorporated data from 1981 to 1996, therefore the 2001 results extend the time-series.

Comparing the results over the time-series mitigates some of the weaknesses of the approach. As explained in chapter three, the literature

[2] In the returns to education literature, followed by this study, only education levels and age are included to provide estimates of overall rates of return to an educational degree (see for example Psacharopoulos, 1981, 1985 and 1994). This contrasts to earnings functions in the labour economics field which generally include a number of variables such as race, family status, union membership, occupation and firm size. Hence, these estimates provide average returns over various fields of study and across other groupings.

has put forward some key criticisms of returns to education studies. The use of an income function time-series controls for these errors. Over a time-series the errors cancel out, allowing a clean comparison of the income effects of qualifications between years. The importance of the results then shifts from the absolute size of the income effects to the difference in income effects between years and over the series.

5.1.3 The Marginal Income Effects of Secondary and Tertiary Qualifications

While the income effects against the No Qualification group provides information on income levels by qualification, from an economic point of view, the marginal income effect of a qualification provides more useful information[3]. The next step is to then calculate the marginal percentage income effects of the qualifications[4]. The coefficients (income effects) calculated above using the model given in equation 5.2 undergo an adjustment (Halvorsen and Palmquist, 1980) to give the marginal effects. The adjustment is as follows:

> The process is best explained with an example. To calculate the marginal percentage income effect of Sixth Form Certificate, first subtract the coefficient for School Certificate from the coefficient for Sixth Form Certificate. Take the anti-log of the result and subtract one. Then multiply by one hundred. The result gives the marginal percentage income effect of Sixth Form Certificate. Equation 5.3 outlines the general formula for calculating the marginal effect of a qualification:

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[3] Chapter six (the results of the income function analysis) show the marginal income effects of all qualifications, the income effects against the No Qualification group as well as comparisons between all other qualifications. However, for emphasis, the marginal income effects are bolded in the results (Tables 6.2 through 6.5, 6.14 through 6.17, and 6.21 through 6.28).

[4] In most cases, the marginal percentage income effects of a qualification refers to the income effect of qualification over the qualification immediately below. However, for Bachelors Degree and Diploma comparisons are made with both Sixth Form Certificate and Bursary. In addition, a comparison is made between Bachelors Degree and Diploma, since those pursuing tertiary qualifications must choose between university and polytechnic qualifications.

$$g_j = \left[\exp\left(b_j - b_k\right) - 1\right] \times 100 \qquad (5.3)$$

where g_j reflects the percentage marginal income effect of the qualification, b_j is the regression coefficient for the higher (marginal) qualification, and b_k is the regression coefficient for the lower qualification.

5.1.4 Expanded Chow Test

The Expanded Chow Test (Chow, 1983) checks the stability of the coefficients for each qualification from 1996 to 2001. The test involves pooling together the 2001 sample with the 1996 sample, where the binary variable technique and the Wald test are performed. Inference on the stability of each coefficient over time is made through t-tests relating to interaction effect of the coefficients for each qualification against the time variable. The test is represented below in equation 5.4.

$$\begin{aligned} \ln Y_i = {} & a + b_1 SchoolCert_i(Year11) + b_2 SixthFormCert_i(Year12) + b_3 Bursary_i(Year13) \\ & + b_4 Diploma_i + b_5 Bachelor'sDegree_i + b_6 Postgrad.Degree_i + AGE_i + b_8 AGE_i^2 \\ & + d_j(\text{interaction effects of age, qualifications and time}) + v_i \end{aligned} \qquad (5.4)$$

5.2 Model Specification

5.2.1 Sample Specification

This study varies the sample specification to extend the analysis and to allow for the characteristics of the larger sample. Firstly, the divergent labour market outcomes, both in income levels and propensities for employment, necessitate the modelling of males and females separately. Moreover, for females in particular, the analysis splits the sample into one that includes all those in employment (All Employed) and a second that includes only those in full-time employment (Full-time Employed). This helps to somewhat alleviate the effect of different hours of work.

5.2.2 The Independent Variable

The analysis first uses Before-Tax income and then After-Tax income as the independent variable to calculate separate models. The results from the two models can be roughly interpreted as the private income effects (for After-Tax income) and social income effect (for Before-Tax income) for each education level. The impact of New Zealand's taxation system on the income effects of qualifications is also then assessed.

5.2.3 The Dependent Variables

To explore the effects of labour force experience, the analysis replaces the age and age squared variable with a potential years of labour force experience variable and its square[5]. Like age, the potential years of labour force experience variable represents a proxy for actual years of labour force experience[6]. However, the potential years of labour force experience variable may be a more accurate reflection of labour force experience. Therefore, using this specification may give a better reflection of not only the income effect of labour force experience, but the income effect of education as well.

Also, the analysis makes an adjustment to the sample to allow for the divergent labour market outcomes of the large number of immigrants into New Zealand during the two Census years. The model achieves this by adding a dummy variable for immigrants who have lived in New Zealand for five years or less. Maani (1999) posits that language, cultural and other barriers faced by new immigrants in the workplace created a gap between

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[5] The general formula for calculation of the potential years of labour force experience is as follows: Potential Years of Labour Force Experience = Age – the number of years required to complete the highest level of qualification – 5 years (primary school entrance age). For someone with a Bachelors Degree the calculation is as follows: Potential Years of Labour Force Experience = Age – [13 years (the number of years required to complete primary and secondary school) + 3 years (number of years required to complete a Bachelors Degree)] – 5 years (primary school entrance age).

[6] Potential years of labour force experience is inferred from the data on age. However, actual years of labour force experience may vary around the calculated value depending on the actual length of time an individual spends studying and, more importantly, in employment.

the labour market outcomes of immigrants and long-term residents. Introducing the recent immigrant variable may give a better reflection of the actual income effects of qualifications. Furthermore, the model will indicate difference in income levels of recent immigrants and long-term residents for a given qualification.

5.2.4 Investigating the Diploma Qualification

Finally, the analysis adjusts the model to break down the Diploma qualification into four variables; Basic Vocational Diploma, Skilled Vocational Diploma, Intermediate Vocational Diploma, and Advanced Vocational Diploma. This model estimates the income effects for each of the four separate Diploma qualifications and then compares them with the income effect of the single Diploma variable. From this model, as before, the analysis calculates the marginal income effects for the four qualifications and compares them to the marginal effect of the single Diploma qualification.

The analysis then performs testing on the significance of the coefficients for the four separate dummy variables. The following hypotheses are tested:

$$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0 \qquad (5.5)$$

$$\alpha_1 = \alpha_2 = 0 \qquad (5.6)$$

$$\alpha_3 = \alpha_4 = 0 \qquad (5.7)$$

where α_1, α_2, α_3 and α_4 refer to the coefficients for Basic Vocational Diploma, Skilled Vocational Diploma, Intermediate Vocational Diploma and Advanced Vocational Diploma respectively. The hypothesis represented by equation 5.5 tests whether the income effects of Basic Vocational Diploma, Skilled Vocational Diploma, Intermediate Vocational Diploma, and Advanced Vocational Diploma are equal (or not). Equation 5.6 tests whether the income effects of Basic Vocational Diploma and Skilled Vocational Diploma are equal (or not). Lastly, equation 5.7 tests whether the income effects of Intermediate Vocational Diploma and Advanced Vocational Diploma are equal (or not).

6 Income Function Analysis – Results and Discussion

Results from the 2001 Census data show a general increase in the income effect for both females and males of all qualifications against the group with No Qualification since 1996. The Bursary qualification showed the highest increase in income effect against the No Qualification group. The expanded Chow Test, section 6.12, confirmed that the income effect increased for most qualifications against the No Qualification group from 1996 to 2001[7]. The marginal income effect of qualifications, shown in Tables 6.6 to 6.12, increased for Sixth Form Certificate; Bursary; Diploma and Bachelors Degree (from Sixth Form Certificate); and for Bachelors Degree (instead of Diploma) for both females and males over the five-year period. In contrast, they decreased for Diploma and Bachelors Degree (from Bursary); and for Postgraduate Degree. Section 6.1 reports in detail the comparison of results from the 1996 and 2001 Censuses.

Using potential years of labour force experience and labour force experience squared in the income function, instead of age and age squared, leads to higher income effects against the No Qualification group for tertiary qualifications and lower income effects for secondary qualifications. This result alters the structure of the income returns to secondary and tertiary qualifications. Unlike Maani (1999), this result is explored and discussed fully in section 6.21. Following on from there, the results from other model specifications are reported and examined.

Finally, the results from section 6.3 show a diverse range of outcomes for the Diploma qualification. For both females and males, the range of income effects for the four sub-qualifications is large. Testing on the model using four variables within the Diploma qualification, reported in section 6.3.1, confirms that the model using four variables is superior to the model using

[7] School Certificate and Postgraduate Degree were accepted the 80 and 90 percent confidence intervals respectively for males. For females, the School Certificate was rejected and Bursary only accepted at the 75 percent confidence interval.

only one. Put differently, the income effects of the four sub-qualifications against the No Qualification group are sufficiently different to be reported separately.

The appendices at the end of the chapter lay out in full the results of the *income function* analysis.

6.1 2001 Census Results

6.1.1 Income Effect of Qualifications vs. the No Qualification Group

The income effect of all levels of qualification against the omitted No Qualification group, reported in Table 6.1, showed an increase from 1996 to 2001 for the female samples. The results showed an overall increase in the income effect in all the samples: All-Employed, Employed-Fulltime as well as for Before-Tax and After-Tax incomes. Only two qualifications, School Certificate and Sixth Form Certificate, moved against the overall upward trend. School Certificate showed a decrease in the Employed-Fulltime sample. Likewise, Sixth Form Certificate reported a decrease for the Employed-Fulltime sample, but only with After-Tax income as the dependent variable. The overall increase in the income effect held even taking into account movements in the value of the intercept term and the coefficients of age and age squared. The Bursary qualification showed the largest increase in the income effect followed by Bachelors Degree, Postgraduate Degree, and then the Diploma qualification. The two

Table 6.1: Income Effects of Secondary and Tertiary Education for Employed-Fulltime Females and Males - 1996 and 2001

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	Females		Males	
	1996	2001	1996	2001
Intercept	7.820108 (278.04)	7.784646 (286.78)	7.445156 (362.03)	7.542144 (365.38)
School Certificate	0.236446 (32.45)	0.216051 (29.87)	0.167989 (29.37)	0.179775 (32.60)
Sixth Form Certificate	0.352459 (43.63)	0.355919 (44.54)	0.268048 (41.88)	0.304824 (49.10)
Bursary	0.245391 (18.60)	0.324807 (27.67)	0.203508 (21.40)	0.29109 (32.25)
Diploma	0.358518 (55.54)	0.375408 (56.11)	0.26468 (60.80)	0.307365 (65.64)
Bachelors Degree	0.549112 (59.26)	0.608375 (75.27)	0.558003 (79.46)	0.616495 (92.36)
Postgraduate Degree	0.691028 (56.72)	0.742455 (72.12)	0.670762 (77.19)	0.695607 (82.98)
Age	0.094711 (62.89)	0.101329 (72.50)	0.128067 (118.66)	0.125292 (118.80)
Age^2	-0.00105 (54.29)	-0.00111 (63.60)	-0.0014 (103.48)	-0.00135 (104.31)
Adjusted R^2	0.1569	0.1768	0.2555	0.2541
Sample Size	78,107	87,601	128,529	134,146

remaining secondary qualifications, Sixth Form Certificate and School Certificate, showed the smallest increases (or decreases)[1].

Results for the male samples, displayed in Table 6.1, reported increases for all qualifications across the board (including School Certificate and Sixth Form Certificate). Again, the results held, taking into account the changes in the values of the intercept term and the coefficients of age and age squared. Similar to the female samples, Bursary and Bachelors Degree showed the largest increases in the income effect[2]. In contrast to the female samples, however, Sixth Form Certificate and Diploma reported the next largest increases with Postgraduate Degree and School Certificate showing the smallest increases[3]. Tables 6.9 through 6.12 in the appendices at the end of the chapter provide a more detailed breakdown of the results of the different samples used.

6.1.2 Expanded Chow Test

An expanded Chow Test performed on all samples verified the general increase in the income effect for all qualifications over the 1996 and 2001 period. It reported positive and significant coefficients for the interaction terms for all levels of qualification and the 2001 year dummy variable. The coefficients were all significant at or above the 95 percent confidence level for both female samples. The exception was School Certificate and 2001 year dummy variable interaction term which was positive, but had low t-value of 0.24. For both the male samples, the coefficients all showed positive signs. However, the interaction terms for School Certificate and Postgraduate Degree were significant at the 80 and 90 percent confidence levels respectively with the remainder significant at the 95 percent level.

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[1] The ranking of the magnitude of the increase in the income effect against the No Qualification group discussed here is for the Employed-Fulltime sample. For the All-Employed sample, Sixth Form Certificate showed a larger increase than the Diploma qualification.

[2] For the All-Employed sample the coefficient for Bursary increased from 0.0783 to 0.187, and for the Fulltime-Employed sample it increased from 0.204 to 0.291.

[3] Over the All-Employed and Employed-Fulltime samples, using both Before-Tax and After-Tax income, Diploma and Sixth Form Certificate showed approximately the same increases in the income effect, as did Postgraduate Degree and School Certificate.

Tables 6.9, in the appendix at the end of the chapter, reports in full the results of the expanded Chow Test.

6.1.3 The Marginal Income Effects of Qualifications

The marginal percentage income effect of qualifications, displayed and bolded in Tables 6.2 through 6.5[4], exhibit mixed results although consistent trends over all samples. The general increase in the income effects of all qualifications against the No Qualification group does not necessarily translate into increases in the marginal income effects of the qualifications[5]. Instead it is the relative increase between qualifications that matters. Hence, the results report increases for some qualifications but not for others. Nonetheless, the female and male samples report remarkably similar results.

For the female sample, Sixth Form Certificate, Bursary, Diploma (from Sixth Form Certificate), Bachelors Degree (from Sixth Form Certificate), and Bachelors Degree (instead of Diploma) all showed increased marginal income effects from 1996 to 2001[6]. In contrast, School Certificate, Diploma (from Bursary), Bachelors Degree (from Bursary) and Postgraduate Degree reported decreases. Similar to the results in section 6.1.1, Bursary and Bachelors Degree (from Sixth Form Certificate) exhibit the largest increases. Correspondingly, Diploma (from Bursary) reports the largest decrease.

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[4] Tables 6.3 through 6.6 display the results for the Employed-Fulltime samples. Results for the All-Employed samples are displayed in the appendix at the end of the chapter.

[5] The Tables show the difference in income effects between all qualifications. However, this section only discusses the income effect of the marginal qualification (the effect of the next highest qualification). The income effects of the marginal are those in bold in the tables.

[6] The marginal qualifications are explained as follows: School Certificate equates to No Qualification to School Certificate; Sixth Form Certificate equates to School Certificate to Sixth Form Certificate; Bursary equates to Sixth Form Certificate to Bursary; Diploma equates to either Sixth Form Certificate or Bursary to Diploma; Bachelors Degree equates to either Sixth Form Certificate or Bursary to Bachelors Degree; on top of that is Bachelors Degree instead of Diploma; and finally, Postgraduate Degree equates to Bachelors Degree to Postgraduate Degree.

The male sample exhibits the same trends with the exception of School Certificate which increased. Furthermore, like the female sample, Bursary, Bachelors Degree (from Sixth Form Certificate) along with Sixth Form Certificate reported the largest increases and Diploma (from Bursary) the largest decrease. However, the male sample reported, on average, increases or decreases on a smaller scale.

Table 6.2: Marginal Percentage Income Effects of Secondary and Tertiary Qualifications

Females Fulltime-Employed 1996

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad. Degree
No Qual.		26.67	42.26	27.81	43.12	73.17	99.58
School Cert.	**26.67**		12.30	0.90	12.98	36.71	57.55
6th Form C.	42.26	**12.30**		-10.15	0.61	21.73	40.29
Bursary	27.81	0.90	**-10.15**		11.98	35.49	56.15
Diploma	43.12	12.98	**0.61**	**11.98**		21.00	39.45
Bach. Deg.	73.17	36.71	**21.73**	**35.49**	**21.00**		15.25
P'grad Deg.	99.58	57.55	40.29	56.15	39.45	**15.25**	

Table 6.3: Marginal Percentage Income Effects of Secondary and Tertiary Qualifications

Females Fulltime-Employed 2001

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad. Degree
No Qual.		24.12	42.75	38.38	45.56	83.74	110.11
School Cert.	**24.12**		15.01	11.49	17.28	48.04	69.28
6th Form C.	42.75	**15.01**		-3.06	1.97	28.72	47.19
Bursary	38.38	11.49	**-3.06**		5.19	32.79	51.84
Diploma	45.56	17.28	**1.97**	**5.19**		26.23	44.35
Bach. Deg.	83.74	48.04	**28.72**	**32.79**	**26.23**		14.35
P'grad Deg.	110.11	69.28	47.19	51.84	44.35	**14.35**	

Table 6.4: Marginal Percentage Income Effects of Secondary and Tertiary Qualifications

Males Fulltime-Employed 1996

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad. Degree
No Qual.		18.29	30.74	22.57	30.30	74.72	95.57
School Cert.	**18.29**		10.52	3.62	10.15	47.70	65.33
6th Form C.	30.74	**10.52**		-6.25	-0.34	33.64	49.59
Bursary	22.57	3.62	**-6.25**		6.31	42.55	59.56
Diploma	30.30	10.15	**-0.34**	**6.31**		34.09	50.09
Bach. Deg.	74.72	47.70	**33.64**	**42.55**	**34.09**		11.94
P'grad Deg.	95.57	65.33	49.59	59.56	50.09	**11.94**	

Table 6.5: Marginal Percentage Income Effects of Secondary and Tertiary Qualifications

Males Fulltime-Employed 2001

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad. Degree
No Qual.		19.69	35.64	33.79	35.98	85.24	100.49
School Cert.	**19.69**		13.32	11.77	13.61	54.76	67.50
6th Form C.	35.64	**13.32**		-1.36	0.25	36.57	47.81
Bursary	33.79	11.77	**-1.36**		1.64	38.46	49.86
Diploma	35.98	13.61	**0.25**	**1.64**		36.22	47.44
Bach. Deg.	85.24	54.76	**36.57**	**38.46**	**36.22**		8.23
P'grad Deg.	100.49	67.50	47.81	49.86	47.44	**8.23**	

For Sixth Form Certificate, Bursary, Diploma (from Sixth Form Certificate), Bachelors Degree (from Sixth Form Certificate) and Bachelors Degree (instead of Diploma), the increase in the marginal income effects marks a return to the increases shown from 1981 to 1991 in Maani (1999). In her study, the marginal income effects[1] showed increases from 1981 to 1991 and then stabilisation around 1991 levels in 1996 (the exception was

[1] Maani uses the term "returns to post-compulsory education" instead of income effects of the marginal qualification.

decreases for the marginal income effects of Bachelors Degree against lower qualifications in 1996). Therefore, the results for the qualifications noted above for the 2001 Census data follow the trend from 1981 to 1991 rather than continue the stabilisation of the marginal income effects shown by the 1996 Census data. The most notable exception was the marginal income effect of Postgraduate Degree which showed a decrease and hence reversed the trend shown over previous years. The marginal income effect of Diploma and Bachelors Degree (from Bursary) also produced an anomaly. Section 6.1.5 discusses this below.

6.1.4 Increased Relative Incomes for Skilled Workers

The results from section 6.1.1 indicate an increase in relative incomes for skilled workers (and conversely a decrease relative income for unskilled workers) in both the female and male samples from 1996 to 2001. Looking at the unskilled group of workers, those with No Qualification and those with School Certificate, and comparing them with the skilled workers, in this case those with a Bachelors Degree, the results show a polarisation of incomes. The income effect of Bachelors Degree against the No Qualification group shows the highest increase (after Bursary) and the income effect of School Certificate against the No Qualification group shows the lowest increase. Therefore, from 1996 to 2001 the incomes of the unskilled and skilled workers moved apart.

This result could be the consequence of a structural shift in the economy. A structural shift may have seen the demand for a skilled labour force increase and therefore the price of skilled labour, relative to unskilled, increase as a result. Another explanation lies with the business cycle in that 2001 saw high economic growth and therefore higher incomes in general.[2] This, however, does not explain why all qualifications showed increased income against the omitted level of education, No Qualification.

[2] 2001 saw annual economic growth of 4.5 percent, well above New Zealand's long-run average.

6.1.5 Increased Income Effect of the Bursary Qualification

Results from the 2001 Census data point towards a maturation of the Bursary qualification. From 1981 to 1996 the income effect of Bursary against the No Qualification group was low and significantly below that for Sixth Form Certificate. As a result, the marginal income effect of Bursary was negative, even exceeding negative ten percent for Employed-Fulltime females in 1996. However, results from 2001 showed the income effect of Bursary converging to Sixth Form Certificate. Consequently, the marginal income effect of Bursary moved towards zero percent for Employed-Fulltime females and males. This result can be explained by relative young age of the Bursary qualification in previous Census years, and the increase in its income effect can be explained by the maturity of the qualification.

In previous studies, using older Census data, the majority of observations listing Bursary as their highest qualification were young adults many of whom were students working part-time. In the 2001 Census, a proportion of those same observations have moved into the higher earning cohorts and fulltime employment without gaining higher qualifications. Consequently, the income effect of Bursary has increased relatively against Sixth Form Certificate. Furthermore, the marginal income effect of Bursary moved towards zero. It can be moved now that Bursary is no longer just a stepping stone for those moving on to university (Maani 1994), but also as a "stand alone" qualification. Given this it is useful to compare the marginal income effects of Bachelors Degree, Diploma against Bursary as well as against Sixth Form Certificate. From this it can be noted that while the marginal income effects all decreased against Bursary, against Sixth Form Certificate they increased.

6.2 Model Specification

6.2.1 Labour Force Experience Specification

Using potential years of labour force[3] participation, instead of age, in the income function alters the structure of the results. The pattern of results changes consistently over both years and over the female and male samples. The specification, using age and age squared, results in higher income effects for School Certificate, Sixth Form Certificate against the No Qualification group and a higher coefficient for age. This contrasts with the specification using potential years of labour force experience. The alternative specification exhibits lower income effects for School Certificate, Sixth Form Certificate and a lower coefficient for age. Accordingly, the remaining higher levels of qualification, Bursary and tertiary qualifications report higher income effects than in the standard specification. The results of the alternate specification appeal more intuitively. The reasoning for this is as follows:

> Take the example of two 30 year-old individuals, one with School Certificate and the other with a Bachelors Degree. In the standard specification, their ages are the same; hence the difference in their incomes is reflected solely in their level of education. However, in the alternate specification, the individuals differ in not only their education levels but also in their level of labour force experience. The individual with School Certificate has five more years experience. Therefore, the alternate specification places more emphasis on the level of education to explain the difference in income and less emphasis on the years of experience. Hence, the income effect of School Certificate and the coefficient for labour force experience are lower in the alternate specification than in the standard specification (remembering that the proxy for labour force experience in the standard specification is age).

[3] The calculation of potential years of labour force experience is detailed in chapter 4.

Table 6.6: Income Effects of Secondary and Tertiary Education of Fulltime-Employed Females 1996 and 2001

Comparison of the Age and Potential Years of Labour Force Experience Specifications

(Dependent Variable: The Natural Logarithm of Annual Before-Tax Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1996		2001	
	Age Specification	Lab. Force Exp. Specification	Age Specification	Lab. Force Exp. Specification
Intercept	7.820108 (278.04)	9.181221 (1013.59)	7.784646 (286.78)	9.279658 (1003.81)
School Certificate	0.236446 (32.45)	0.218243 (29.90)	0.216051 (29.87)	0.201197 (27.74)
Sixth Form Certificate	0.352459 (43.63)	0.339205 (41.61)	0.355919 (44.54)	0.337639 (41.77)
Bursary	0.245391 (18.60)	0.25731 (19.35)	0.324807 (27.67)	0.320995 (27.03)
Diploma	0.358518 (55.54)	0.389534 (59.01)	0.375408 (56.11)	0.395109 (57.75)
Bachelors Degree	0.549112 (59.26)	0.646579 (67.92)	0.608375 (75.27)	0.690453 (82.16)
Postgraduate Degree	0.691028 (56.72)	0.807234 (65.39)	0.742455 (72.12)	0.846464 (80.32)
Age	0.094711 (62.89)	- -	0.101329 (72.50)	- -
Age^2	-0.00105 (54.29)	- -	-0.00111 (63.60)	- -
Yrs. of Lab. Force Exp.	- -	0.054785 (69.45)	- -	0.057074 (78.45)
Yrs. of Lab. Force $Exp.^2$	- -	-0.00098 (53.98)	- -	-0.00101 (62.34)
Adjusted R^2	0.1569	0.1565	0.1768	0.1741
Sample Size	78,107	78,107	87,601	87,601

Table 6.7: Income Effects of Secondary and Tertiary Education of Fulltime-Employed Males 1996 and 2001

Comparison of the Age and Potential Years of Labour Force Experience Specifications

(Dependent Variable: The Natural Logarithm of Annual Before-Tax Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1996		2001	
	Age Specification	Lab. Force Exp. Specification	Age Specification	Lab. Force Exp. Specification
Intercept	7.445156 (362.03)	9.268678 (1374.88)	7.542144 (365.38)	9.347303 (1322.77)
School Certificate	0.167989 (29.37)	0.145638 (25.38)	0.179775 (32.60)	0.162203 (29.34)
Sixth Form Certificate	0.268048 (41.88)	0.265552 (41.17)	0.304824 (49.10)	0.300904 (48.09)
Bursary	0.203508 (21.40)	0.235255 (24.58)	0.29109 (32.25)	0.314331 (34.59)
Diploma	0.26468 (60.80)	0.315575 (71.13)	0.307365 (65.64)	0.349869 (73.45)
Bachelors Degree	0.558003 (79.46)	0.672562 (95.31)	0.616495 (92.36)	0.715574 (105.77)
Postgraduate Degree	0.670762 (77.19)	0.804502 (92.57)	0.695607 (82.98)	0.81677 (96.26)
Age	0.128067 (118.66)	- -	0.125292 (118.80)	- -
Age^2	-0.0014 (103.48)	- -	-0.00135 (104.31)	- -
Yrs. of Lab. Force Exp.	- -	0.076258 (127.49)	- -	0.074624 (126.68)
Yrs. of Lab. Force $Exp.^2$	- -	-0.00134 (101.90)	- -	-0.00128 (102.26)
Adjusted R^2	0.2555	0.2529	0.2541	0.2503
Sample Size	128,529	128,529	134,146	134,146

Maani (1999), while reporting the results for both specifications, does not discuss this in detail. This study, however, places more emphasis on the alternative specification, and puts forward that it be considered equally in any analysis using this technique. The results of the alternate specification are provided alongside the standard specification in Tables 6.6 and 6.7 above.

6.2.2 Before-Tax Versus After-Tax Earnings

The income function analysis utilised both Before-Tax and After-Tax income as the dependent variable and produced consistent results over all samples. It must be pointed out that the marginal tax rates in 1996 and 2001 differed; therefore, comparing the after-tax income results is not possible. The before-tax results serve this purpose. In all the samples, the Before-Tax income effects against the No Qualification group and the marginal income effects exceed the corresponding After-Tax results. Overall, the difference between the Before-Tax and After-Tax results widens as the level of education moves higher. This reflects the progressive taxation system in place in New Zealand at the time of both Censuses. Tables 6.9 through 6.12 show the Before-Tax and After-Tax results in full in the appendices at the end of the chapter.

6.2.3 All-Employed Versus Employed-Fulltime Samples

The results of the income regression analysis on the All-Employed (AE) and Fulltime-Employed (FE) samples differ significantly. Firstly, the female AE sample shows higher income effects for Diploma, Bachelors Degree and Postgraduate Degree in both 1996 and 2001. In comparison, the FE sample shows higher income effects for School Certificate, Sixth Form Certificate and Bursary. For the FE samples this corresponds to; lower marginal income effects for Diploma and Bachelors Degree (from both Sixth Form Certificate and Bursary); and for Bachelors Degree (instead of Diploma); while the remaining qualifications all show higher marginal income effects than for the AE sample. The male samples show similar characteristics. The only exception is that Bachelors Degree (instead of Diploma) shows a higher marginal income effect in the FE sample than in the AE sample.

The link between labour force status and the level of education drives the pattern of change in the income effects and subsequent marginal income effects between the two samples[4]. The AE samples include many individuals studying or working part-time with Sixth Form Certificate or Bursary as their highest level of qualification. These individuals have relatively low incomes hence the lower income effects and higher marginal income effects relative to these qualifications in the AE samples. The FE samples omit these individuals, so the average income for Sixth Form Certificate and Bursary increases. This leads to higher income effects and lower marginal income effects relative to Sixth Form Certificate and Bursary.

Similar reasoning explains the large decrease in the income effect of Bachelors Degree from the female AE sample to the FE sample, and the fall in the marginal income effect of Bachelors Degree (instead of Diploma). The labour force participation rates of females with Bachelors Degrees is high relative to the lower qualifications (and high compared to females with Diplomas), therefore the average income is higher also. This leads to a higher income effect for Bachelors Degree. The FE sample removes the individuals employed part-time and therefore the average incomes of the lower qualifications increase relative to the average for individuals with a Bachelors Degree. As a consequence, the income effect of Bachelors Degree decreases, the income effects of the lower qualifications increase, including for Diploma. Furthermore, the marginal income effect of Bachelors Degree (instead of Diploma) decreases.

6.2.4 Allowing for the Increase in Immigration

Incorporating a variable for immigration[5] into the income function leads to an increase in the income effects of Bachelors Degree and Postgraduate Degree against the No Qualification group in all samples. This result mirrors that of Maani (1999) for earlier years. This result can be traced to

[4] Figures 4.5 and 4.6, in chapter 4, show labour status by level of education for the female and male samples.
[5] Chapter 4 details the definition of a recent immigrant used in this study.

the targeted immigration policy of accepting skilled immigrants into New Zealand during the two periods. So while large numbers of skilled immigrants entered New Zealand, their incomes on average failed to reach the same level as long-term residents. Maani (1999) posits that language, cultural and other barriers faced by new immigrants in the workplace created this gap. Tables 6.16 and 6.17 compare the results using this specification are compared with the standard specification in the appendices at the end of the chapter.

6.3 Diploma Breakdown

Using four dummy variables for the Diploma qualification, instead of a single variable, demonstrated a wide range of outcomes for the Diploma qualification (See Table 6.8 on the following page for the comparison). For example, the coefficient for the single Diploma variable for the Fulltime-Employed females sample in 1996 was 0.359. Using four variables, the coefficients for Basic Vocational Diploma, Skilled Vocational Diploma, Intermediate Vocational Diploma and Advanced Vocational Diploma were 0.206941, 0.276477, 0.457444 and 0.429674 respectively. Therefore, the range around the single variable was over 0.25 from the lowest coefficient for Basic Vocational Diploma to the highest for Intermediate Vocational Diploma. Table 6.8 highlights the comparison of the results of the income function using one variable against using four. The 2001 and both male samples found similar ranges to the 1996 female sample. The marginal income effect for Diploma (from Sixth Form Certificate), using the single variable, was 0.61 percent. The marginal income effect for Basic Vocational Diploma, Skilled Vocational Diploma, Intermediate Vocational Diploma and Advanced Vocational Diploma were 13.1, -6.79, 11.7 and 8.64 percent respectively. Again, other samples reported results of similar magnitudes.

Furthermore, the breakdown of the Diploma qualification revealed additional volatility. The coefficient for Intermediate Vocational Diploma and the

Table 6.8: Income Effects of Secondary and Tertiary Education of Fulltime-Employed Females

Comparison of the Standard Model with the Diploma Breakdown Model

(Dependent Variable: The Natural Logarithm of Annual Before-Tax Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1996		2001	
	Aggregated Dip. Variable	Diploma Breakdown	Aggregated Dip. Variable	Diploma Breakdown
Intercept	7.820108 (278.04)	7.860042 (278.51)	7.784646 (286.78)	7.832156 (286.26)
School Certificate	0.236446 (32.45)	0.233959 (32.11)	0.216051 (29.87)	0.213399 (29.50)
Sixth Form Certificate	0.352459 (43.63)	0.346831 (42.92)	0.355919 (44.54)	0.349297 (43.69)
Bursary	0.245391 (18.60)	0.237197 (17.95)	0.324807 (27.67)	0.314064 (26.71)
Basic Voc. Diploma	- -	0.206941 (17.94)	- -	0.239431 (22.62)
Skilled Voc. Diploma	- -	0.276477 (25.65)	- -	0.271532 (23.43)
Int. Voc. Diploma	- -	0.457444 (22.28)	- -	0.26807 (18.08)
Advanced Voc. Diploma	- -	0.429674 (59.52)	- -	0.466549 (62.76)
Diploma	0.358518 (55.54)	- -	0.375408 (56.11)	- -
Bachelors Degree	0.549112 (59.26)	0.545135 (58.79)	0.608375 (75.27)	0.602078 (74.45)
Postgraduate Degree	0.691028 (56.72)	0.689478 (56.55)	0.742455 (72.12)	0.739192 (71.75)
Age	0.094711 (62.89)	0.093112 (61.74)	0.101329 (72.50)	0.099715 (71.04)
Age^2	-0.00105 (54.29)	-0.00103 (53.54)	-0.00111 (63.60)	-0.0011 (62.82)
Adjusted R^2	0.1569	0.1619	0.1768	0.1827
Sample Size	78,107	78,107	87,601	87,601

corresponding marginal income effect fluctuate significantly for the female samples from 1996 to 2001. In the Employed-Fulltime female sample for 1996, the marginal income effects of Intermediate Vocational Diploma and Advanced Vocational Diploma (from Sixth Form Certificate) were 11.7 percent and 8.64 percent. In the 2001 sample, the marginal income effects reversed; for Intermediate Vocational Diploma the marginal income effect dropped to -7.8 percent while for Advanced Vocational Diploma it rose to 12.44 percent. The most likely explanation for this fluctuation lies in the changing definitions of the Intermediate Vocational Diploma qualification over the two censuses. This has been confounded by the introduction of a new range of polytechnic qualifications in recent time. However, the grouping of the Diploma into a single variable would not have revealed this result. Tables 6.21 through 6.26, in the appendices at the end of the chapter, include the breakdown of the marginal income effects of the four sub-Diploma qualifications.

6.3.1 Stability Testing on the Diploma Breakdown

Testing on the significance of the coefficients for the four separate dummy variables confirmed the above results. The hypotheses:

$$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0 \qquad (6.1)$$

$$\alpha_1 = \alpha_2 = 0 \qquad (6.2)$$

$$\alpha_3 = \alpha_4 = 0 \qquad (6.3)$$

where α_1, α_2, α_3 and α_4 refer to the coefficients for Basic Vocational Diploma, Skilled Vocational Diploma, Intermediate Vocational Diploma and Advanced Vocational Diploma respectively, were all rejected at the 99 percent confidence level. The rejection of the hypothesis as represented by equation 6.1 implies that the coefficients for Basic Vocational Diploma, Skilled Vocational Diploma, Intermediate Vocational Diploma and Advanced Vocational Diploma are not equal. That is to say they are significantly different from each other. Furthermore, the rejection of the hypotheses as represented by equations 6.2 and 6.3 indicates that the coefficients for Basic Vocational Diploma and Skilled Vocational Diploma are not equal and likewise for Intermediate Vocational Diploma and Advanced Vocational Diploma.

6.4 Chapter 6 - Appendices

Table 6.9: 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 Sample		Fulltime-Employed Sample	
	Before-Tax Income	After-Tax Income	Before-Tax Income	After-Tax Income
Intercept	7.138381 (291.46)	6.908654 (283.60)	7.820108 (278.04)	7.601088 (272.60)
School Certificate	0.169949 (22.74)	0.167234 (22.55)	0.236446 (32.45)	0.233048 (32.39)
Sixth Form Cert.	0.258716 (30.22)	0.254187 (29.92)	0.352459 (43.63)	0.346278 (43.41)
Bursary	0.09548 (7.90)	0.090422 (7.52)	0.245391 (18.60)	0.237893 (18.21)
Diploma	0.370828 (56.77)	0.36577 (56.5)	0.358518 (55.54)	0.351641 (55.21)
Bachelors Degree	0.600791 (61.72)	0.587246 (61.27)	0.549112 (59.26)	0.53204 (58.67)
Postgrad. Degree	0.729262 (55.12)	0.707195 (54.71)	0.691028 (56.72)	0.664076 (56.24)
Age	0.114375 (87.42)	0.113341 (87.21)	0.094711 (62.89)	0.093144 (62.51)
Age^2	-0.00127 (75.29)	-0.00126 (75.24)	-0.00105 (54.29)	-0.00103 (54.09)
Adjusted R^2	0.1561	0.155	0.1569	0.1545
Sample Size	119772	119772	78107	78107

Table 6.10: 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 Sample		Fulltime-Employed Sample	
	Before-Tax Income	After-Tax Income	Before-Tax Income	After-Tax Income
Intercept	6.448932 (322.21)	6.260489 (316.62)	7.445156 (362.03)	7.260503 (358.85)
School Certificate	0.137667 (22.86)	0.129806 (22.04)	0.167989 (29.37)	0.160342 (28.84)
Sixth Form Certificate	0.212151 (31.19)	0.199214 (29.93)	0.268048 (41.88)	0.25473 (40.98)
Bursary	0.078262 (8.24)	0.065277 (6.99)	0.203508 (21.40)	0.188891 (20.35)
Diploma	0.273398 (60.29)	0.262658 (59.51)	0.26468 (60.80)	0.253559 (60.09)
Bachelors Degree	0.529299 (71.93)	0.49825 (70.13)	0.558003 (79.46)	0.52505 (77.84)
Postgraduate Degree	0.641805 (70.36)	0.602158 (68.85)	0.670762 (77.19)	0.629336 (75.89)
Age	0.17606 (167.54)	0.172784 (167.02)	0.128067 (118.66)	0.12463 (117.86)
Age^2	-0.00196 (148.87)	-0.00193 (149.04)	-0.0014 (103.48)	-0.00136 (103.29)
Adjusted R^2	0.3363	0.336	0.2555	0.2528
Sample Size	143177	143177	128529	128529

Table 6.11: Income Effects of Secondary and Tertiary Education of Females 2001

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	All-Employed Sample		Fulltime-Employed Sample	
	Before-Tax Income	After-Tax Income	Before-Tax Income	After-Tax Income
Intercept	6.808991 (296.47)	6.629163 (291.02)	7.784646 (286.78)	7.62494 (284.73)
School Certificate	0.189501 (26.28)	0.184529 (25.94)	0.216051 (29.87)	0.210168 (29.71)
Sixth Form Certificate	0.300911 (36.91)	0.2918 (36.31)	0.355919 (44.54)	0.343803 (44.07)
Bursary	0.251615 (22.76)	0.241649 (22.10)	0.324807 (27.67)	0.310785 (26.98)
Diploma	0.408701 (61.10)	0.39937 (60.60)	0.375408 (56.11)	0.362699 (55.49)
Bachelors Degree	0.698905 (82.55)	0.677284 (81.78)	0.608375 (75.27)	0.581963 (74.29)
Postgraduate Degree	0.812466 (71.45)	0.778912 (70.84)	0.742455 (72.12)	0.702564 (71.47)
Age	0.133924 (112.21)	0.132105 (111.85)	0.101329 (72.50)	0.098517 (71.69)
Age^2	-0.00147 (97.41)	-0.00145 (97.37)	-0.00111 (63.60)	-0.00108 (63.13)
Adjusted R^2	0.1994	0.1983	0.1768	0.1739
Sample Size	133,557	133,557	87,601	87,601

Table 6.12: Income Effects of Secondary and Tertiary Education of Males 2001

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	All-Employed Sample		Fulltime-Employed Sample	
	Before-Tax Income	After-Tax Income	Before-Tax Income	After-Tax Income
Intercept	6.543255 (322.45)	6.41226 (321.60)	7.542144 (365.38)	7.416732 (367.87)
School Certificate	0.158038 (27.11)	0.1471 (26.07)	0.179775 (32.60)	0.169005 (31.94)
Sixth Form Certificate	0.258992 (39.08)	0.239244 (37.38)	0.304824 (49.10)	0.284152 (47.93)
Bursary	0.187008 (20.47)	0.16487 (18.59)	0.29109 (32.25)	0.266255 (30.75)
Diploma	0.310183 (62.86)	0.293084 (61.71)	0.307365 (65.64)	0.289429 (64.67)
Bachelors Degree	0.588856 (83.27)	0.541113 (80.81)	0.616495 (92.36)	0.565463 (90.32)
Postgraduate Degree	0.664756 (73.96)	0.607218 (71.98)	0.695607 (82.98)	0.63507 (81.56)
Age	0.171978 (165.59)	0.167555 (165.02)	0.125292 (118.80)	0.120641 (117.80)
Age^2	-0.00188 (147.56)	-0.00184 (148.00)	-0.00135 (104.31)	-0.0013 (104.22)
Adjusted R^2	0.3268	0.3278	0.2541	0.2519
Sample Size	148,782	148,782	134,146	134,146

Table 6.13: Expanded Chow Test Males and Females

(Dependent Variable: The Natural Logarithm of Annual Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	Females		Males	
	Single Dip. Variable	Diploma Breakdown	Single Dip. Variable	Diploma Breakdown
Intercept	-2.65283 (15.85)	-2.71941 (16.39)	0.862082 (6.86)	0.825053 (6.59)
School Certificate	0.221641 (3.75)	0.246832 (12.57)	-0.15178 (3.64)	0.089964 (6.44)
Sixth Form Certificate	-0.02304 (0.37)	-0.0001 (0.00)	-0.60976 (13.20)	-0.51912 (11.87)
Bursary	-1.22391 (13.87)	-1.19803 (14.42)	-1.53259 (23.90)	-1.4418 (23.12)
Diploma	-0.22987 (4.18)	- -	-0.3771 (10.00)	- -
Basic Voc. Diploma	- -	0.091036 (1.17)	- -	-0.36809 (5.83)
Skilled Voc. Diploma	- -	0.320109 (3.65)	- -	0.265076 (5.96)
Int. Voc. Diploma	- -	0.393699 (2.99)	- -	-0.17844 (2.28)
Advanced Voc. Diploma	- -	-0.50143 (8.36)	- -	-0.76272 (12.10)
Bachelors Degree	-1.45765 (18.33)	-1.4465 (19.53)	-1.61729 (25.48)	-1.52713 (24.65)
Postgraduate Degree	-1.59307 (14.11)	-1.5912 (14.55)	-1.55233 (16.16)	-1.46492 (15.40)
Age	1.267392 (68.31)	1.272467 (68.49)	0.868899 (62.26)	0.867155 (61.93)
Age^2	-0.4659 (62.14)	-0.0467 (62.14)	-0.02992 (53.45)	-0.0297 (52.82)
Year Dummy	-0.07576 (2.08)	-0.07469 (2.04)	0.107083 (3.89)	0.109613 (3.97)

Table 6.13: (Continued)

Sch. Cert. * Yr. Dummy	0.002497 (0.24)	0.001249 (0.12)	0.012703 (1.61)	0.010147 (1.29)
6th F.C. * Yr. Dummy	0.027858 (2.48)	0.025634 (2.28)	0.02742 (3.11)	0.024944 (2.83)
Bursary * Year Dummy	0.01944 (1.16)	0.016504 (0.99)	0.050743 (4.06)	0.048013 (3.84)
Diploma * Year Dummy	0.020098 (2.18)	- -	0.047132 (7.46)	- -
B. Voc. Dip. * Yr. Dum.	- -	0.023986 (1.57)	- -	0.05235 (4.22)
Sk. Voc. Dip. * Yr. Dum.	- -	0.020644 (1.31)	- -	0.043289 (5.74)
Int. Voc. Dip. * Yr. Dum.	- -	-0.1637 (6.65)	- -	-0.01197 (1.02)
Adv. V. Dip * Yr. Dum.	- -	0.041303 (4.02)	- -	0.073923 (7.60)
Bach. Deg. * Yr. Dummy	0.054139 (4.51)	0.052113 (4.34)	0.044854 (4.76)	0.043437 (4.61)
P'grad Deg. * Yr. Dum.	0.046978 3.01	0.04576 (2.93)	0.022254 (1.89)	0.021756 (1.85)
Age * Year Dummy	0.009959 (5.16)	0.010219 (5.29)	-0.00155 (1.08)	-0.00134 (0.93)
Age² * Year Dummy	-0.00011 (4.62)	-0.00012 (4.87)	0.000021 (1.19)	0.000016 (0.88)
School Certificate * Age	0.000613 (0.20)	-0.0009 (1.94)	0.015577 (7.03)	0.001788 (5.10)
6th Form Cert. * Age	0.019676 (5.71)	0.018391 (5.98)	0.044815 (17.55)	0.039917 (16.46)
Bursary * Age	0.086274 (16.56)	0.084845 (17.10)	0.093253 (25.27)	0.088356 (24.53)
Diploma * Age	0.02811 (9.87)	- -	0.033818 (17.52)	- -
Basic Voc. Dip. * Age	- -	0.006599 (1.50)	- -	0.027113 (7.89)
Skilled Voc. Dip. * Age	- -	-0.00325 (0.68)	- -	0.001763 (0.77)
Int. Voc. Diploma. * Age	- -	0.00005 (0.01)	- -	0.027807 (7.01)

Table 6.13: (Continued)

Adv. Voc. Dip. * Age	- -	0.04598 (15.17)	- -	0.054445 (17.14)
Bachelors Degree * Age	0.100704 (23.50)	0.100016 (25.02)	0.102236 (31.23)	0.097355 (30.54)
Postgrad. Degree * Age	0.108006 (18.62)	0.107781 (19.23)	0.10188 (21.66)	0.097115 (20.89)
Age² * Age	0.000736 (56.81)	0.000737 (56.79)	0.000452 (47.24)	0.000447 (46.55)
School Cert. * Age²	-0.00002 (0.48)	0.0001 (.)	-0.00018 (6.30)	0.0001 (.)
Sixth Form Cert. * Age²	-0.00027 (6.04)	-0.00025 (6.24)	-0.00052 (15.62)	-0.00046 (14.43)
Bursary * Age²	-0.0011 (15.63)	-0.00108 (15.99)	-0.0011 (22.36)	-0.00104 (21.56)
Diploma * Age²	-0.00032 (9.21)	- -	-0.00042 (17.71)	- -
Basic Voc. Dip. * Age²	- -	-0.00011 (1.84)	- -	-0.00032 (7.24)
Skilled Voc. Dip. * Age²	- -	0.000024 (0.39)	- -	-0.00007 (2.66)
Int. Voc. Diploma * Age²	- -	-0.000001 (0.01)	- -	-0.00036 (7.43)
Adv. Voc. Dip. * Age²	- -	-0.00054 (14.66)	- -	-0.00062 (16.05)
Bach. Degree * Age²	-0.00118 (21.51)	-0.00117 (22.73)	-0.0011 (27.22)	-0.00104 (26.42)
Postgrad. Degree * Age²	-0.0012 (16.81)	-0.00119 (17.34)	-0.00108 (19.37)	-0.00102 (18.55)
Age² * Age²	-0.000004 (52.22)	-0.000004 (52.19)	-0.000002 (42.74)	-0.000002 (42.10)
Recent Imm. Dummy	0.024916 (0.09)	0.036298 (14.42)	0.543448 (2.41)	0.607118 (2.69)
Rec. Imm. Dummy * Yr.Dum	0.16816 (3.99)	0.161898 (3.85)	0.163598 (4.68)	0.157808 (4.52)
Rec. Imm. Dummy * Age	-0.03273 (1.90)	-0.03347 (1.96)	-0.06041 (4.78)	-0.06357 (5.01)
Rec. Imm. Dum. * Age²	0.000364 (1.48)	0.000377 (1.55)	0.00066 (3.82)	0.000695 (4.01)
Adjusted R^2	0.2340	0.2403		0.2403
Sample Size	165,708	165,708	165,708	165,708

Table 6.14: Percentage Income Differentials of Secondary and Tertiary Qualifications

Females All-Employed 1996

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad . Degree
No Qual.		18.52	29.53	10.02	44.89	82.36	107.35
School Cert.	**18.52**		9.28	-7.18	22.25	53.86	74.95
6th Form C.	29.53	**9.28**		-15.06	11.86	40.79	60.09
Bursary	10.02	-7.18	**-15.06**		31.70	65.75	88.47
Diploma	44.89	22.25	**11.86**	**31.70**		25.86	43.11
Bach. Deg.	82.36	53.86	**40.79**	**65.75**	**25.86**		13.71
P'grad Deg.	107.35	74.95	60.09	88.47	43.11	**13.71**	

Table 6.15: Percentage Income Differentials of Secondary and Tertiary Qualifications

Females All-Employed 2001

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad . Degree
No Qual.		20.86	35.11	28.61	50.49	101.15	125.35
School Cert.	**20.86**		11.79	6.41	24.51	66.43	86.44
6th Form C.	35.11	**11.79**		-4.81	11.38	48.88	66.79
Bursary	28.61	6.41	**-4.81**		17.01	56.41	75.22
Diploma	50.49	24.51	**11.38**	**17.01**		33.67	49.75
Bach. Deg.	101.15	66.43	**48.88**	**56.41**	**33.67**		12.03
P'grad Deg.	125.35	86.44	66.79	75.22	49.75	**12.03**	

Table 6.16: Percentage Income Differentials of Secondary and Tertiary Qualifications

Males All-Employed 1996

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad . Degree
No Qual.		14.76	23.63	8.14	31.44	69.77	89.99
School Cert.	**14.76**		7.73	-5.77	14.54	47.94	65.56
6th Form C.	23.63	**7.73**		-12.53	6.32	37.32	53.67
Bursary	8.14	-5.77	**-12.53**		21.55	56.99	75.69
Diploma	31.44	14.54	**6.32**	**21.55**		29.16	44.54
Bach. Deg.	69.77	47.94	**37.32**	**56.99**	**29.16**		11.91
P'grad Deg.	89.99	65.56	53.67	75.69	44.54	**11.91**	

Table 6.17: Percentage Income Differentials of Secondary and Tertiary Qualifications

Males All-Employed 2001

Level of Qualification	No Qual.	School Cert.	6th Form Cert.	Bursary	Diploma	Bach. Degree	Postgrad . Degree
No Qual.		17.12	29.56	20.56	36.37	80.19	94.40
School Cert.	**17.12**		10.62	2.94	16.43	53.85	65.98
6th Form C.	29.56	**10.62**		-6.95	5.25	39.08	50.04
Bursary	20.56	2.94	**-6.95**		13.11	49.46	61.24
Diploma	36.37	16.43	**5.25**	**13.11**		32.14	42.56
Bach. Deg.	80.19	53.85	**39.08**	**49.46**	**32.14**		7.89
P'grad Deg.	94.40	65.98	50.04	61.24	42.56	**7.89**	

Table 6.18: Income Effects of Secondary and Tertiary Education of Fulltime-Employed Females 1996 and 2001

Comparison of the Standard Model with the Model Including the Recent Immigrant Variable

(Dependent Variable: The Natural Logarithm of Annual Before-Tax Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1996		2001	
	Without Rec. Imm. Variable	With Rec. Imm. Variable	Without Rec. Imm. Variable	With Rec. Imm. Variable
Intercept	7.820108 (278.04)	7.816197 (278.27)	7.784646 (286.78)	7.776863 (286.64)
School Certificate	0.236446 (32.45)	0.231879 (31.86)	0.216051 (29.87)	0.213099 (29.48)
Sixth Form Certificate	0.352459 (43.63)	0.347092 (43.04)	0.355919 (44.54)	0.351873 (44.07)
Bursary	0.245391 (18.60)	0.240807 (18.27)	0.324807 (27.67)	0.322324 (27.54)
Diploma	0.358518 (55.54)	0.360947 (56.04)	0.375408 (56.11)	0.380423 (56.86)
Bachelors Degree	0.549112 (59.26)	0.560943 (60.98)	0.608375 (75.27)	0.623371 (77.40)
Postgraduate Degree	0.691028 (56.72)	0.718813 (58.92)	0.742455 (72.12)	0.772761 (74.77)
Age	0.094711 (62.89)	0.095485 (63.47)	0.101329 (72.50)	0.102306 (73.21)
Age^2	-0.00105 (54.29)	-0.00106 (55.02)	-0.00111 (63.60)	-0.00112 (64.48)
Rec. Immigrant Variable	- -	-0.30927 (14.10)	- -	-0.24049 (16.67)
Adjusted R^2	0.1569	0.1607	0.1768	0.1806
Sample Size	78,107	78,107	87,601	87,601

Table 6.19: Income Effects of Secondary and Tertiary Education of Fulltime-Employed Males 1996 and 2001

Comparison of the Standard Model with the Model Including the Recent Immigrant Variable

(Dependent Variable: The Natural Logarithm of Annual Before-Tax Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1996		2001	
	Without Rec. Imm. Variable	With Rec. Imm. Variable	Without Rec. Imm. Variable	With Rec. Imm. Variable
Intercept	7.445156 (362.03)	7.440352 (361.91)	7.542144 (365.38)	7.533346 (365.15)
School Certificate	0.167989 (29.37)	0.165361 (28.94)	0.179775 (32.60)	0.177247 (32.19)
Sixth Form Certificate	0.268048 (41.88)	0.265357 (41.49)	0.304824 (49.10)	0.301958 (48.70)
Bursary	0.203508 (21.40)	0.200805 (21.13)	0.29109 (32.25)	0.290012 (32.19)
Diploma	0.26468 (60.80)	0.267284 (61.43)	0.307365 (65.64)	0.313434 (66.96)
Bachelors Degree	0.558003 (79.46)	0.570614 (82.02)	0.616495 (92.36)	0.636907 (95.77)
Postgraduate Degree	0.670762 (77.19)	0.69601 (79.69)	0.695607 (82.98)	0.731316 (87.46)
Age	0.128067 (118.66)	0.128649 (119.24)	0.125292 (118.80)	0.126264 (119.79)
Age²	-0.0014 (103.48)	-0.00141 (104.20)	-0.00135 (104.31)	-0.00136 (105.53)
Rec. Immigrant Variable	- -	-0.2468 (15.14)	- -	-0.27577 (22.80)
Adjusted R^2	0.2555	0.2579	0.2541	0.2584
Sample Size	128,529	128,529	134,146	134,146

Table 6.20: Income Effects of Secondary and Tertiary Education of Fulltime-Employed Males

Comparison of the Standard Model with the Diploma Breakdown Model

(Dependent Variable: The Natural Logarithm of Annual Before-Tax Income)

Least Squares Regression Coefficients
(t-ratios)

Explanatory Variables	1996		2001	
	Aggregated Dip. Variable	Diploma Breakdown	Aggregated Dip. Variable	Diploma Breakdown
Intercept	7.445156 (362.03)	7.468898 (362.54)	7.542144 (365.38)	7.559341 (364.84)
School Certificate	0.167989 (29.37)	0.167193 (29.23)	0.179775 (32.60)	0.179189 (32.50)
Sixth Form Certificate	0.268048 (41.88)	0.26671 (41.67)	0.304824 (49.10)	0.303791 (48.93)
Bursary	0.203508 (21.40)	0.201405 (21.16)	0.29109 (32.25)	0.289281 (32.03)
Basic Voc. Diploma	- -	0.161877 (17.72)	- -	0.224072 (25.70)
Skilled Voc. Diploma	- -	0.227704 (43.73)	- -	0.254887 (45.24)
Int. Voc. Diploma	- -	0.321897 (38.89)	- -	0.303958 (35.16)
Advanced Voc. Diploma	- -	0.355765 (51.80)	- -	0.431143 (61.44)
Diploma	0.26468 (60.80)	- -	0.307365 (65.64)	- -
Bachelors Degree	0.558003 (79.46)	0.558018 (79.44)	0.616495 (92.36)	0.616262 (92.32)
Postgraduate Degree	0.670762 (77.19)	0.671431 (77.24)	0.695607 (82.98)	0.695906 (83.01)
Age	0.128067 (118.66)	0.126938 (117.48)	0.125292 (118.80)	0.124557 (117.80)
Age^2	-0.0014 (103.48)	-0.00138 (102.52)	-0.00135 (104.31)	-0.00134 (103.62)
Adjusted R^2	0.2555	0.2582	0.2541	0.2576
Sample Size	128,529	128,529	134,146	134,146

Table 6.21: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Females All-Employed 1996

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		18.23	28.91	9.27	29.79	30.21	67.14	54.67	81.78	107.04
School Cert.	18.23		9.03	-7.58	9.77	10.13	41.37	30.82	53.75	75.12
Sixth FC	28.91	9.03		-15.24	0.68	1.00	29.66	19.98	41.01	60.61
Bursary	9.27	-7.58	15.24		18.78	19.16	52.96	41.55	66.36	89.48
Bas. V. Dip.	29.79	9.77	0.68	18.78		0.32	28.78	19.18	40.06	59.53
Sk. V. Dip.	30.21	10.13	1.00	19.16	0.32		28.37	18.79	39.61	59.01
Int. V. Dip.	67.14	41.37	29.66	52.96	28.78	28.37		-7.46	8.76	23.87
Adv. V. Dip.	54.67	30.82	19.98	41.55	19.18	18.79	-7.46		17.52	33.86
Bach. Deg.	81.78	53.75	41.01	66.36	40.06	39.61	8.76	17.52		13.90
P'grad Deg.	107.04	75.12	60.61	89.48	59.53	59.01	23.87	33.86	13.90	

Table 6.22: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Females Fulltime-Employed 1996

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		26.36	41.46	26.77	22.99	31.85	58.00	53.68	72.48	99.27
School Cert.	26.36		11.95	0.32	-2.67	4.34	25.04	21.62	36.50	57.70
Sixth FC.	41.46	11.95		-10.38	13.05	-6.79	11.70	8.64	21.93	40.87
Bursary	26.77	0.32	10.38		-2.98	4.01	24.64	21.22	36.06	57.19
Bas. V. Dip.	22.99	-2.67	13.05	-2.98		7.20	28.47	24.95	40.24	62.02
Sk. V. Dip.	31.85	4.34	-6.79	4.01	7.20		19.84	16.56	30.82	51.13
Int. Voc. Dip.	58.00	25.04	11.70	24.64	28.47	19.84		-2.74	9.17	26.12
Adv. V. Dip.	53.68	21.62	8.64	21.22	24.95	16.56	-2.74		12.24	29.67
Bach. Deg.	72.48	36.50	21.93	36.06	40.24	30.82	9.17	12.24		15.53
P'grad Deg.	99.27	57.70	40.87	57.19	62.02	51.13	26.12	29.67	15.53	

Table 6.23: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Females All-Employed 2001

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		17.91	31.77	27.58	38.22	34.33	55.51	69.04	124.45	158.90
School Cert.	17.91		11.75	8.20	17.23	13.93	31.89	43.37	90.36	119.58
Sixth FC	31.77	11.75		-3.18	4.90	1.95	18.02	28.29	70.34	96.49
Bursary	27.58	8.20	-3.18		8.34	5.30	21.90	32.50	75.93	102.94
Bas. V. Dip.	38.22	17.23	4.90	8.34		-2.81	12.51	22.30	62.39	87.31
Sk. V. Dip.	34.33	13.93	1.95	5.30	-2.81		15.76	25.84	67.09	92.73
Int. V. Dip.	55.51	31.89	18.02	21.90	12.51	15.76		8.70	44.33	66.48
Adv. V. Dip.	69.04	43.37	28.29	32.50	22.30	25.84	8.70		32.78	53.16
Bach. Deg.	124.45	90.36	70.34	75.93	62.39	67.09	44.33	32.78		15.35
P'grad Deg.	158.90	119.58	96.49	102.94	87.31	92.73	66.48	53.16	15.35	

Table 6.24: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Females Fulltime-Employed 2001

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		23.79	41.81	36.90	27.05	31.20	30.74	59.45	82.59	109.42
School Cert.	23.79		14.56	10.59	2.64	5.99	5.62	28.81	47.50	69.18
Sixth FC	41.81	14.56		-3.46	10.40	-7.48	-7.80	12.44	28.76	47.68
Bursary	36.90	10.59	-3.46		-7.19	-4.16	-4.50	16.47	33.38	52.98
Bas. V. Dip.	27.05	2.64	10.40	-7.19		3.26	2.91	25.50	43.71	64.83
Sk. V. Dip.	31.20	5.99	-7.48	-4.16	3.26		-0.35	21.53	39.17	59.63
Int. V. Dip.	30.74	5.62	-7.80	-4.50	2.91	-0.35		21.95	39.66	60.18
Adv. V. Dip.	59.45	28.81	12.44	16.47	25.50	21.53	21.95		14.51	31.34
Bach. Deg.	82.59	47.50	28.76	33.38	43.71	39.17	39.66	14.51		14.70
P'grad Deg.	109.42	69.18	47.68	52.98	64.83	59.63	60.18	31.34	14.70	

Table 6.25: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Males All-Employed 1996

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		14.65	23.45	7.90	19.12	27.78	38.11	42.06	69.77	90.09
School Cert.	14.65		7.68	-5.89	3.90	11.45	20.46	23.91	48.07	65.80
Sixth FC	23.45	7.68		-12.60	-3.51	3.50	11.87	15.07	37.51	53.98
Bursary	7.90	-5.89	12.60		10.40	18.42	28.00	31.66	57.34	76.17
Bas. V. Dip.	19.12	3.90	-3.51	10.40		7.26	15.94	19.26	42.51	59.57
Sk. V. Dip.	27.78	11.45	3.50	18.42	7.26		8.08	11.18	32.86	48.76
Int. Voc. Dip.	38.11	20.46	11.87	28.00	15.94	8.08		2.86	22.92	37.64
Adv. V. Dip.	42.06	23.91	15.07	31.66	19.26	11.18	2.86		19.50	33.80
Bach. Deg.	69.77	48.07	37.51	57.34	42.51	32.86	22.92	19.50		11.97
P'graduate Deg.	90.09	65.80	53.98	76.17	59.57	48.76	37.64	33.80	11.97	

Table 6.26: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Males Fulltime-Employed 1996

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		18.20	30.57	22.31	17.57	25.57	37.97	42.73	74.72	95.70
School Cert.	18.20		10.46	3.48	-0.53	6.24	16.73	20.75	47.82	65.57
Sixth FC	30.57	10.46		-6.32	-9.95	-3.83	5.67	9.31	33.82	49.89
Bursary	22.31	3.48	-6.32		-3.88	2.66	12.81	16.69	42.85	60.00
Bas. V. Dip.	17.57	-0.53	-9.95	-3.88		6.80	17.35	21.40	48.61	66.45
Sk. V. Dip.	25.57	6.24	-3.83	2.66	6.80		9.88	13.66	39.14	55.85
Int. Voc. Dip.	37.97	16.73	5.67	12.81	17.35	9.88		3.44	26.63	41.84
Adv. V. Dip.	42.73	20.75	9.31	16.69	21.40	13.66	3.44		22.42	37.12
Bach. Deg.	74.72	47.82	33.82	42.85	48.61	39.14	26.63	22.42		12.01
P'grad Deg.	95.70	65.57	49.89	60.00	66.45	55.85	41.84	37.12	12.01	

Table 6.27: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Males All-Employed 2001

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		17.04	29.42	20.34	26.31	30.13	36.49	52.19	80.15	94.44
School Cert.	17.04		10.58	2.82	7.92	11.18	16.62	30.04	53.92	66.13
Sixth FC.	29.42	10.58		-7.02	-2.41	0.55	5.47	17.60	39.20	50.24
Bursary	20.34	2.82	-7.02		4.96	8.14	13.43	26.47	49.70	61.58
Bas. V. Dip.	26.31	7.92	-2.41	4.96		3.03	8.07	20.50	42.63	53.94
Sk. V. Dip.	30.13	11.18	0.55	8.14	3.03		4.89	16.96	38.44	49.42
Int. Voc. Dip.	36.49	16.62	5.47	13.43	8.07	4.89		11.50	31.98	42.45
Adv. V. Dip.	52.19	30.04	17.60	26.47	20.50	16.96	11.50		18.37	27.76
Bach. Deg.	80.15	53.92	39.20	49.70	42.63	38.44	31.98	18.37		7.93
P'grad Deg.	94.44	66.13	50.24	61.58	53.94	49.42	42.45	27.76	7.93	

Table 6.28: Percentage Income Differentials of Secondary and Tertiary Qualifications with Diploma Breakdown

Males Fulltime-Employed 2001

Percentage	No Qual.	School Cert.	6th Form Cert.	Bursary	Bas. Voc. Dip.	Sk. Voc. Dip.	Int. Voc. Dip.	Adv. Voc. Dip.	Bach. Deg.	P'grad Deg.
No Qual.		19.62	35.50	33.55	25.12	29.03	35.52	53.90	85.20	100.55
School Cert.	19.62		13.27	11.64	4.59	7.86	13.29	28.65	54.82	67.65
Sixth FC.	35.50	13.27		-1.44	-7.66	-4.77	0.02	13.58	36.68	48.01
Bursary	33.55	11.64	-1.44		-6.31	-3.38	1.48	15.24	38.68	50.17
Bas. V. Dip.	25.12	4.59	-7.66	-6.31		3.13	8.32	23.01	48.02	60.29
Sk. V. Dip.	29.03	7.86	-4.77	-3.38	3.13		5.03	19.27	43.53	55.43
Int. V. Dip.	35.52	13.29	0.02	1.48	8.32	5.03		13.56	36.66	47.99
Adv. V. Dip.	53.90	28.65	13.58	15.24	23.01	19.27	13.56		20.34	30.31
Bach. Deg.	85.20	54.82	36.68	38.68	48.02	43.53	36.66	20.34		8.29
P'grad Deg.	100.55	67.65	48.01	50.17	60.29	55.43	47.99	30.31	8.29	

7 Elaborate Analysis – Methodology

7.1 Elaborate Analysis

The second method utilised in this study calculates the rates of return to investments in secondary and tertiary education. Firstly, it estimates the discount rate where the stream of lifetime gains from educational qualifications and the costs of acquiring the educational qualifications are equated. Secondly, using the same general framework, it calculates the discounted sum of the returns to secondary and tertiary educational qualifications. The lifetime gains are essentially the higher income levels enjoyed by those with higher educational attainment and the increased job security and propensities for employment that go along with it. The main costs include forgone income and personal expenditures on the additional education such as tuition fees and textbooks. Psacharopoulos (1981) refers to this technique as the 'elaborate method'.

7.1.1 Age-Income Profiles

The first step in the elaborate analysis calculates age-income profiles for each education level for both females and males using the following equation:

$$Y_i = a + bAGE_i + c(AGE_i)^2 \qquad (7.1)$$

where Y_i is the Before-Tax income. In addition to the main qualifications, the analysis calculates age-income profiles for the four sub-Diploma qualifications.

7.1.2 Private Rates of Return Analysis

In the second step, the model predicts the estimated values of lifetime income (Y) for each education level, and then uses these predicted returns

to solve equation (7.2) and derive the rates of return (r) to secondary and tertiary qualifications.

$$\sum_{t=S+1}^{n} \frac{[Yh_t(1-x) - Ys_t(1-x)]_t}{(1+r)^t} = \sum_{t=1}^{S} \frac{[Ys_t(1-x) + P_t]_t}{(1+r)^t} \qquad (7.2)$$

where *Yh* and *Ys* represent the before-tax incomes with the higher and the lower levels of education respectively, x is the income tax rate, P_t represents the personal expenditures on education per year, $t=1$ is the first period of study for the qualification, r is the discount rate, and S is the number of years required for the qualification. The literature refers to returns calculated in this way as the internal rates of return or the abbreviation IRR and this study follows the established convention.

This study concentrates on the marginal rates of return for qualifications. Marginal returns provide useful information in economic decision making. In equation 7.2, *Yh* is the Before-Tax income at the qualification level of interest and *Ys* is the Before-Tax income at the qualification level immediately below it[6]. Thus, the resulting (r) derived from equation 7.2 gives the marginal return to the investment in a qualification. The following example best illustrates the process used to calculate the marginal return:

> Take the example of a female student having obtained Bursary and now entering university to complete a Bachelors Degree at the age of 19. During the three years spent studying at university, the student's income is assumed to be zero. Her costs are her tuition fees and the forgone income she could have earned as a female with Bursary. The total costs from the three years spent in university make up her investment in the qualification. Upon graduation at the age of 22, she commences working. The gain in income she receives equals the income for a female university graduate less the income

[6] However, for Bachelors Degree and Diploma comparisons are made with both Sixth Form Certificate and Bursary. In addition, a comparison is made between Bachelors Degree and Diploma, since those pursuing tertiary qualifications must choose between university and polytechnic qualifications.

she would have received for a female with Bursary. The gains in income continue each year until she stops working at age 65. Then Using equation 7.2, the marginal rate of return (r) of completing the Bachelors Degree is derived.

7.1.3 The Net Discounted Sum of the Private Returns

Alongside the rates of return for each qualification, the model calculates the net discounted sums of returns[7]. This calculation takes the net present value of all lifetime private income gains discounted at five percent real discount rate minus the discounted sum of private costs. Equation 7.3 gives a mathematical representation of this calculation:

$$N(pvt)_i = \sum_{t=S+1}^{n} \frac{[Yh_i(1-x) - Ys_i(1-x)]_t}{1.05^t} - \sum_{t=1}^{S} \frac{[Ys_i(1-x) + P_i]_t}{1.05^t} \qquad (7.3)$$

The discount rate of five percent was chosen to maintain consistency with previous studies (Maani, 2000) and for its approximation of the risk free cost of capital[8].

7.2 Social Rates of Return Analysis

In addition to the private rates of return to investment in higher education, the model calculates the social rates of return. Equation 7.3 forms the basis of the social rates of return model:

$$\sum_{t=S+1}^{n} \frac{[Yh_i - Ys_i]_t}{(1+r_s)^t} = \sum_{t=1}^{S} \frac{[Ys_i + P_i + G_i]_t}{(1+r_s)^t} \qquad (7.3)$$

Government expenditure, G_i, is average expenditure per student at the corresponding education level and institution type. Personal expenditure,

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[7] The abbreviation used for the net discounted sums of returns throughout the study is NPV (Net Present Value). Essentially the net discounted sums of returns and the net present value (NPV) of returns are one in the same.

[8] The risk free cost of capital can be defined as the return to government bonds in New Zealand. Five percent can be said to be a close approximation of the average government bond return in recent times.

P_i, is the average polytechnic or university tuition fee[9], and r_s is the social discount rate.

7.2.1 The Discounted Sum of the Social Returns

Again following the calculation of the social rates of return, the analysis calculates the discounted sums of returns based on a similar framework. Equation 7.4 represents the calculation below:

$$N(soc)_i = \sum_{t=S+1}^{n} \frac{[Yh_i - Ys_i]_t}{1.05^t} - \sum_{t=1}^{S} \frac{[Ys_i + P_i + G_i]_t}{1.05^t} \qquad (7.4)$$

The analysis calculates all returns for females and males separately, for both 1996 and 2001 samples, and for all qualifications, including the four sub-Diploma qualifications. The analysis converts 1996 income data to its equivalent in 2001 dollars. Also, the 1996 calculations use 2001 marginal tax rates and 2001 tuition fees and government expenditure.

With the results in hand, the analysis then proceeds to check that the results correspond to that of previous studies. The results examined include the following assertions put forward by Psacharopoulos (2001): that the returns for females exceed males; that the private returns exceed the social returns; that the returns to education diminish for each additional year of schooling or additional qualification; and that vocational qualifications offer low marginal returns. Also, the analysis compares the difference between the returns for 1996 and 2001. And lastly, the analysis compares the results calculated in the rates of return framework to the results calculated in the discounted sums of return framework.

7.2.2 Sensitivity Analysis

Sensitivity analysis of the rates of return is performed on the key variables. The parameters of interest and the approach to the sensitivity analysis of these parameters are outlined here:

[9] For secondary school qualifications private costs are assumed to be zero.

i. The analysis varies the level of foregone income from 50 percent to 100 percent of the average income for the corresponding age and qualification level. This reflects recent trends of an increasing number of full-time students working part-time and during the summer vacation period between school years. Therefore, students often reduce their level of forgone income below the full 100 percent.

ii. The analysis varies the length of courses. This reflects the increasing popularity of summer courses and one-year Master Degree programmes which result in students finishing their studies faster than previously possible. In the other extreme, increasing the course lengths shows the effect of, for example, repeating a year.

iii. The level of tuition subsidy is varied from zero to 100 percent to analyse the impact on the private rates of return and options for government policy on higher education funding.

In contrast to other studies such as Maani (1997), this study takes a neutral stance towards the existence of externalities. Hence, the estimates reported in the results section exclude any allowance for the externality and do not attempt to adjust the estimates for externalities in any way[10]. Furthermore, the method of calculating the returns, described in section 7.1.2, differs to Maani's methodology. In particular, this study focuses more on the marginal returns. Therefore, in contrast to the income function analysis results, the results from this chapter are not directly comparable to Maani's results.

7.3 Quantile Regression Estimates of Returns

The returns to a qualification vary according to the labour market outcomes of an individual. All of the previous methods gave point estimates of the returns using based on the median or mean. The quantile estimates of the

[10] For a further discussion of this see section 2.6 in chapter 2.

returns, calculated in this section, allow exploration of the returns at different points on the distribution.

7.3.1 Analytical Framework

The first step in the analysis estimates age-income profiles at the 10th, 25th, 50th, 75th and 90th quantiles for each qualification level, for both the female and male samples, and for both periods. Equation 7.5 represents the initial mathematical framework (Martins & Pereira, 2004) for the quantile estimates of the age-income profiles.

$$Y_i = a_\theta + b_{\theta 1} AGE_i + c_{\theta 2} (AGE_i)^2 + \mu_i \qquad (7.5)$$

where $i=1,...,N$ (N being the number of observations), $\theta=0.1$, 0.25, 0.5, 0.75 and 0.9 is the quantile being analysed, and Y is the annual income Before-Tax.

With the age-income profiles at each quantile calculated the next step basically follows the methods explained in 7.1.3 and 7.1.5. The quantile returns analysis focuses only on the net discounted sums of returns[11]. For example, to calculate the marginal return to a Postgraduate Degree for a female at the 10th quantile the method is as follows:

> Firstly, the lifetime income is calculated using the 10th quantile age-income profile for a female with a Postgraduate Degree and the result is then substituted into equation 7.3 as *Yh*; secondly, the lifetime income for a female with a Bachelors Degree is calculated using the 50th quantile age-income profile and the result is substituted into equation 7.3 as *Ys*; with this information it is then possible to calculate the marginal female return to a Postgraduate Degree at the 10th quantile. The analysis then repeats the process

[11] The returns of most qualifications are expected to be negative at the 10th and 25th quantiles. The NPV criteria deals more proficiently with negative returns, therefore it is more useful and robust than the internal rate of return criteria in this analysis.

to estimate the returns at the remaining quantiles. For each calculation, the analysis holds *Ys* constant[12].

The process is repeated to calculate the discounted sums of social returns based on the framework shown in equation 7.4. Also, the analysis calculates quantile estimates of the returns for the four sub-Diploma qualifications.

7.3.2 Utilising the Quantile Estimates of Returns

The analysis tries to reconcile the level of returns calculated in sections 7.1.3 and 7.1.5 to the quantile estimates. Moreover, relationships between the level of qualifications and the distribution of returns as shown by the quantile estimates are explored. Also, the analysis compares the quantile estimates for females and males, for the two Census years, and the private and social sums of discounted returns.

[12] *Ys* represents the forgone income for a Postgraduate Degree. The 50^{th} quantile estimate is assumed to be the average lifetime income that would have earned had the individual not pursued a Postgraduate Degree.

8 Elaborate Analysis – Results and Discussion

The private returns to all levels of qualification, as calculated by the internal rate of return (IRR) method, show a similar magnitude, although lower in most cases, to that calculated in chapter 6. Over the two periods, female returns decreased for all qualifications except for Sixth Form Certificate and Bachelors Degree (instead of Diploma). In contrast for males, the returns increased for all but Bachelors Degree (from Bursary) and Postgraduate Degree. The breakdown of the returns to the Diploma qualification showed low returns which deteriorated from 1996 to 2001 for females. Similarly for males, the returns to the four sub-qualifications within the Diploma qualification showed low or negative returns, however, some did improve from 1996 to 2001.

The alternative Net Present Value (NPV) criteria ranked the returns to qualifications differently, in some cases, to the IRR Method. The NPV criteria ranked Bachelors Degree (instead of Diploma) highest for females while the IRR method ranked School Certificate highest. However, the change in returns over the two periods showed consistent movements over the criteria. Also, the NPV criteria found large negative results for the four qualifications within the Diploma qualification.

Sensitivity analysis found that the returns to a Bachelors Degree are sensitive to the level of forgone earnings and length of study. However, the returns are relatively less sensitive to the level of tuition fees and timing of study. In addition, both criteria found diminishing returns from School Certificate to Diploma and from Bachelors Degree to Postgraduate Degree.

Results from the social returns section unveiled a major anomaly. Using the IRR criteria, results showed that the private returns exceeded the social returns. The NPV criteria, in stark contrast, found that the social returns exceeded the private returns. This was due to the NPV criteria taking into

consideration the larger relative scale of social investment and income returns over the life cycle. This is discussed in more detail in section 8.3.

Quantile regression estimates of the returns to education showed that the distribution of returns is larger for Bachelors Degree and Postgraduate Degree than for secondary school qualifications. Also, the distribution of returns for males was larger than for females. Finally, the results showed that marginal income effects for qualifications calculated in chapter six or the returns calculated in this chapter, both methods which use mean or average returns as their basis, gave a poor indication of the overall distribution of the returns.

8.1 Age-Income Profiles

The Age-Income Profiles[1] for both the 1996 and 2001 female samples (Figures 8.1 and 8.2) showed similar characteristics with incomes not surprisingly higher in 2001. The profiles for No Qualification, School Certificate and Diploma are relatively flat over the working-life years. The Sixth Form Certificate, Bursary, Bachelors Degree and Postgraduate Degree, in contrast, are relatively peaked. The difference in profiles for Bachelors Degree and Postgraduate Degree and all other levels of education is most obvious. The profiles for the male samples (Figures 8.3 and 8.4) share similar characteristics. Although, the profiles for Bachelors Degree and Postgraduate Degree move together more closely over the working-life years than for the female samples.

8.1.1 Diploma Breakdown

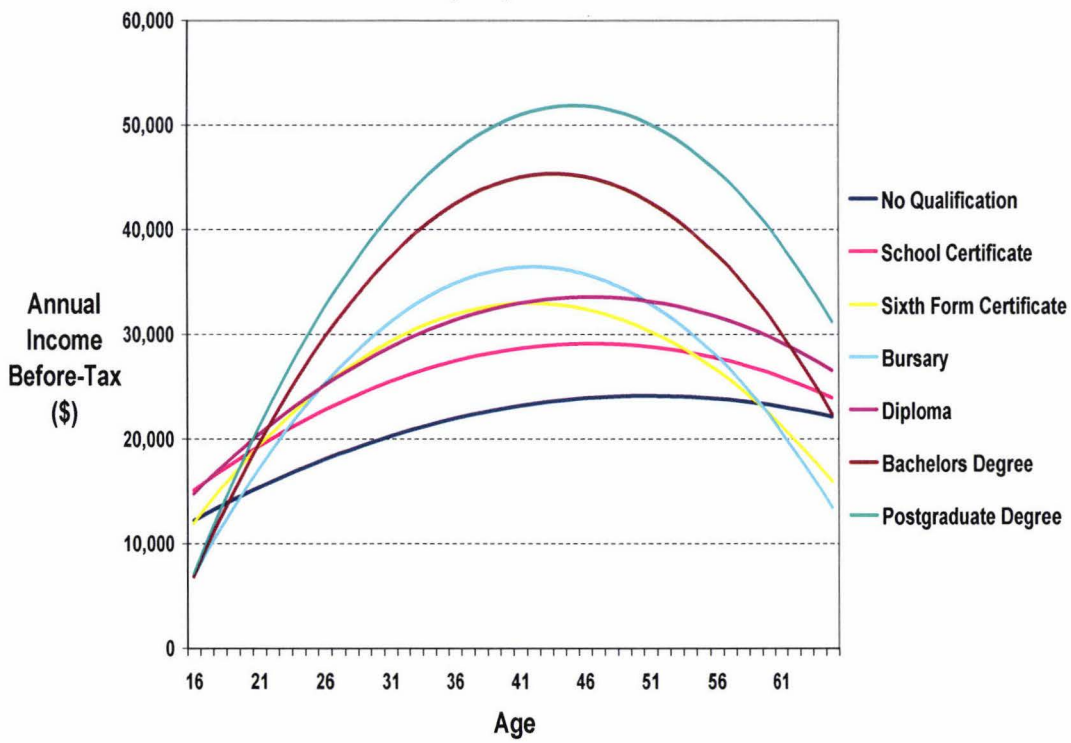
The profiles showing the overall Diploma qualification and the four sub-qualifications demonstrate the wide range of income profiles within the

[1] The first step in elaborate analysis involves calculating Age-Income Profiles for each sample at each level of education. What this means is that for each level of education, an ordinary least squares regression is run with annual before-tax income as the dependent variable and age and age squared as the independent variables.

Diploma qualification[2]. In the female samples the, annual income varies by $7,000 and $10,000 at its widest point in 1996 and 2001 respectively. In the male samples, the difference is more pronounced at $10,000 and $16,000 for 1996 and 2001 respectively. The profiles are noticeable for one other phenomenon; in all the figures the profile for Intermediate Vocational Diploma lies above Advanced Vocational Diploma, going against the classification of Advanced Vocational Diploma as the highest qualification within the Diploma category. The Age-Income Profiles for the four Diploma qualifications as well as the single qualification are shown in Figures 8.5 through 8.8 in the appendices at the end of the chapter.

Figure 8.1: Age-Income Profiles

Full-Time Employed Females 1996



[2] It must be remembered that the Diploma profile is not an average of the four other profiles but a single regression run independently of the other four profiles.

Figure 8.2: Age-Income Profiles

Full-Time Employed Females 2001

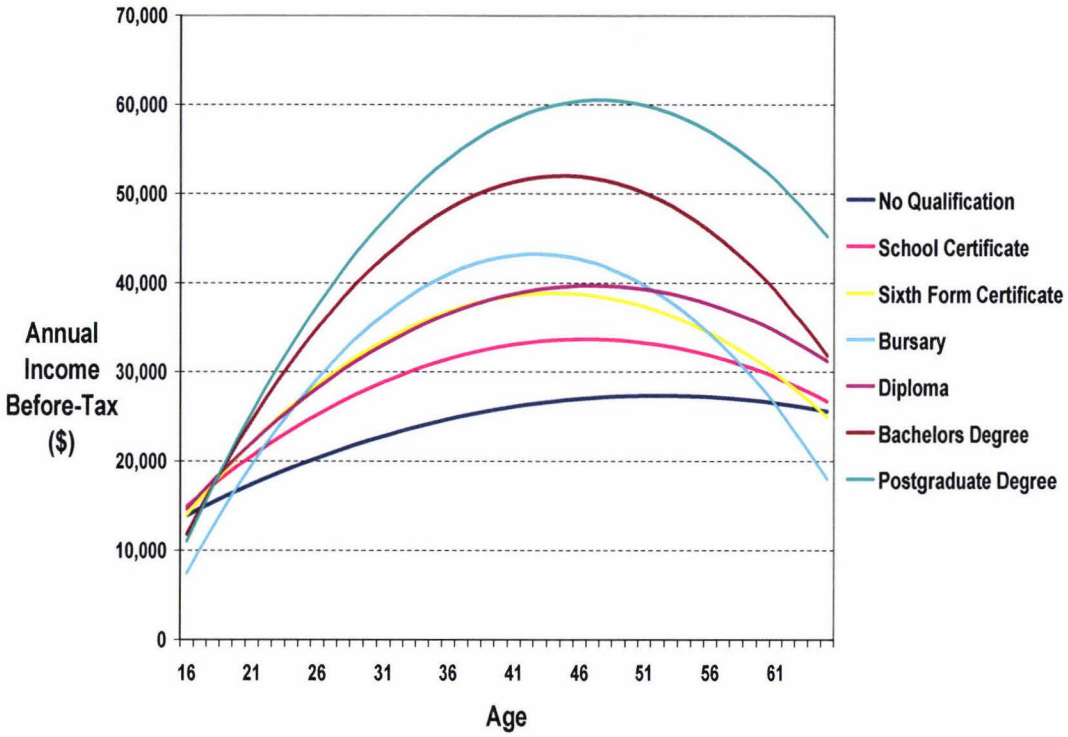


Figure 8.3: Age-Income Profiles

Full-Time Employed Males 1996

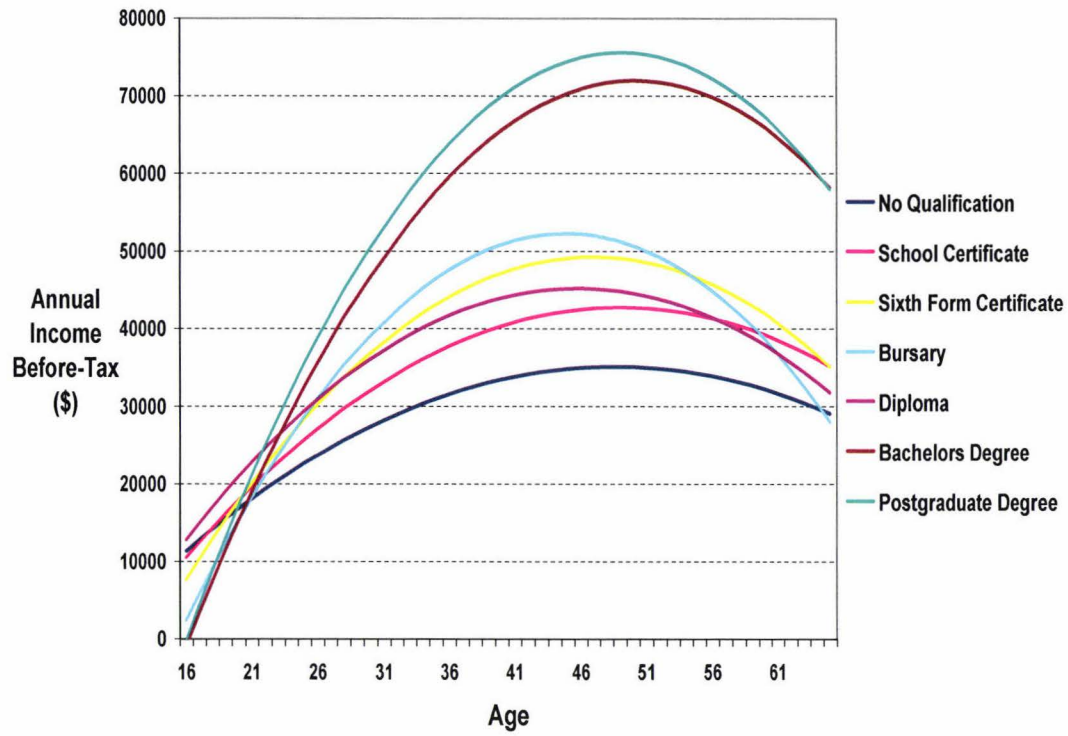
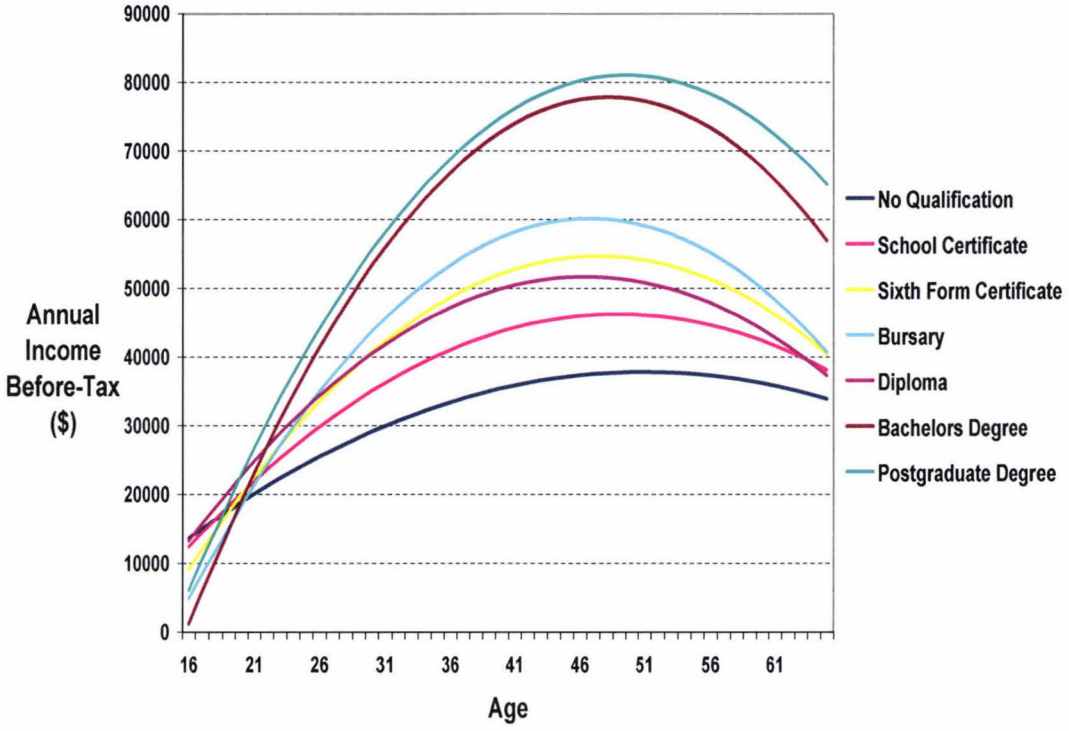


Figure 8.4: Age-Income Profiles

Full-Time Employed Males 2001



8.2 Private Returns to Secondary and Tertiary Education

8.2.1 The Private Returns – The Internal Rate of Return Method

The private returns to secondary and tertiary qualifications as calculated by the IRR method in this chapter showed results of similar magnitude to the marginal income effects of qualifications calculated in chapter six. In general, however, the IRR method, showed lower returns. The difference in the results from the two chapters was more pronounced for the tertiary qualifications. The lower returns calculated in this chapter reflect the higher forgone earnings and tuition fees for tertiary qualifications. The marginal income effects calculated in chapter six reflect only the difference in incomes between education levels. Therefore, the marginal income effects for tertiary qualifications are relatively higher than the private returns calculated using the IRR method.

8.2.2 The Private Returns – 1996 to 2001

Over the 1996 to 2001 period, the private returns showed a less discernable pattern of change than that displayed by the marginal income effects calculated in chapter six. For the female sample, all the IRRs fell with the exception of Sixth Form Certificate and Bachelors Degree (instead of Diploma). In contrast for the male sample, School Certificate, Sixth Form Certificate, Bursary and Bachelors Degree (instead of Diploma) exhibited increases; Bachelors Degree (from Bursary) and Postgraduate Degree fell; while the remaining qualifications showed static returns or were incalculable[3].

8.2.3 The Private Returns – Net Present Values

The private returns as calculated using the NPV criteria often ranked the highest returning qualifications differently to the returns calculated using the IRR method. The NPV criteria ranked Bachelors Degree (instead of Diploma) the highest for all samples. The IRR criteria, in contrast, ranked School Certificate the highest for the female samples. Overall, the NPV criteria ranked the tertiary qualifications relatively higher and secondary qualifications relatively lower. Conversely, the IRR criteria ranked secondary qualifications relatively higher and tertiary qualifications relatively lower.

> Comparing results of the two criteria illustrates the inconsistency. In 1996, the IRR for the female sample for Sixth Form Certificate was 9.38 percent and the corresponding NPV was $12,142. For Bachelors Degree (from Bursary) the IRR was slightly lower at 8.71 percent. However, the NPV was considerably higher at $35,393. The results from the 1996 male sample present a similar example: the IRR and NPV for School Certificate were 16.63 percent and $45,905 respectively; in comparison, for Bachelors Degree (from Bursary) the

[3] The results from the male samples for Diploma (from Sixth Form Certificate with Bursary, from Sixth Form Certificate without Bursary and from Bursary) showed incalculable IRRs. In this case the IRR can be taken to be negative and the reader is referred to the corresponding NPV value to gauge the magnitude of the return.

Table 8.1: Private Net Discounted Sums of Returns and Internal Rates of Return

Fulltime-Employed Females and Males
(2001 Dollars)

Qualifications	Females				Males			
	1996		2001		1996		2001	
	Net Present Value	Internal Rate of Return	Net Present Value	Internal Rate of Return	Net Present Value	Internal Rate of Return	Net Present Value	Internal Rate of Return
School Certificate	$55,127	30.24%	$55,069	22.31%	$45,905	16.63%	$51,894	16.93%
Sixth Form Certificate	$12,142	9.38%	$32,596	14.52%	$36,432	14.22%	$43,427	14.36%
Bursary	-$1,716.07	4.53%	-$1,584.86	4.47%	-$1,076.46	4.47%	$16,306.26	8.94%
Dip. (from 6th FC/No Bursary)	-$17,235	2.56%	-$28,331	0.70%	-$38,658	Incalculable*	-$35,427	Incalculable*
Dip. (from 6th FC/with Bursary)	-$31,047	1.50%	-$42,431	-0.21%	-$53,576	Incalculable*	-$50,930	Incalculable*
Diploma (from Bursary)	-$30,798	0.20%	-$42,888	-0.89%	-$55,124	-16.24%	-$70,598	Incalculable*
Bach. Degree (from 6th FC)	$31,992	7.42%	$31,265	7.33%	$81,739	9.72%	$77,037	9.72%
Bach. Degree (from Bursary)	$35,393	8.71%	$34,492	8.40%	$86,956	10.99%	$63,767	10.01%
Bach. Degree (instead of Dip.)	$66,191	18.64%	$77,381	21.99%	$142,080	18.89%	$134,365	20.51%
Postgraduate Degree	$18,938	7.26%	$16,050	6.51%	-$2,053	4.64%	-$20,943	2.28%

IRR was lower at 10.99 percent, but, the NPV value was almost double the School Certificate value at $86,956.

The NPV criteria, to a greater extent, reflect the larger investments (forgone earnings, tuition fees and private costs) and higher earnings over the life-cycle. The IRR criteria place less emphasis on the scale of the investment. As a result, the ranking of qualifications differs between the NPV and IRR criteria. This means that as explained in the methodology chapter, the NPV criteria is more useful for comparing investments that differ in both in time scale and in the size of the investment. In the context of this study, it means that the IRR criteria results are more useful to compare the with the marginal income effects results from chapter six. The NPV values, alternatively, are more useful in comparing the returns between qualifications and between males and females with the same qualification.

8.2.4 Diminishing Returns

Using both the NPV and IRR criteria, the private returns exhibit diminishing returns from School Certificate up to Diploma. From Diploma to Bachelors Degree, however, the returns increase and then fall again from Bachelors Degree to Postgraduate Degree. The diminishing returns up to the Diploma level are consistent with other findings in the literature (Psacharopoulos, 1996). The departure from diminishing returns from Diploma to Bachelors Degree is not unexpected. The explanation may lie in credentialism or the screening hypothesis (Arrow, 1973). Another possible explanation is that the demand for skilled labour has shifted so that there are now two separate demand curves for labour; one for skilled labour, and the other for unskilled labour. As a consequence, individuals with Bachelors Degrees face the higher demand curve, and therefore, command higher wages.

8.2.5 Breakdown of Returns to the Diploma Qualification

The private returns to the four Diploma qualifications show low or negative returns for both the male and female samples. Only Intermediate Vocational Diploma (from Sixth Form Certificate) manages to report both a positive IRR and NPV. For the female samples, from 1996 to 2001, the

majority of Diploma qualifications show a decrease in the private returns. For males, however, only from Bursary did the private returns of the four Diploma qualifications show a decrease. The poor performance of the Diploma qualifications is consistent with the literature which reports low returns for vocational qualifications (Psacharopoulos, 1981). Table 8.3 displays the full breakdown of the private returns to the four Diploma qualifications in the appendices at the end of the chapter.

8.2.6 Sensitivity Analysis

Sensitivity analysis on the private returns to a Bachelors Degree showed that the results were sensitive to the extent of forgone earnings and the length of study. Reducing the extent of forgone earnings from 100 percent to 75 and 50 percent resulted in a significant increase in the returns to a Bachelors Degree. For the 2001 female sample, the net present value and internal rate of return calculated with full forgone earnings were $34,492 and 8.40 percent. At 75 percent, the results were $43,987 and 10.13 percent, and, at 50 percent, the results were $53,482 and 12.76 percent. The female 1996 sample and the male samples reported similar results. Completing a Bachelors Degree in two years increased the net present value and internal rate of return to $51,359 and 11.66 percent. Conversely, taking four years to complete gave results of $13,511 and 6.05 percent.

In contrast, varying the level of tuition fees had little impact on the returns. Using a private contribution of 25, 33 and 50 percent to the full tuition with the 1996 female sample, resulted in net present values (internal rates of return) of $32,867 (8.71%), $30,327 (8.28%) and $25,245 (7.52%). The other samples showed a similar narrow range of results. Furthermore, delaying entry into university by one, three, five or ten years still produced a positive net present value and an internal rate of return in excess of the five percent discount rate for all samples[1].

[1] For the 2001 female sample delaying entry to university by ten years gave a net present value of -$727 and an internal rate of return of 4.95 percent. This was the only case of a negative result.

8.3 Social Returns to Secondary and Tertiary Education

8.3.1 Internal Rates of Return

As expected, the social returns to secondary and tertiary education, calculated using the IRR criteria, are lower than the private returns for all samples and qualifications. For most qualifications, the difference is between zero and two percent. Therefore, the inclusion of before-tax incomes almost cancels out the inclusion of government expenditure in the calculations. Moreover, the trends and patterns observed in the results for the private returns (section 8.2) remain in the results for the social returns (section 8.3). Likewise, the breakdown of the Diploma qualification showed lower social returns than private returns which meant even lower returns or more negative results than those found in section 8.2. Table 8.2 presents the results of the social returns as calculated using the IRR and NPV criteria. Table 8.4 shows the breakdown of the social returns to the Diploma qualification in the appendices at the end of the chapter.

8.3.2 Net Present Values

In contrast to the social internal rate of return results, the social net present values normally exceeded the private net present values when positive and were more negative when negative[2] (Table 8.2 above compares the social returns as calculated using both the IRR and NPV criteria). Also, the differences tended to increase the higher the level of net present value. This finding contradicts the literature which in general states that private returns exceed social returns (Psacharopoulos, 1999).

[2] The exceptions were Sixth Form Certificate to Bachelors Degree in both years and Bursary to Bachelors Degree in 1996.

Table 8.2: Social Discounted Sums of Returns and Internal Rates of Return

Fulltime-Employed Females and Males
(2001 Dollars)

Qualifications	Females				Males			
	1996		2001		1996		2001	
	Net Present Value	Internal Rate of Return	Net Present Value	Internal Rate of Return	Net Present Value	Internal Rate of Return	Net Present Value	Internal Rate of Return
School Certificate	$67,200	24.25%	$64,361	18.44%	$61,418	14.66%	$66,509	14.84%
Sixth Form Certificate	$12,215	8.14%	$36,711	12.44%	$50,740	13.15%	$60,235	13.30%
Bursary	-$4,414.38	4.17%	-$2,774.46	4.39%	-$1,746.57	4.44%	$23,383.88	8.72%
Dip. (from 6th FC/No Bursary)	-$35,062	1.79%	-$45,682	0.22%	-$66,827	Incalculable	-$58,193	Incalculable
Dip. (from 6th FC/with Bursary)	-$55,768	0.85%	-$66,724	-0.66%	-$88,952	Incalculable	-$80,979	Incalculable
Diploma (from Bursary)	-$53,921	-0.41%	-$67,147	-1.47%	-$91,566	-17.10%	-$109,581	Incalculable
Bach. Degree (from 6th FC)	$26,836	6.27%	$31,073	6.49%	$107,498	8.80%	$112,733	9.26%
Bach. Degree (from Bursary)	$32,813	7.03%	$35,540	7.18%	$114,707	9.67%	$93,816	9.45%
Bach. Degree (instead of Dip.)	$86,734	15.44%	$102,687	18.19%	$206,273	17.29%	$203,397	19.11%
Postgraduate Degree	$19,472	6.45%	$21,648	6.35%	-$9,708	3.94%	-$29,504	2.53%

In the male samples, the social net present values exceeded the private net present values for all qualifications. The differences in many cases were significant. For example the private net present value for Bachelors Degree (instead of Diploma) in 2001 was $134,365, whereas the social net present value was $203,397. For the female samples, the social net present values exceeded the private net present values for all qualifications except for Bachelors Degree (from Sixth Form Certificate and Bursary) in 1996 and for Bachelors Degree (from Sixth Form Certificate) in 2001. Again, like the male samples, as the scale of the returns increased, so too did the difference between the social and private net present values.

The reason for this is the difference in net present value and internal rate of return criteria. This follows the same logic as the reasoning put forward to explain the differences in ranking between the NPV and IRR criteria in section 8.2.3. The net present value criteria reflect the greater social investment, relative to private, in secondary and tertiary education. Also it takes into account the greater gain in income over the working-life that is made when comparing Before-Tax incomes rather than After-Tax incomes. As a result, the social returns normally exceed the private returns using the net present value, but the opposite is true for the internal rate of return criteria.

8.3.3 Sensitivity Analysis

Sensitivity analysis on the social returns to a Bachelors Degree again showed that the results were sensitive to the extent of forgone earnings and the length of study, but not particularly sensitive to tuition fee levels or the timing of study. Following the result from section 8.3.2, the social net present values were larger than the private net present values and therefore more sensitive to changes in the parameters. In contrast, the internal rates of return moved less or were less sensitive as they were in general less than the private internal rates of return.

8.4 Quantile Regression Estimates

8.4.1 Private Returns to Education – Quantile Estimates

Results from the quantile estimates of the private returns to secondary and tertiary qualifications show that the spread of returns is larger for Bachelors Degree and Postgraduate Degree than for the Diploma qualification and secondary qualifications. The quantile estimates for Diploma and secondary qualifications share similar spreads, moving up or down according to the position of each qualification's average return. In contrast, Bachelors Degree and Postgraduate Degree have much larger spreads, especially at the 10^{th} and 90^{th} quantile levels. Figures 8.9 through 8.12 show the quantile estimates of the private returns.

8.4.2 The Spread of Returns and the Magnitude of Investment

The spread of returns for a particular qualification, as measured by the difference between the 25^{th} and 75^{th} quantile estimates or the 10^{th} and 90^{th} quantile estimates, is related to the magnitude of the investment in the given qualification. Put another way, the spread of returns is positively related to both the magnitude of investment and the variability of earnings. In this case, the magnitude of investment is defined strictly as foregone earnings, tuition fees and other private costs. Therefore, the higher the combined foregone earnings, tuition fees and other private costs of a qualification, then the larger the spread of returns and vice versa. This reasoning conforms to the findings above in section 8.4.1.

Bachelors Degree and Postgraduate Degree have the highest foregone earnings, tuition fees and other private costs (over a longer period) and therefore the largest spread of returns. Conversely, secondary qualifications and Diploma have the lower foregone earnings, (no) tuition fees and (no) other private costs (over a shorter period), and hence a smaller spread of returns relative to Bachelors Degree and Postgraduate Degree. Moreover, the variability of lifetime income for those with Bachelors Degree and Postgraduate Degree is higher, particularly at the

upper income levels. This adds to the spread of returns for Bachelors Degree and Postgraduate Degree.

8.4.3 Male and Female Returns – 1996 and 2001 Returns

The spread of male and 2001 returns exceeds female and 1996 respectively due to the same reasoning as above in section 8.4.2. Males have higher mean incomes therefore higher forgone earnings (as well as a larger variation in incomes). Likewise, in 2001, the mean income is higher which translates into higher foregone earnings. In both cases, higher foregone earnings translate into a larger investment in each qualification. As a result, the spread of returns is larger for the male and 2001 samples than for the female and 1996 samples.

8.4.4 The Spread of Returns and the Mean Return

The mean return, the results of which are shown in section 8.2, gives a poor indication of the spread of returns. Alternatively, a high mean return does not necessarily go hand in hand with a large spread of returns. Normally investments with high returns are associated with high risk. Defining high risk as a large spread of returns, and looking at the results from section 8.2, it would be expected that School Certificate (NPVs in excess of $60,000 for all samples) would have a large spread of returns. In fact, the opposite is true. School Certificate, along with the other secondary qualifications, has a narrow spread of returns relative to the university qualifications. Figures 8.5 through 8.8 illustrate this point.

Figure 8.5: Private Net Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Females 1996

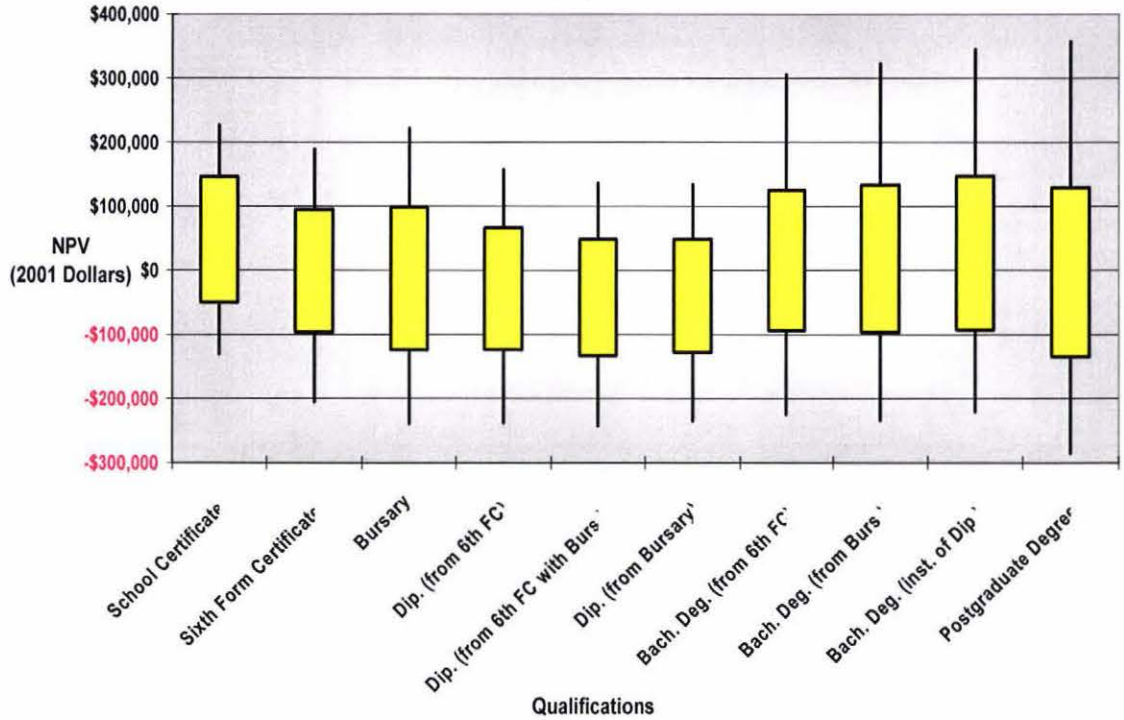


Figure 8.6: Private Net Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Females 2001

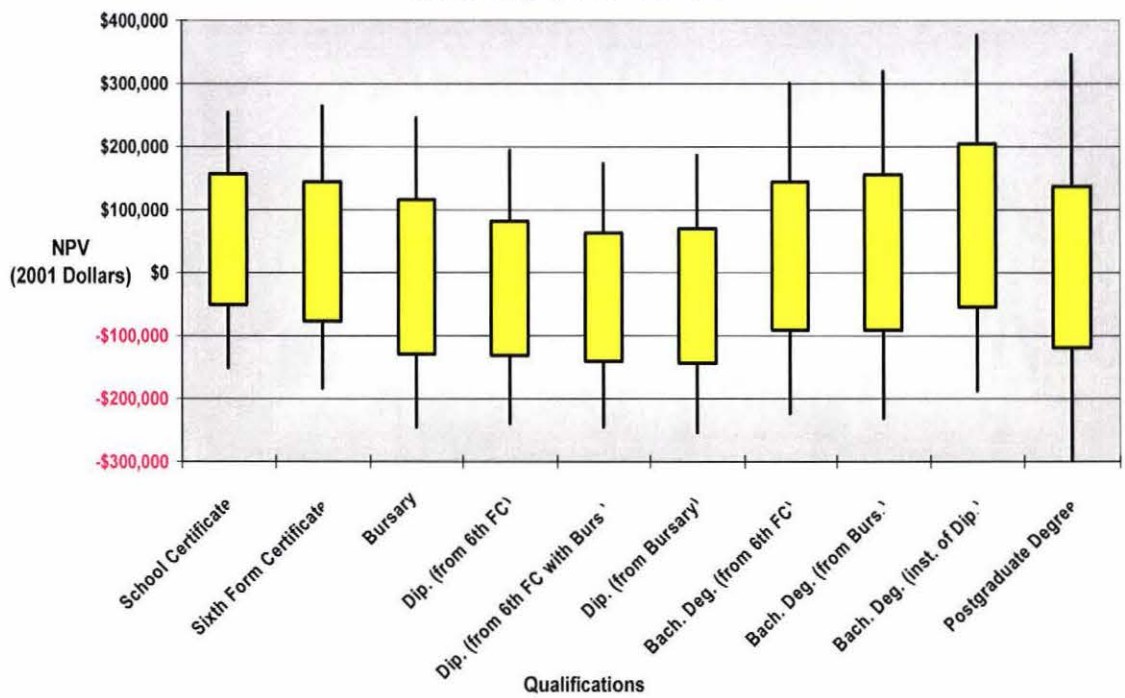


Figure 8.7: Private Net Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Males 1996

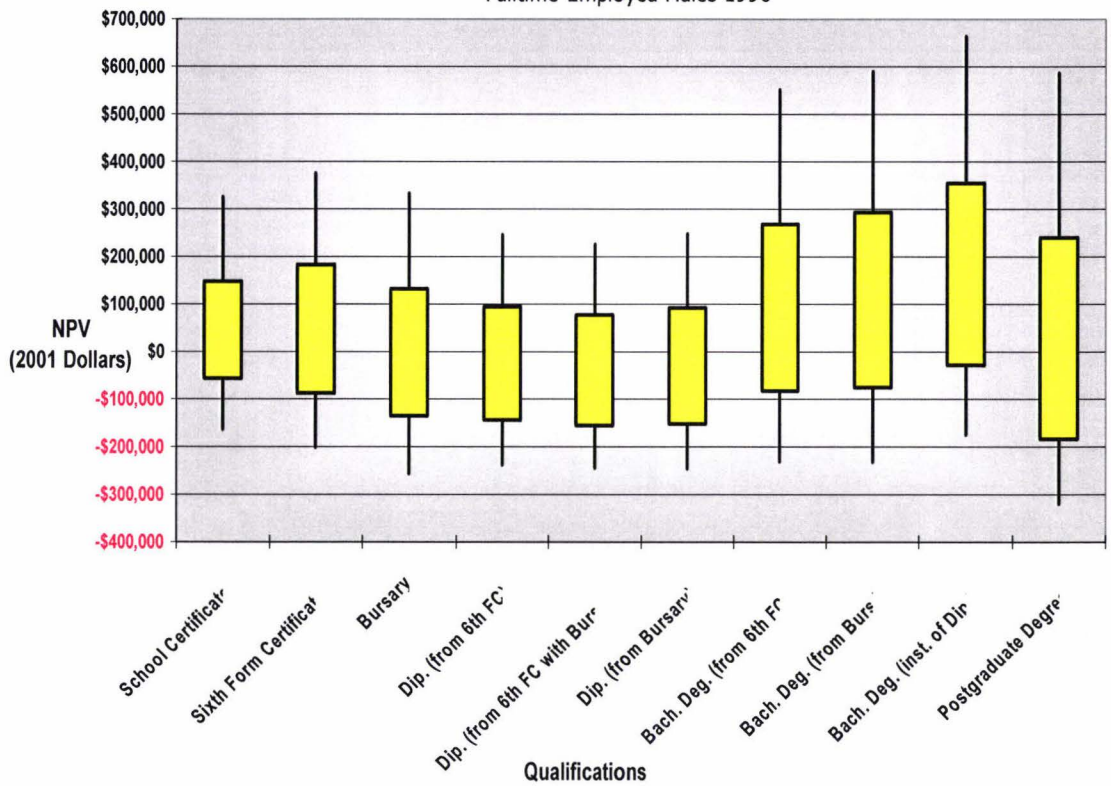
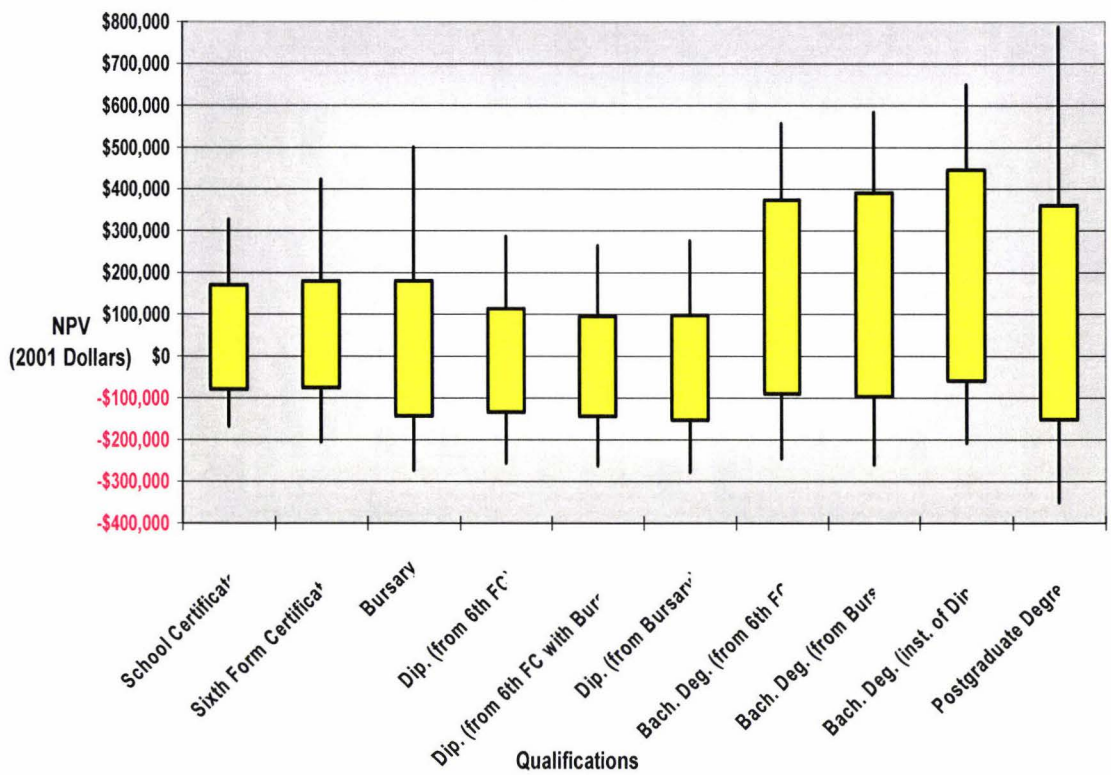


Figure 8.8: Private Net Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Males 2001



8.4.5 Social Returns to Education – Quantile Estimates

Like the results in section 8.3.2, the quantile estimates of the social returns exceed the private returns for all samples. As a result, the spread between the 25^{th} and 75^{th} quantiles and the 10^{th} and 90^{th} quantiles is also larger. The same reasoning used to explain the difference between social and private returns in section 8.3.2 applies to the quantile estimates. Moreover, the link between the spread of returns, the scale of the investment and the variability of income is magnified in the calculations of the quantile estimates of the social returns. Therefore, the difference in spread of the social returns of university qualifications (compared to secondary qualifications); the male samples (compared to females); and the 2001 sample (compared to the 1996 sample) further surpasses the spread of the private returns.

8.5 Chapter 8 - Appendices

Figure 8.9: Age-Income Profiles - Diploma Breakdown
Fulltime-Employed Females 1996

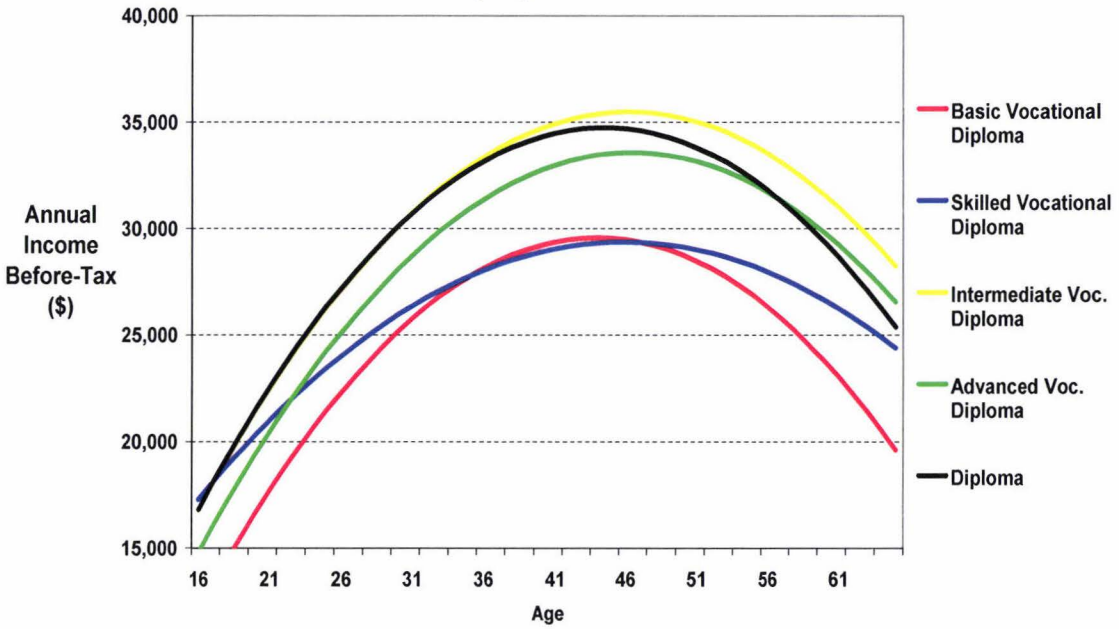


Figure 8.10: Age-Income Profiles - Diploma Breakdown
Fulltime-Employed Females 2001

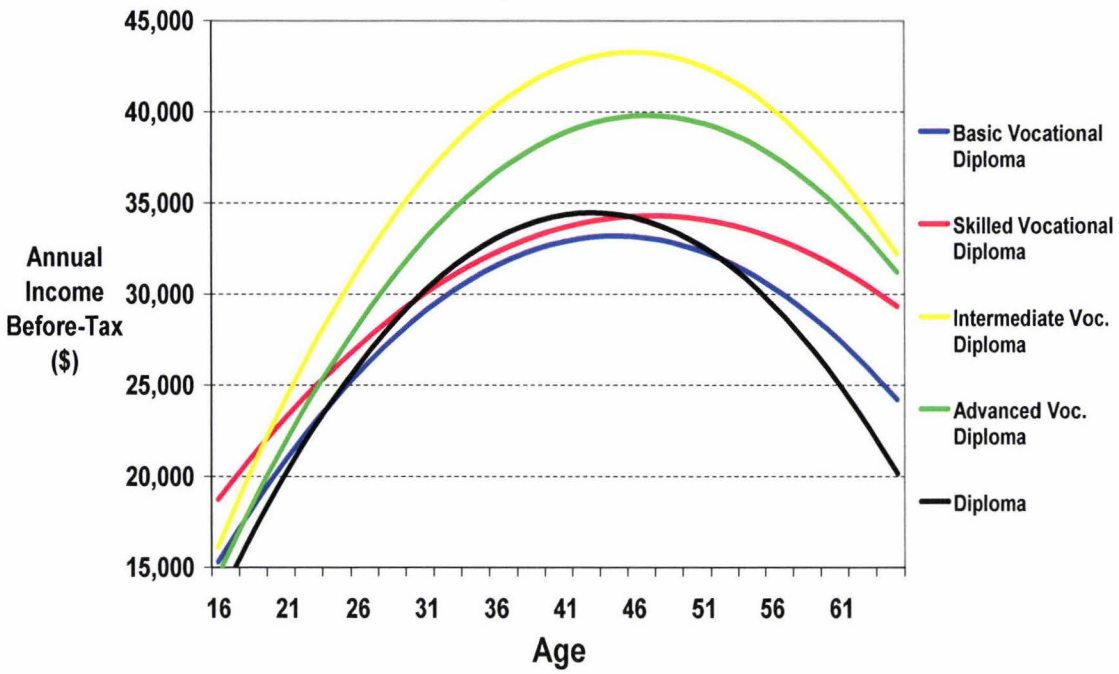


Figure 8.11: Age-Income Profiles - Diploma Breakdown

Fulltime-Employed Males 1996

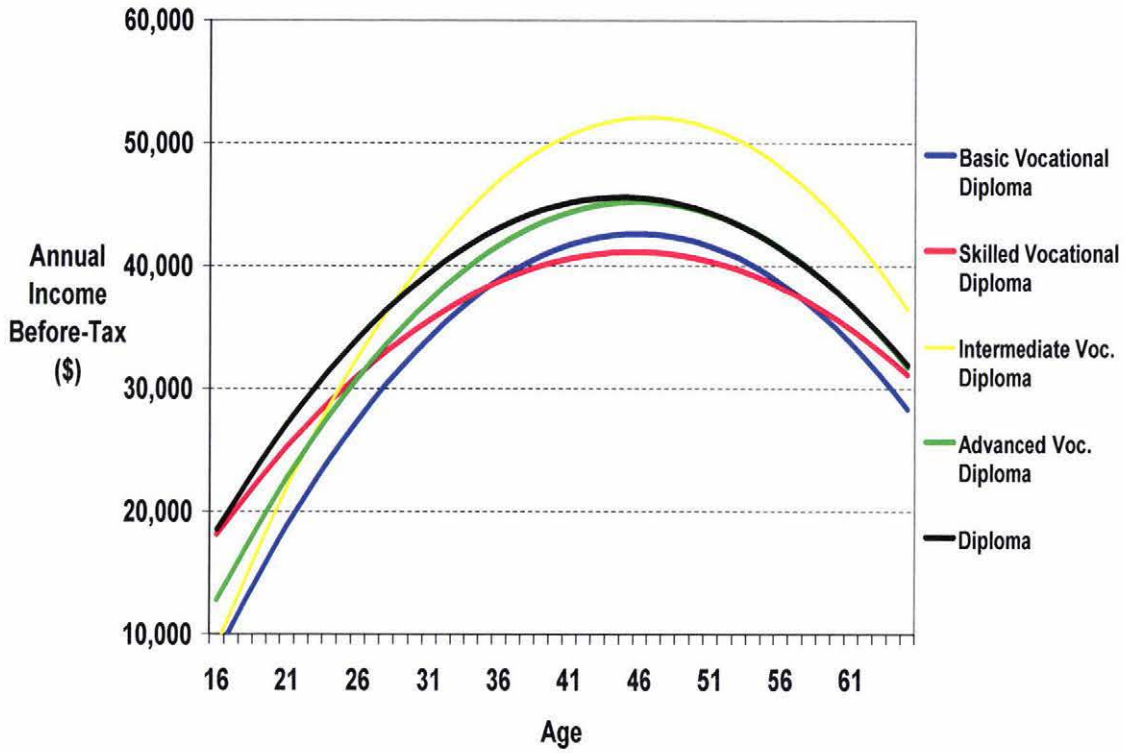


Figure 8.12: Age-Income Profiles - Diploma Breakdown

Fulltime-Employed Males 2001

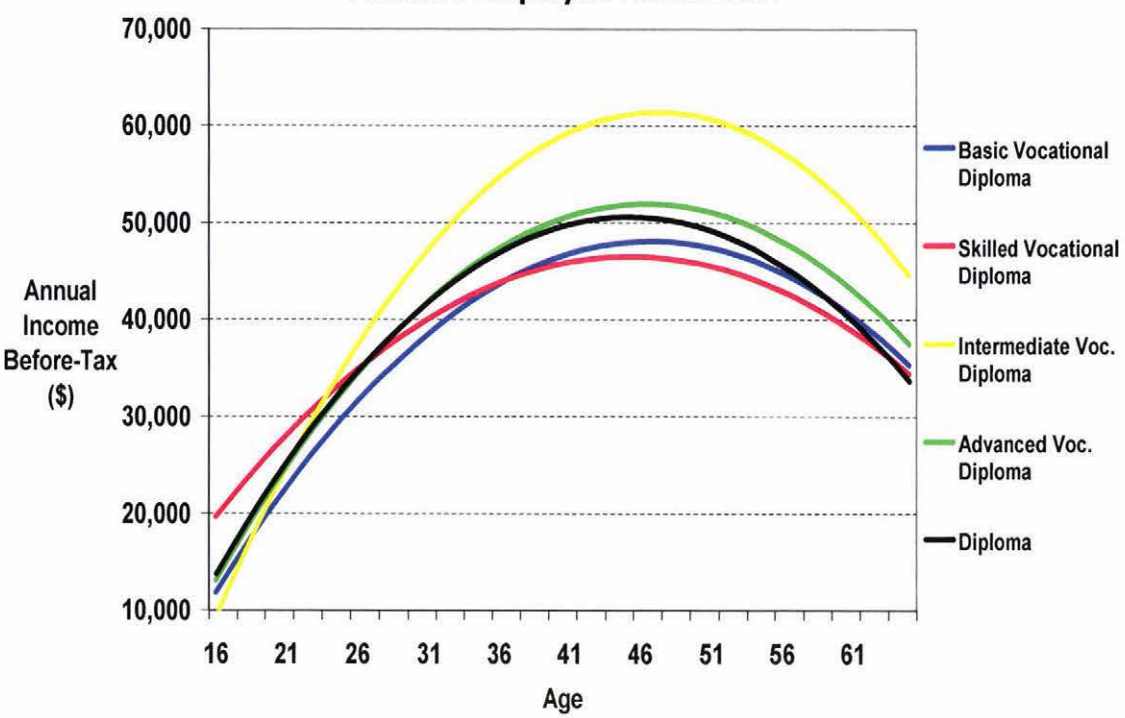


Table 8.3: Private Net Discounted Sums of Returns and Internal Rates of Return- Diploma Breakdown

Fulltime-Employed Females and Males
(2001 Dollars)

Qualifications	Females				Males			
	1996		2001		1996		2001	
	NPV	IRR	NPV	IRR	NPV	IRR	NPV	IRR
School Cert. to Basic Vocational Dip.	-$24,395	Incalculable	-$16,700	Incalculable	-$15,858	Incalculable	$2,764	6.36%
School Cert. to Skilled Voc. Diploma	-$1,052	4.23%	$6,900	9.39%	$21,471	37.27%	$31,047	32.84%
SFC to Basic Voc. Dip. (No Bursary)	-$49,713	-8.01%	-$65,434	Incalculable	-$64,955	Incalculable	-$56,279	Incalculable
SFC to Basic Voc. Dip. (With Bursary)	-$61,396	-8.12%	-$79,044	Incalculable	-$76,133	Incalculable	-$69,691	Incalculable
SFC to Skilled Voc. Dip. (No Bursary)	-$28,771	-2.62%	-$42,909	-10.39%	-$32,471	Incalculable	-$31,797	Incalculable
SFC to Skilled Voc. Dip. (With Bursary)	-$43,543	-3.09%	-$58,505	-10.45%	-$49,519	Incalculable	-$49,816	Incalculable
SFC to Int. Voc. Dip. (No Bursary)	$8,909	6.37%	$8,640	6.32%	$2,647	5.63%	$20,864	8.45%
SFC to Int. Voc. Dip. (With Bursary)	-$6,372	4.27%	-$6,980	4.18%	-$11,278	2.98%	$5,988	5.77%
SFC to Adv. Voc. Dip. (No Bursary)	-$17,235	2.56%	-$28,593	0.62%	-$38,658	Incalculable	-$36,285	Incalculable
SFC to Adv. Voc. Dip. (With Bursary)	-$31,047	1.50%	-$42,675	-0.29%	-$53,576	Incalculable	-$51,749	Incalculable
Bursary to Basic Vocational Diploma	-$62,664	-9.57%	-$81,376	-14.04%	-$78,809	Incalculable	-$91,697	Incalculable
Bursary to Skilled Vocational Diploma	-$43,918	-5.04%	-$59,810	-6.89%	-$50,864	Incalculable	-$70,828	Incalculable
Bursary to Intermediate Voc. Dip.	-$4,889	4.09%	-$5,709	4.04%	-$10,712	2.44%	-$12,234	1.60%
Bursary to Advanced Vocational Dip.	-$30,798	0.20%	-$43,188	-0.98%	-$55,124	-16.24%	-$72,858	Incalculable
Advanced Dip. or Bachelors Degree	$66,191	18.64%	$78,210	22.04%	$142,080	18.89%	$138,999	20.65%

Table 8.4: Social Discounted Sums of Returns and Internal Rates of Return- Diploma Breakdown

Fulltime-Employed Females and Males
(2001 Dollars)

Qualifications	Females				Males			
	1996		2001		1996		2001	
	NPV	IRR	NPV	IRR	NPV	IRR	NPV	IRR
School Cert. to Basic Vocational Dip.	-$37,997	Incalculable	-$26,344	Incalculable	-$27,119	Incalculable	-$81	4.97%
School Cert. to Skilled Voc. Diploma	-$8,023	1.58%	$2,972	6.13%	$20,508	24.21%	$34,339	23.90%
SFC to Basic Voc. Dip. (No Bursary)	-$70,732	-8.09%	-$87,230	Incalculable	-$98,092	Incalculable	-$84,490	Incalculable
SFC to Basic Voc. Dip. (With Bursary)	-$89,006	-8.22%	-$107,919	Incalculable	-$115,718	Incalculable	-$104,931	Incalculable
SFC to Skilled Voc. Dip. (No Bursary)	-$43,840	-2.82%	-$59,250	-10.47%	-$56,701	Incalculable	-$54,827	Incalculable
SFC to Skilled Voc. Dip. (With Bursary)	-$66,081	-3.32%	-$82,404	-10.54%	-$81,865	Incalculable	-$80,992	Incalculable
SFC to Int. Voc. Dip. (No Bursary)	-$677	4.94%	$3,436	5.34%	-$5,489	4.25%	$24,766	7.53%
SFC to Int. Voc. Dip. (With Bursary)	-$23,269	3.29%	-$19,494	3.48%	-$26,339	2.15%	$2,759	5.22%
SFC to Adv. Voc. Dip. (No Bursary)	-$35,062	1.79%	-$46,002	0.15%	-$66,827	Incalculable	-$59,465	Incalculable
SFC to Adv. Voc. Dip. (With Bursary)	-$55,768	0.85%	-$67,022	-0.74%	-$88,952	Incalculable	-$82,202	Incalculable
Bursary to Basic Vocational Diploma	-$88,821	-9.73%	-$110,522	-14.27%	-$119,670	Incalculable	-$136,843	Incalculable
Bursary to Skilled Vocational Diploma	-$64,750	-5.26%	-$83,731	-7.24%	-$84,124	Incalculable	-$111,706	Incalculable
Bursary to Intermediate Voc. Dip.	-$19,797	2.83%	-$17,677	3.08%	-$25,823	1.54%	-$23,768	1.00%
Bursary to Advanced Vocational Dip.	-$53,921	-0.41%	-$67,581	-1.55%	-$91,566	-17.10%	-$112,977	Incalculable
Advanced Dip. or Bachelors Degree	$86,734	15.44%	$104,014	18.25%	$206,273	17.29%	$211,252	19.30%

Figure 8.13: Social Discounted Sum of Returns - Quantile Estimates

Fulltime-Employed Females 1996

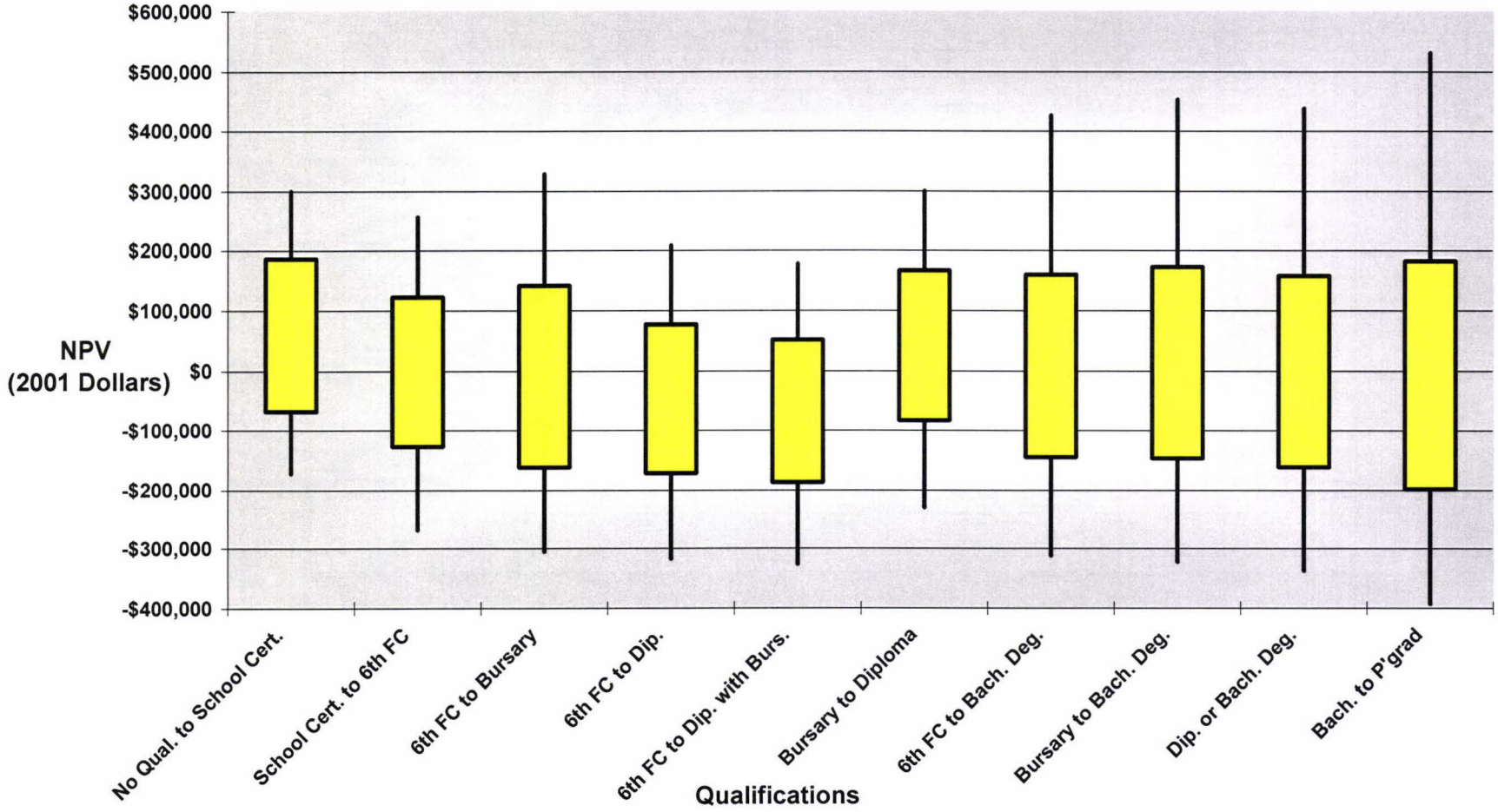


Figure 8.14: Social Discounted Sum of Returns - Quantile Estimates

Fulltime-Employed Females 2001

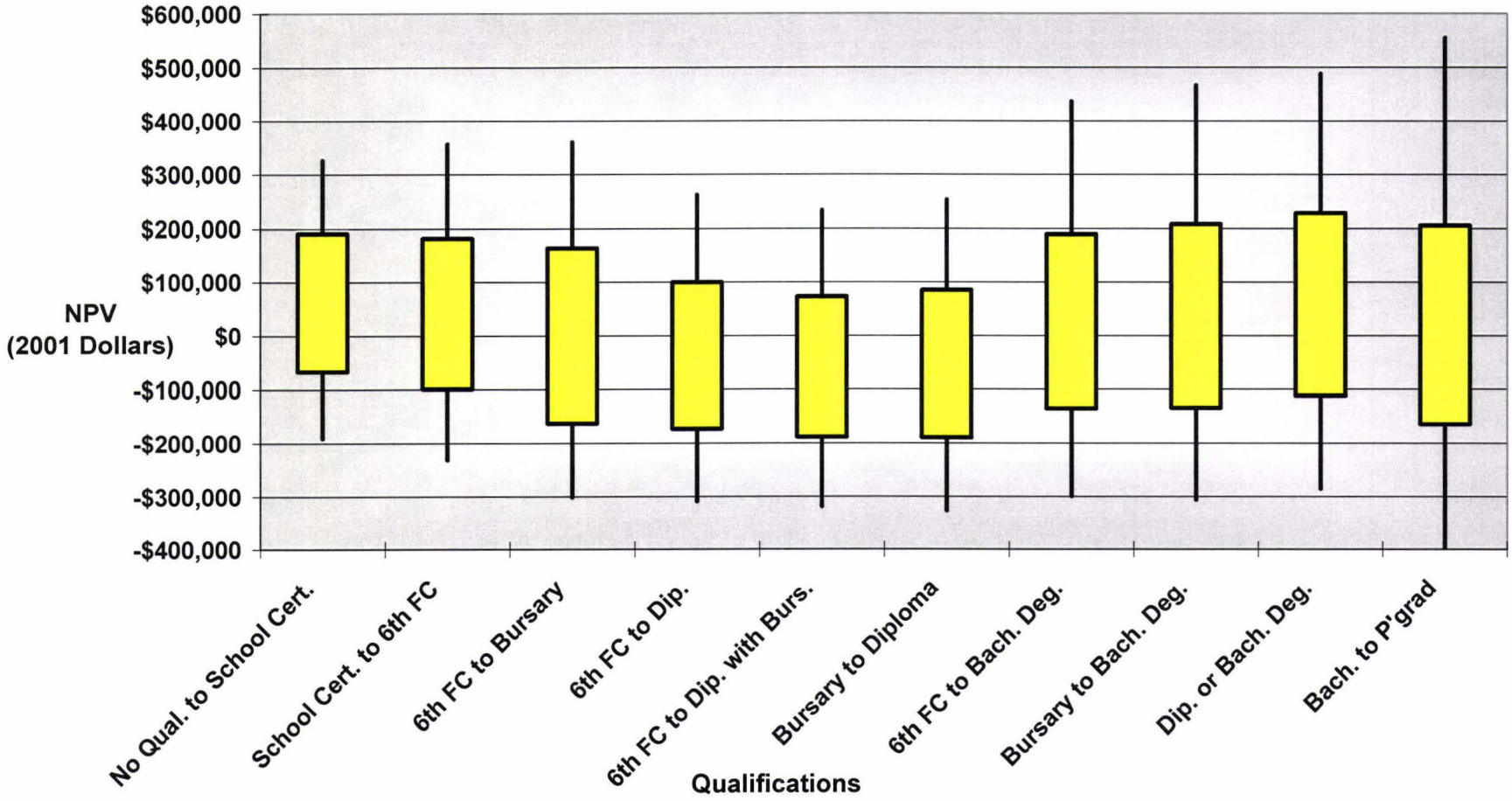


Figure 8.15: Social Discounted Sum of Returns - Quantile Estimates

Fulltime-Employed Males 1996

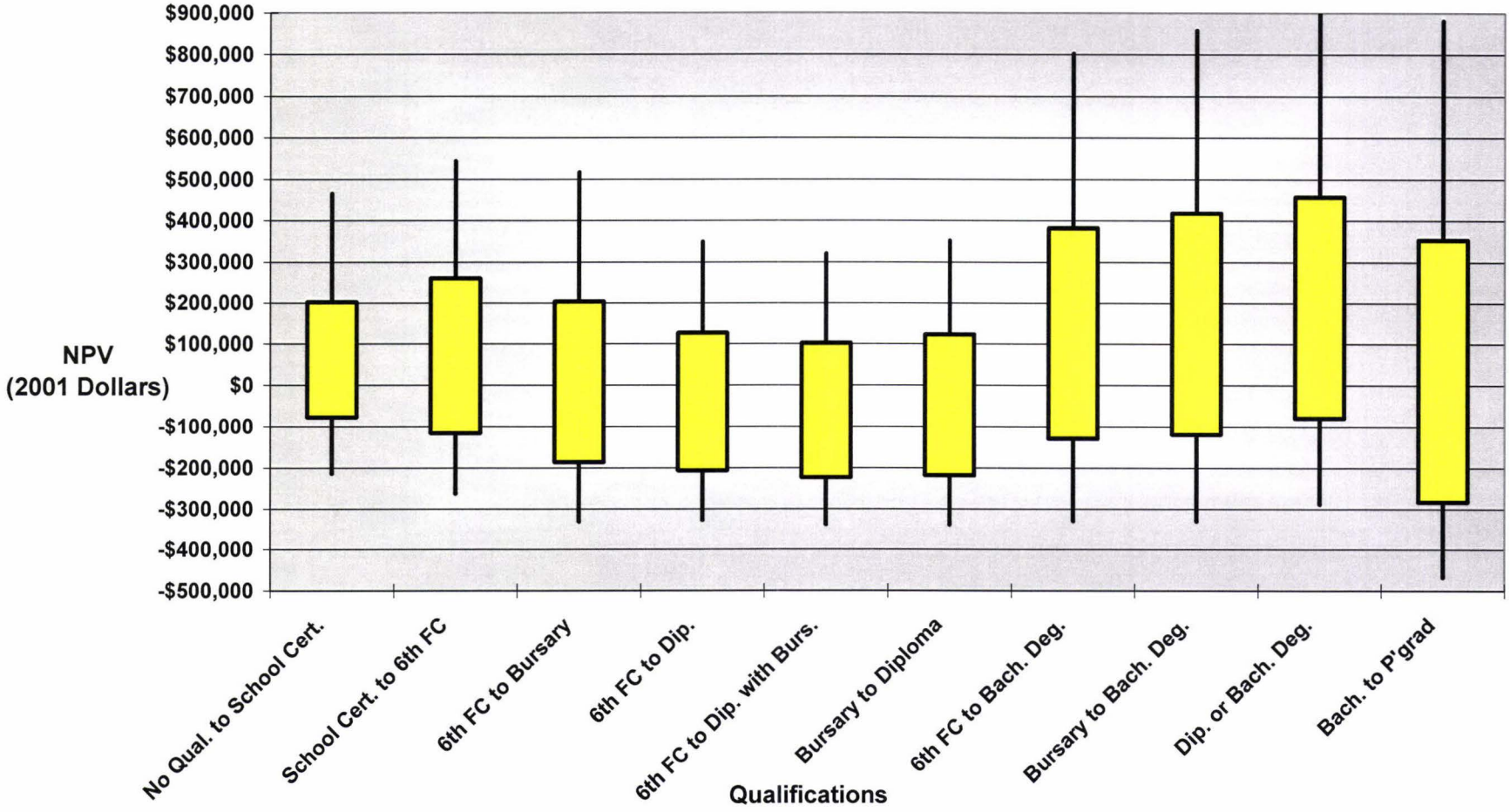


Figure 8.16: Social Discounted Sum of Returns - Quantile Estimates

Fulltime-Employed Males 2001

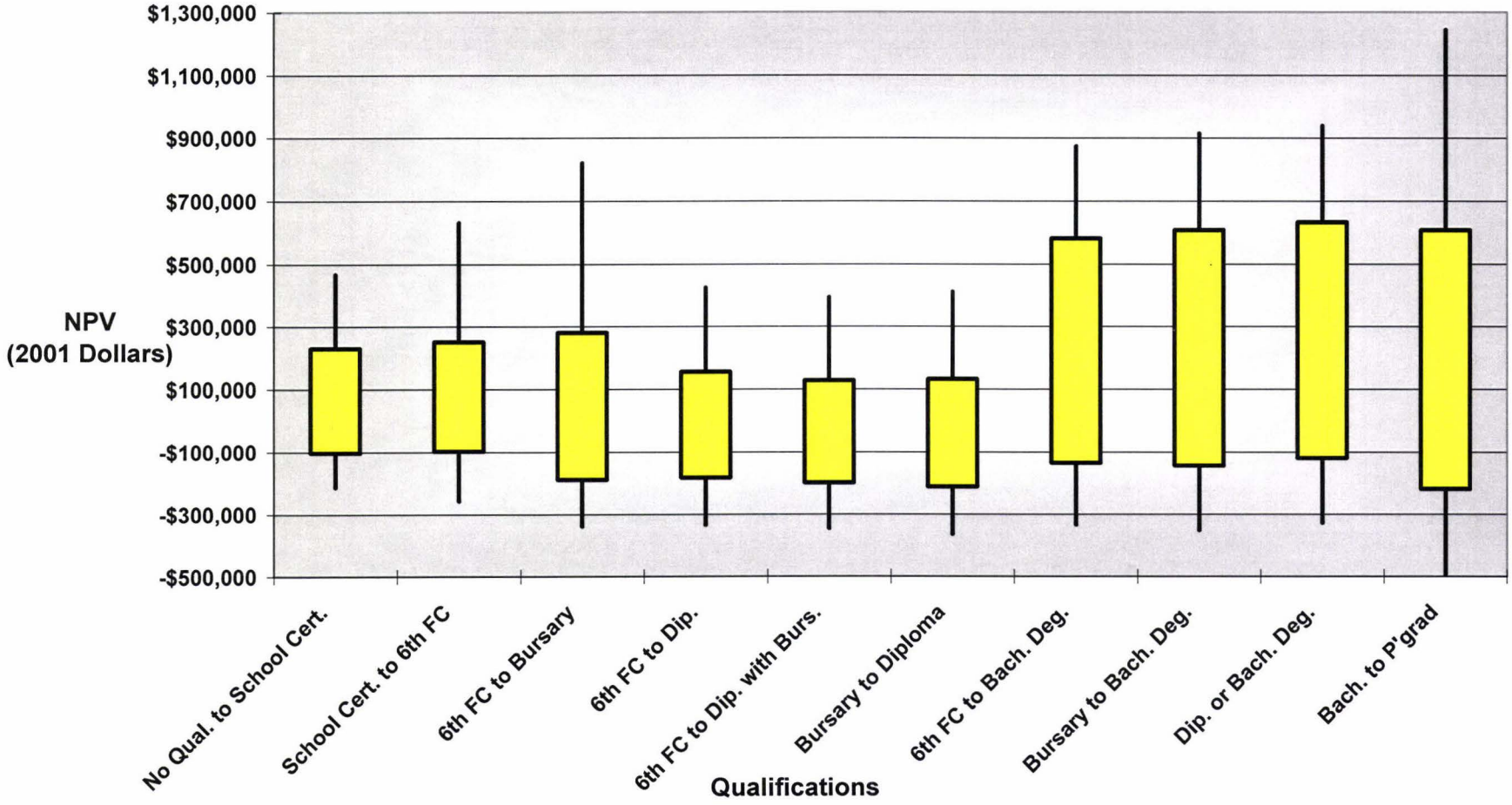


Table 8.5: Private Net Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Females
(2001 Dollars)

Qualifications	Quantile									
	10th		25th		50th		75th		90th	
	1996	2001	1996	2001	1996	2001	1996	2001	1996	2001
No Qualification to School Certificate	-$130,460	-$150,155	-$49,613	-$50,463	$56,477	$45,036	$146,589	$156,988	$226,701	$253,978
School Certificate to Sixth Form Certificate	-$204,990	-$182,989	-$96,050	-$76,957	$10,735	$36,768	$94,815	$144,146	$189,107	$264,556
Sixth Form Certificate to Bursary	-$238,706	-$244,768	-$124,424	-$129,240	-$5,130	-$5,856	$98,710	$116,389	$221,853	$245,497
Bursary to Diploma	-$234,082	-$253,017	-$127,974	-$142,999	-$6,201	-$38,748	$49,051	$70,453	$134,935	$186,478
Bursary to Bachelors Degree	-$233,197	-$230,356	-$96,422	-$91,170	$36,357	$37,670	$133,877	$155,863	$322,454	$320,077
Bachelors Degree to Postgraduate Degree	-$284,393	-$302,024	-$134,459	-$119,184	-$9,470	$30,048	$129,554	$137,355	$357,690	$346,383
Sixth Form Certificate to Diploma (No Bursary)	-$237,045	-$239,707	-$123,702	-$130,797	$5,418	-$26,037	$66,705	$82,152	$157,835	$194,279
Sixth Form Certificate to Diploma (With Bursary)	-$241,898	-$244,739	-$133,077	-$139,961	-$8,190	-$40,674	$48,474	$63,327	$136,554	$173,827
Sixth Form Certificate to Bachelors Degree	-$223,923	-$223,158	-$93,661	-$90,600	$32,795	$32,105	$125,671	$144,670	$305,268	$301,064
Diploma or Bachelors Degree	-$220,180	-$187,130	-$92,446	-$54,545	$45,407	$80,738	$147,743	$204,840	$345,111	$377,265

Table 8.6: Private Net Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Males
(2001 Dollars)

Qualifications	Quantile									
	10th		25th		50th		75th		90th	
	1996	2001	1996	2001	1996	2001	1996	2001	1996	2001
No Qualification to School Certificate	-$162,488	-$167,015	-$56,346	-$78,930	$39,656	$28,324	$147,982	$170,285	$325,345	$326,620
School Certificate to Sixth Form Certificate	-$200,471	-$204,125	-$87,353	-$75,443	$37,753	$38,907	$182,724	$180,041	$375,035	$422,457
Sixth Form Certificate to Bursary	-$255,382	-$272,422	-$135,335	-$142,505	-$13,048	$724	$132,415	$180,839	$333,118	$500,366
Bursary to Diploma	-$244,825	-$276,696	-$151,880	-$152,923	-$48,554	-$39,633	$92,760	$97,803	$248,028	$276,074
Bursary to Bachelors Degree	-$230,783	-$258,855	-$75,218	-$96,730	$79,759	$66,788	$293,114	$390,643	$589,158	$583,040
Bachelors Degree to Postgraduate Degree	-$319,276	-$349,288	-$183,451	-$151,747	-$22,336	-$8,410	$240,217	$360,711	$586,336	$787,475
Sixth Form Certificate to Diploma (No Bursary)	-$237,611	-$255,110	-$144,197	-$133,568	-$41,479	-$20,691	$95,039	$114,058	$246,085	$286,407
Sixth Form Certificate to Diploma (With Bursary)	-$243,704	-$261,697	-$155,184	-$143,817	-$56,778	-$35,923	$77,806	$94,968	$225,680	$264,751
Sixth Form Certificate to Bachelors Degree	-$230,330	-$244,705	-$82,173	-$90,301	$65,424	$65,431	$268,620	$373,864	$550,566	$557,099
Diploma or Bachelors Degree	-$173,937	-$207,114	-$27,913	-$59,155	$133,487	$110,924	$355,036	$445,302	$663,542	$649,469

Table 8.7: Social Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Females
(2001 Dollars)

Qualifications	Quantile									
	10th		25th		50th		75th		90th	
	1996	2001	1996	2001	1996	2001	1996	2001	1996	2001
No Qualification to School Certificate	-$172,212	-$190,575	-$67,912	-$66,735	$68,956	$51,898	$186,442	$190,968	$300,563	$326,556
School Certificate to Sixth Form Certificate	-$266,819	-$231,363	-$126,928	-$99,647	$10,240	$41,627	$122,254	$182,140	$257,378	$356,741
Sixth Form Certificate to Bursary	-$305,149	-$301,333	-$162,195	-$163,551	-$4,840	-$7,935	$141,656	$164,146	$328,254	$360,434
Bursary to Diploma	-$229,673	-$326,075	-$82,949	-$189,407	$86,250	-$59,902	$166,399	$84,918	$300,511	$254,058
Bursary to Bachelors Degree	-$322,715	-$306,044	-$147,036	-$133,142	$31,781	$34,829	$172,938	$207,571	$453,086	$467,125
Bachelors Degree to Postgraduate Degree	-$392,902	-$397,413	-$198,133	-$165,151	-$26,377	$49,112	$182,324	$205,237	$531,590	$555,446
Sixth Form Certificate to Diploma (No Bursary)	-$317,466	-$308,705	-$171,921	-$173,413	-$5,344	-$43,276	$76,926	$99,851	$208,568	$262,958
Sixth Form Certificate to Diploma (With Bursary)	-$326,666	-$318,483	-$186,928	-$188,323	-$25,787	-$64,985	$50,546	$72,939	$178,272	$234,025
Sixth Form Certificate to Bachelors Degree	-$312,187	-$299,406	-$144,874	-$134,737	$25,428	$25,235	$159,863	$189,751	$426,670	$436,946
Diploma or Bachelors Degree	-$337,751	-$285,065	-$162,072	-$112,163	$16,745	$55,808	$157,902	$228,550	$438,049	$488,104

Table 8.8: Social Discounted Sums of Returns - Quantile Estimates

Fulltime-Employed Males
(2001 Dollars)

Qualifications	Quantile									
	10th		25th		50th		75th		90th	
	1996	2001	1996	2001	1996	2001	1996	2001	1996	2001
No Qualification to School Certificate	-$213,862	-$213,371	-$76,758	-$103,080	$48,645	$31,136	$201,655	$230,479	$465,760	$468,476
School Certificate to Sixth Form Certificate	-$262,320	-$257,619	-$117,064	-$97,766	$51,467	$50,439	$260,066	$251,459	$543,551	$631,189
Sixth Form Certificate to Bursary	-$330,209	-$339,602	-$186,440	-$189,949	-$15,414	$2,342	$203,184	$281,077	$517,215	$820,817
Bursary to Diploma	-$337,888	-$365,771	-$218,536	-$212,015	-$82,205	-$64,760	$122,824	$132,302	$352,628	$412,042
Bursary to Bachelors Degree	-$328,888	-$351,727	-$120,161	-$144,432	$101,567	$87,750	$417,714	$607,604	$858,479	$914,875
Bachelors Degree to Postgraduate Degree	-$467,396	-$492,878	-$282,636	-$218,623	-$48,189	-$16,454	$354,311	$607,387	$881,931	$1,244,446
Sixth Form Certificate to Diploma (No Bursary)	-$326,419	-$334,302	-$206,466	-$183,318	-$71,089	-$36,885	$126,660	$155,585	$349,594	$425,192
Sixth Form Certificate to Diploma (With Bursary)	-$337,212	-$346,011	-$223,543	-$199,577	-$93,704	-$59,334	$101,562	$128,344	$320,423	$394,763
Sixth Form Certificate to Bachelors Degree	-$328,641	-$332,636	-$129,852	-$135,212	$81,317	$85,914	$382,409	$581,012	$802,186	$873,651
Diploma or Bachelors Degree	-$288,231	-$326,712	-$79,503	-$119,417	$142,225	$112,765	$458,371	$632,618	$899,137	$939,889

Figure 8.17: Private Net Discounted Sums of Returns
Diploma Breakdown - Quantile Estimates

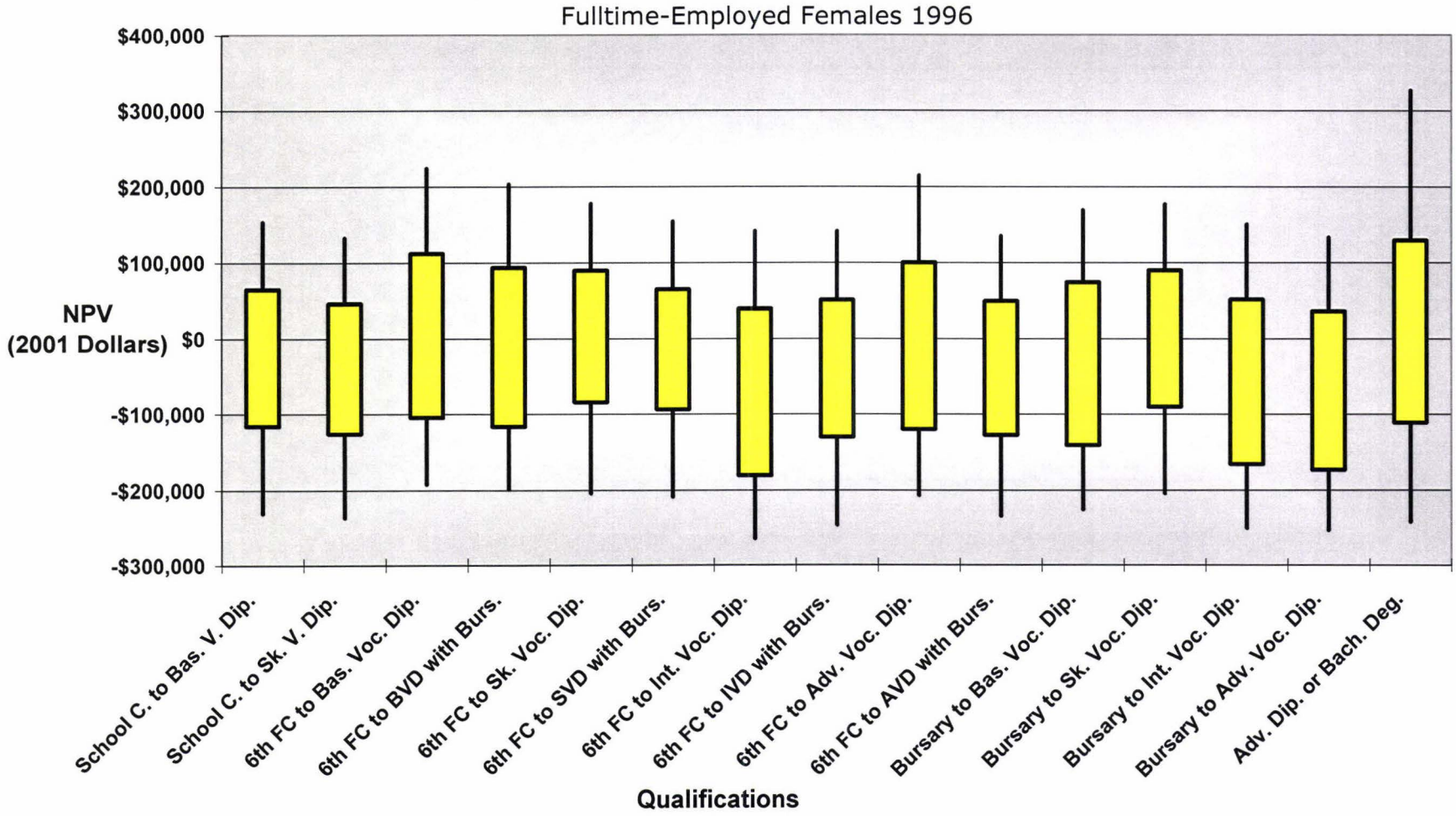


Figure 8.18: Private Net Discounted Sums of Returns
Diploma Breakdown - Quantile Estimates
Fulltime-Employed Females 2001

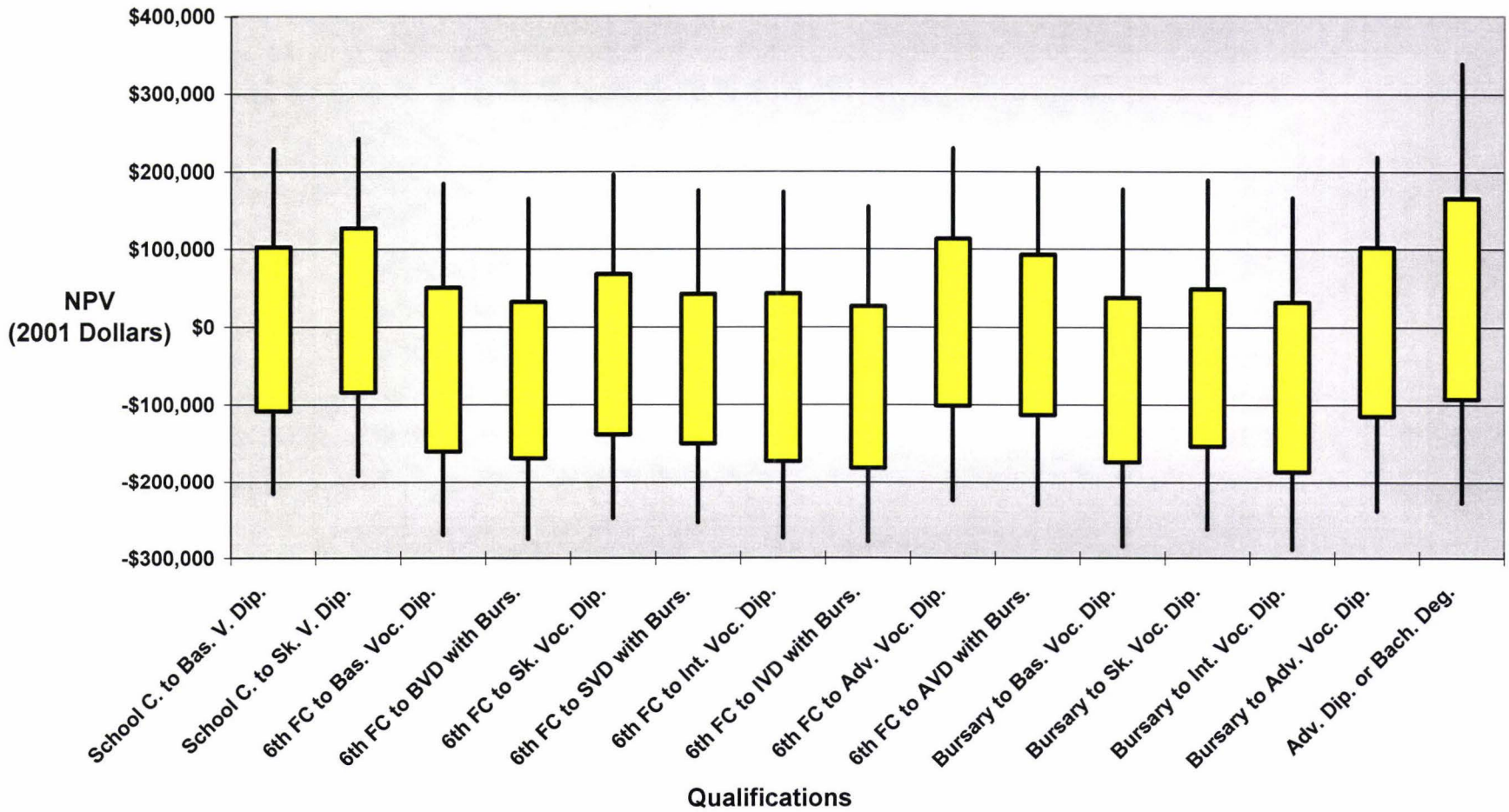


Figure 8.19: Private Net Discounted Sums of Returns
Diploma Breakdown - Quantile Estimates
Fulltime-Employed Males 1996

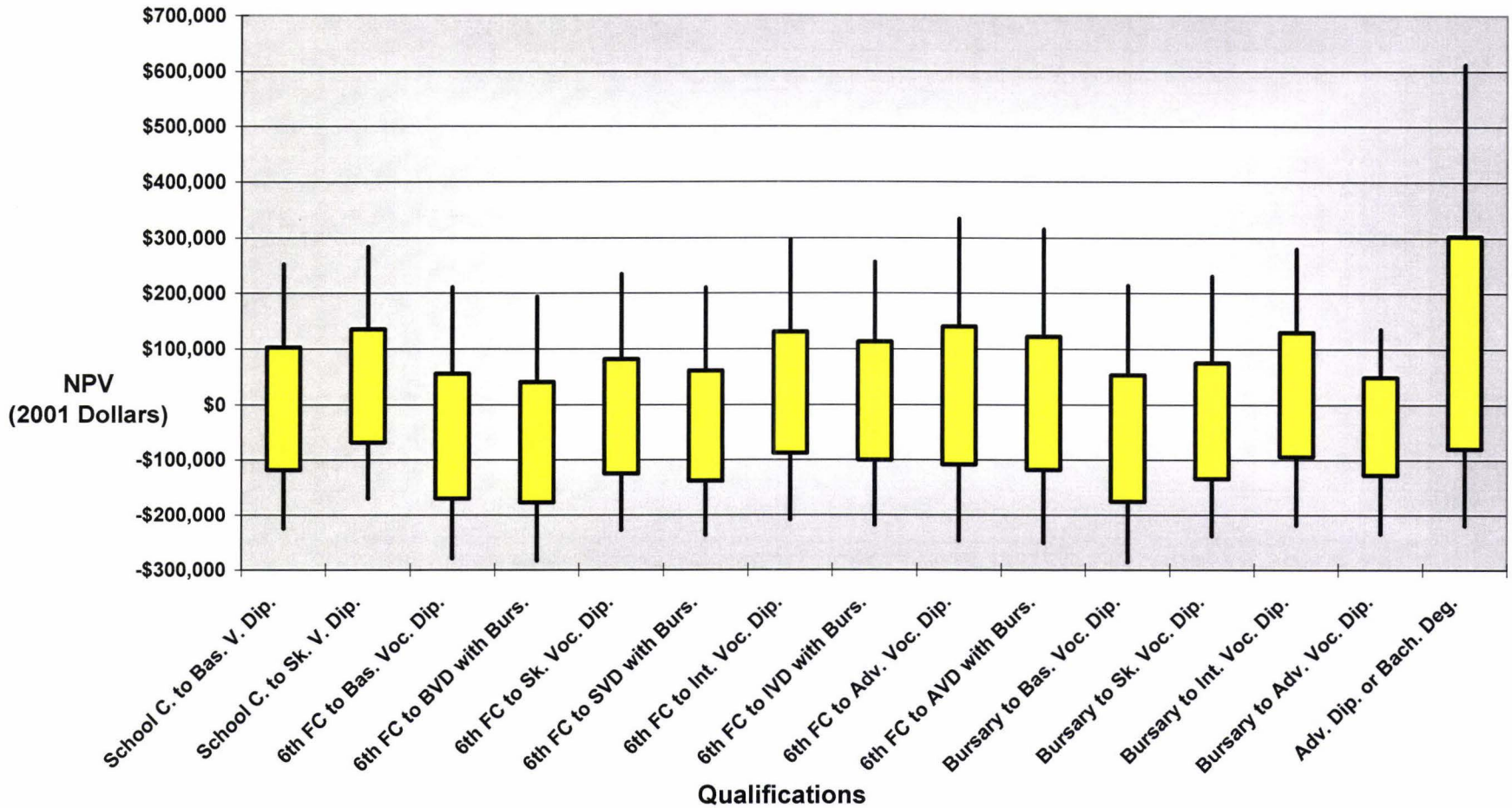


Figure 8.20: Private Net Discounted Sums of Returns
Diploma Breakdown - Quantile Estimates
Fulltime-Employed Males 2001

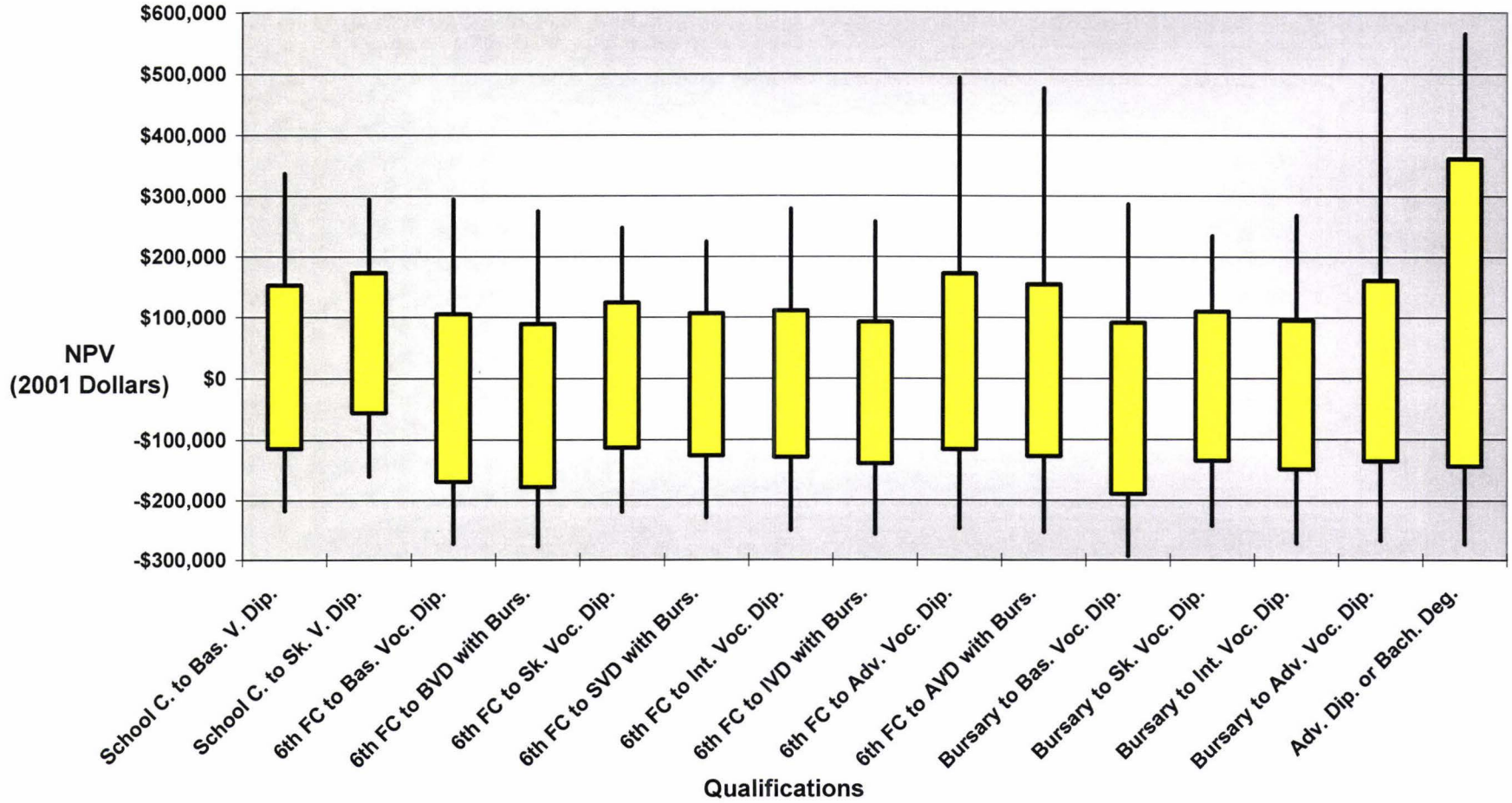


Figure 8.21: Social Discounted Sum of Returns
Diploma Breakdown - Quantile Estimates
Fulltime-Employed Females 1996

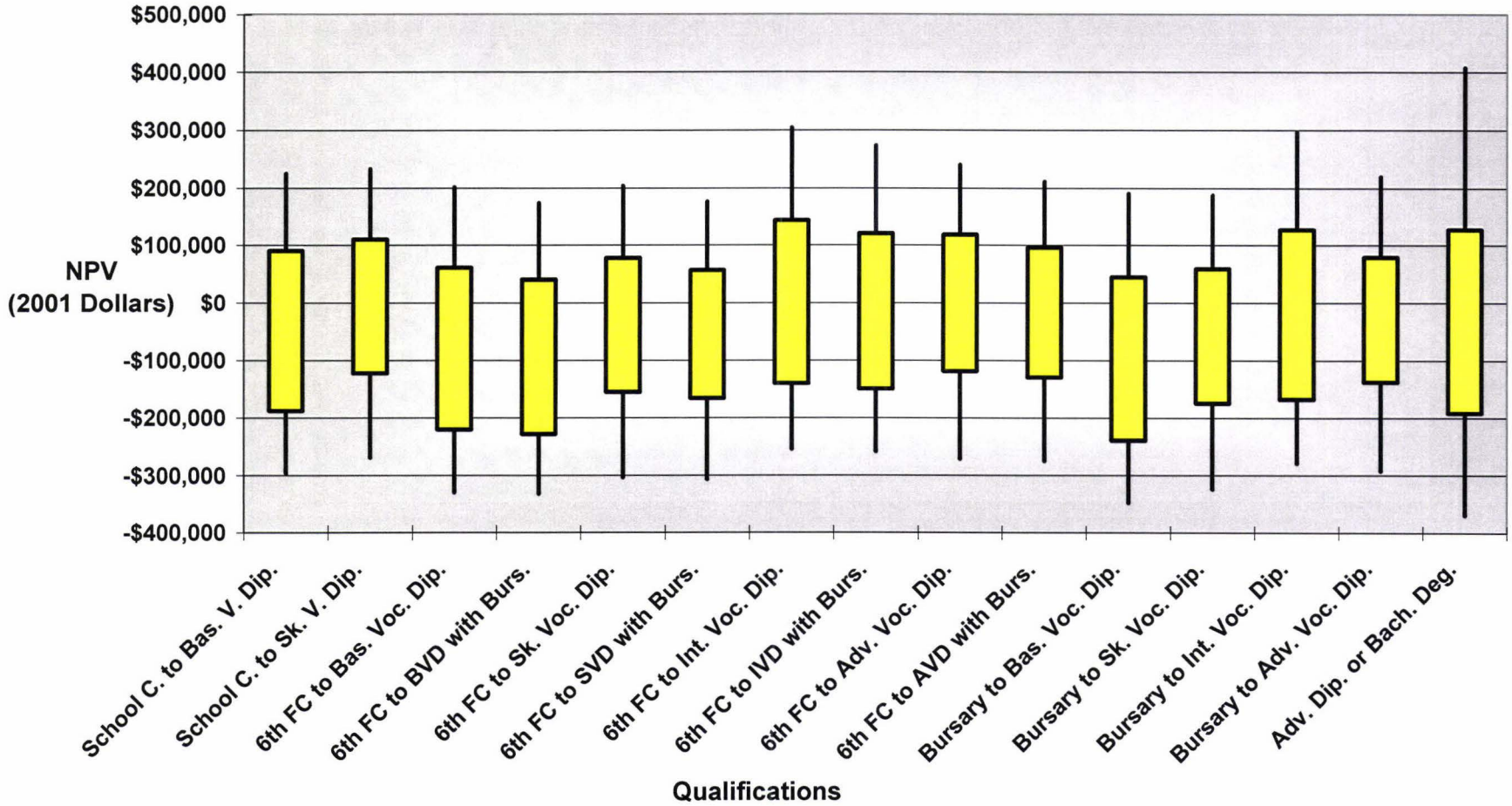


Figure 8.22: Social Discounted Sum of Returns
Diploma Breakdown - Quantile Estimates
Fulltime-Employed Females 2001

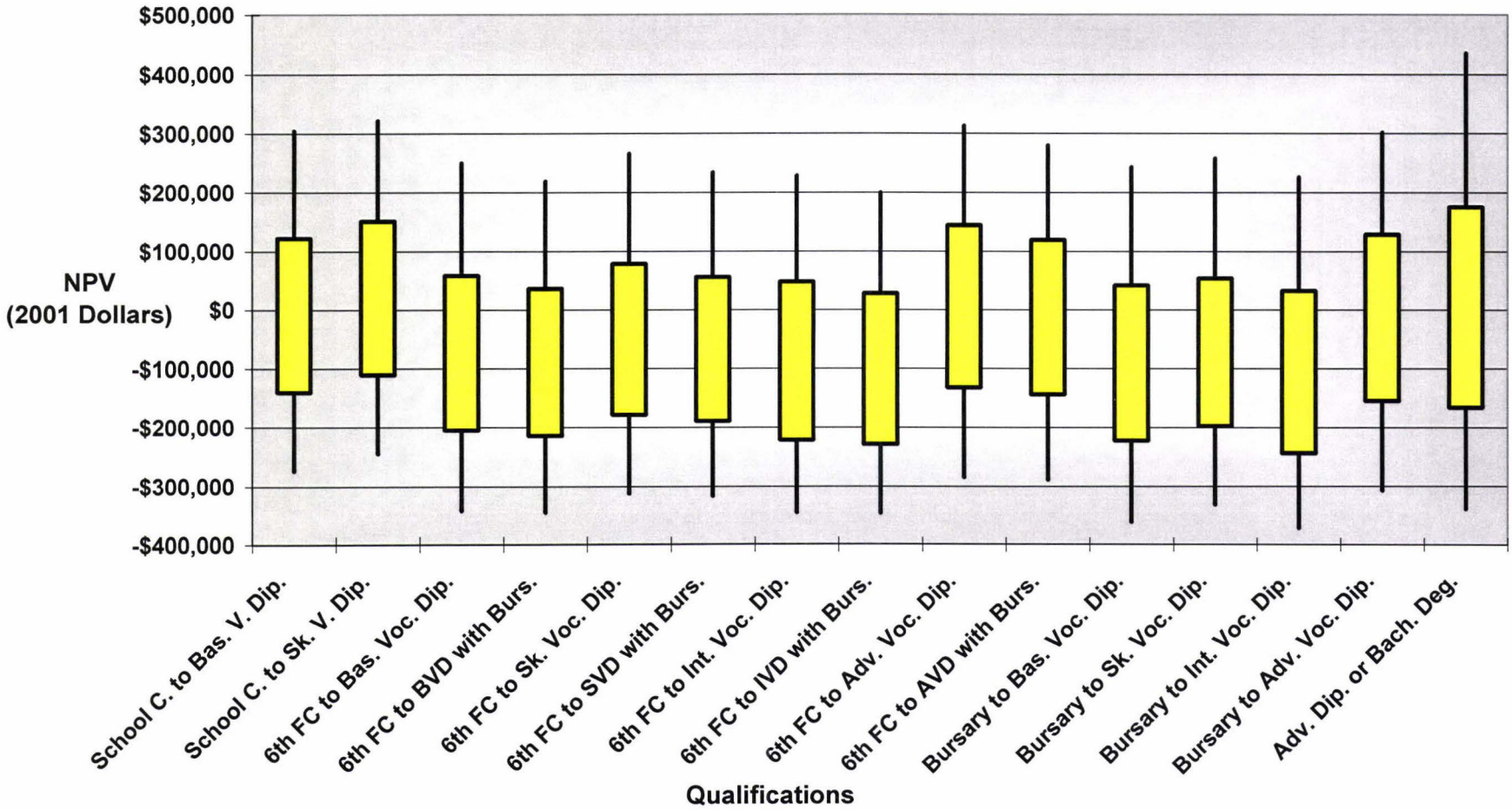


Figure 8.23: Social Discounted Sum of Returns
Diploma Breakdown - Quantile Estimates

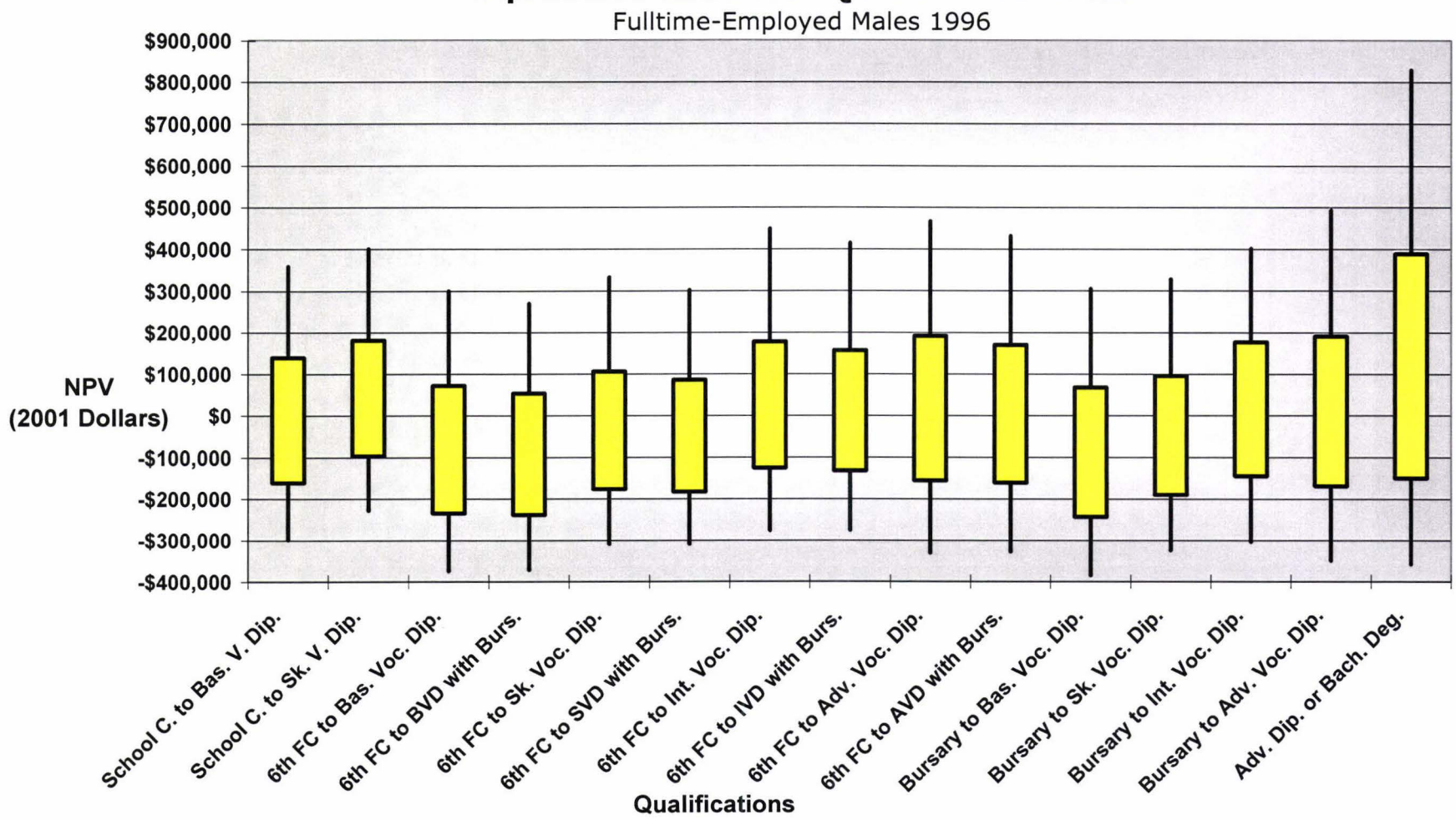
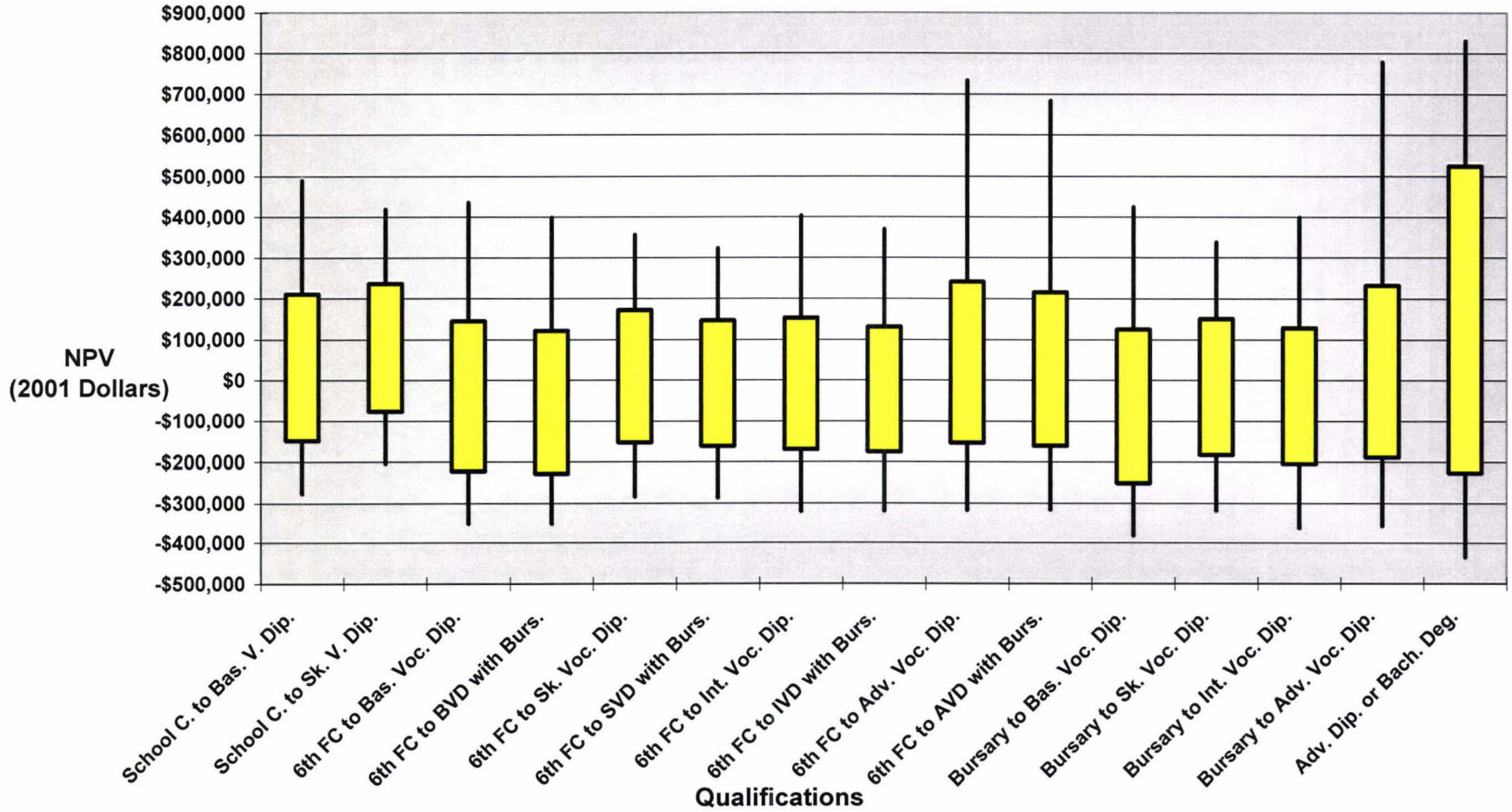


Figure 8.24: Social Discounted Sum of Returns
Diploma Breakdown - Quantile Estimates
Fulltime-Employed Males 2001



9 Tertiary Sector Policy Implications

Results from Chapter eight highlight the importance of foregone earnings for the investment in education and as a consequence the returns to education[1]. With this in mind, this chapter suggests policies to reduce the level of forgone earnings which, in turn, reduce the level of investment in education. A lower level of investment leads to a lower level of risk and subsequently a higher on average return. The three policy approaches include: enhancing part-time work opportunities for students, facilitating part-time study for those working full-time, and reducing the length of study.

Also, this chapter asserts that recent changes to tuition fee levels and the accompanying level of government funding have had manageable effects on the private returns to tertiary education. Furthermore, the recent increases in tuition fees may explain increased part-time work by students. And, the combined effect of higher tuition fees and increased part-time work by students can in certain frameworks have the counter-intuitive result of increasing the social returns to tertiary education.

The poor performance of the Diploma qualifications, shown in chapter six and eight, requires policies to maximise the returns or at least minimise the losses through promoting the timely entry into Diploma studies. Also, the Advanced Vocational Diploma has become redundant and polytechnics should replace this qualification by offering degree programmes. For Basic Vocational Diploma and Skilled Vocational Diploma, apprenticeship schemes go someway to mitigating their otherwise poor returns.

Finally, to make informed policy decisions, returns to education analysis needs to adopt a broad approach. The NPV criteria may offer more information than the traditional method of comparing rates of return. In fact, results from chapter eight showed that the social discounted sums of

[1] As defined in Chapters seven and eight.

returns may exceed the net private discounted sums of returns. This may necessitate a re-evaluation of previous policy decisions based on rates of return measures. Moreover, the results of the quantile estimates in chapter eight allow the distribution of returns to be considered in policy-making decisions rather than just point estimates based on the mean returns.

9.1 The Importance of Forgone Earnings

The importance of forgone earnings needs to be highlighted in policy decisions. Emphasis usually falls on tuition fee levels, government funding levels, student loan and student allowance programmes. But from an economic point of view, and a returns to education perspective, forgone earnings represent the largest part of the investment in tertiary education. Accordingly, they determine to a large extent the economic success or failure of the decision to invest in education. Also, results from the sensitivity analysis in chapter eight (sections 8.2.3 and 8.3.3) showed that the returns to education were particularly sensitive to changes in the level of forgone earnings and the length of study, but were relatively less sensitive to changes in tuition fees, for example. Therefore, policies need to focus on forgone earnings and be developed to enhance the ability for students to minimise the amount of income they give up during the time spent studying[2].

A three-pronged approach to designing and implementing policies can be used. The first focuses on facilitating full-time study and part-time work in the manner that is traditionally undertaken by students. In other words, so that students can study and work part-time or during their summer breaks, thus decreasing their forgone earnings. The second

[2] The importance of forgone earnings is accentuated in the calculation of the returns to education in the elaborate method. This is because it does not take into account of things such as the leisure time that may be lost when students increase their hours of part-time work. However, this can be countered somewhat by the increased work experience and skills students learn in such jobs.

approach focuses on facilitating fulltime work and part-time study. This approach falls into the general heading of "lifelong learning." The final approach focuses on reducing the length of time spent studying and subsequently reducing forgone earnings. Each of these approaches is outlined in detail below.

9.1.1 Full-Time Study and Part-Time Work Focused Policies

Results from chapter eight unambiguously showed that when the level of forgone earnings reduced from 100 percent to 75 percent and again to 50 percent that the returns to a Bachelors Degree increased significantly. However, policy-makers attention usually focuses on tuition fee levels, student loans and allowances as well as government funding levels. So how can a reduction in forgone earnings be achieved and what kind of policies can help facilitate this?

Recent trends have shown that the number of tertiary students working at part-time jobs has steadily increased in recent years. Thus students have been helping to achieve the goal of reducing forgone earnings independently and have not needed policy-based incentives to do so. However, given the irregularities in students' availability for part-time work, flexible work schedules and the ability to move between jobs quickly are necessary to maximise their part-time earnings. The one stumbling block for students is that to achieve this, they must devote time to job searching. The job search costs can be reduced for students and thus participation in the workforce increased with the aid of an employment agency devoted to students. Student Job Search (SJS) has provided this service, since 1982 (Hunt, 2004).

SJS is funded by tertiary institution student associations and by Study Link through the Ministry of Social Development. In 2003, the government funded SJS to around $4 million per year (Ministry of Social Development, 2005). The analysis that this study has provided indicates that the service that SJS provides and the public funds devoted to it are justifiable and enhance the private and social investment in education.

Furthermore, this study provides a framework for analysis into the appropriate level of government funding to SJS.

In addition, students that receive student allowances are not permitted to earn more than $135.13 a week before tax; however, this runs counter to the goal of minimising forgone earnings. Students already have a time constraint as to how many hours per week they can spend working. Therefore, from an economic perspective, it makes little sense to impose another constraint on how much they can earn while studying and receiving a student allowance[3]. The income limit constrains the amount forgone earnings can be reduced by and in turn reduces not only the potential private return to education, but the potential social return as well.

Rather than a cap on earnings, an abatement regime similar to that used for the unemployment benefit could be used for student allowance recipients. For example, 70 cents could be abated from the student allowance for every dollar earned over $135.13. This kind of policy keeps in tact the incentive to work, and as such, the ability to reduce forgone income. Alternatively and more simply, the income limit could be increased. This may make comparisons to other the situation of other beneficiaries inevitable. However, this can be tempered by the fact that students must pay tuition fees on top of their normal daily living expenses.

9.1.2 Full-Time Work and Part-Time Study Focused Policies

The second approach to reducing forgone earnings is quite simple; don't stop working! Or put another way, combining full-time work with part-time study. The advantage of this is obvious; in that while someone is working full-time their forgone earnings are zero. Therefore, combining full-time work and part-time study is very desirable from a returns to education perspective. Countering this, however, is the knowledge that

[3] The constraint is further enforced by the fact that if a student neglects his or her studies to the point that they fail more than half their papers, they will no longer be eligible for a student allowance.

qualifications will take longer to complete than if studying full-time. But given that personal circumstances and preferences often mean that full-time study is not possible, it is then desirable for policies to facilitate part-time study.

Policies can target individuals or companies to aid full-time workers complete part-time study. While specific policies are not introduced here, some ideas are put forward for discussion. Study leave provisions in worker contracts could be useful, in a similar way to maternity or paternity leave. Another possibility is tax credits for workers who pursue part-time study or for companies who provide resources for employees to do so.

Part-time study while desirable from a returns to education perspective, it is also desirable in the context of a knowledge economy. With technology and knowledge progressing rapidly, workers need to keep pace by upgrading skills and adopting new technologies. This lifetime learning approach adds weight to the argument for policies facilitating part-time study to reduce forgone earnings while studying and to increase the returns to education.

9.1.3 The Death of the Summer Holiday

Similar to the results for forgone income, chapter eight unambiguously showed that when the length of study for a Bachelors Degree was reduced from three to two the returns to a Bachelors Degree increased significantly. Therefore, it is desirable both socially and privately to reduce the length of time spent completing a Bachelors Degree or other tertiary qualifications. The question is how to cram three (or sometimes four) years of study into two (three)?

One option would be to cram more papers into each semester. However, this would increase workloads and in all probability lower average grades. The more sensible option would be to continue studying full-time over the summer. The normal logic has it that a tertiary student studies during the autumn and spring semesters and then takes the summer off to work and

save money (and recuperates) for the following year. This approach is very much engrained in tradition. However, it runs counter to economic logic. Take the example of two students completing a Bachelors Degree;

> The first student takes the traditional approach to tertiary study; he or she studies during the autumn and spring semesters and then works over the summer, repeating this for three years until completion of the Bachelors Degree. In total, the student studies for six semesters and works for two (summer semesters), earning at a wage rate appropriate for a school-leaver. The second student studies right through each summer. By doing this, he or she completes the Bachelors Degree in two years or six semesters of study. Upon completion of the Bachelors Degree, the student starts working and earning at a rate appropriate for a university graduate. Comparing the two, we see that after three years both have completed a Bachelors Degree. And for arguments sake, both have worked for approximately one year[4]. The difference is, however, the traditional student earned a wage at a school-leaver's level while the student completing the Bachelors Degree in two years earned at a university graduate's level. Furthermore, the student entering the labour force after three years would command a lower salary in the first year and subsequent years than the student who had already had a year's experience.

Therefore, from an economic perspective, summer holidays reduce the both the private and social returns to a Bachelors Degree.

Universities and polytechnics have begun to offer summer programmes, however, the courses offered are limited. Using Massey University as an example; the majority of papers on offer in semester 3, 2004 were at the first year level. Meaning that first year students could take a full paper load, but second and third year students were limited to lower level courses and, in particular, could not take papers to complete their major

[4] Making the assumption that two summers' of work is approximately equal to a year's work.

requirements. Other universities and polytechnics offered a similar or lower number of courses to Massey University.

The main barriers to increased summer study include entrenched student and academic traditions. From an economic viewpoint, the marginal costs are low. Therefore, with encouragement from policy-makers a full summer semester offering is feasible. The returns would not be confined just to the individual student. Better utilisation of existing tertiary institution infrastructure would mean additional benefits to the tertiary education sector.

9.2 Tuition Fee Levels and the Government Funding of Tertiary Education

From the sensitivity analysis in chapter 8 (sections 8.2.3 and 8.3.3), results showed that the returns to a Bachelors Degree was not sensitive to the level of tuition fees and the accompanying level of government funding. In addition, the income effects for Bachelors Degree and Postgraduate Degree in the earnings regression analysis in chapter six, section 6.1 showed an increase against the No Qualification group over the two periods studied. Therefore, as the sensitivity analysis suggested, the increase in tuition fees and the accompanying decrease in of the government contribution per student, as a percentage of the total tuition[5], has had a manageable impact on the private returns to a Bachelors Degree and a Postgraduate Degree.

9.2.1 The Tuition Fees Paradox

From an incentives point of view, increasing tuition fee levels may actually help achieve the goal from the previous section of decreasing forgone earnings. Also, the increased level of tuition fees goes a long way to

[5] See chapter three for data on government funding levels.

explain the increased numbers of students working part-time and over the summer break.

If tertiary education were free, students would have little incentive to work to finance their studies and what work they may do, would normally be to cover living expenses only. In contrast, when students pay tuition fees, the incentives to work are increased above the level required to finance living costs alone. Therefore, introducing tuition fees or increasing them will increase the amount of part-time work students undertake and subsequently decrease the level of forgone earnings. From a private standpoint, the increase in fees may be cancelled out by a decrease in forgone earnings and therefore the increase in fees may have a neutral effect on the level of private returns to education (depending on the relative level of the increase in earnings and tuition fees). From a social point of view, where it does not matter whether the government or student pays the tuition fee, increasing tuition fees may actually have a positive effect on the return social returns to education.

The paradox as explained above only holds in the framework where the returns to education are measured using the elaborate technique outlined in chapter seven. This technique excludes externalities and non-measurable benefits of education. Therefore, when the analysis incorporates other values such as the value of students' leisure time (which would decrease if part-time work increased) the conclusion no longer holds.

9.3 The Performance of Diploma Qualifications

9.3.1 The Timing of Diploma Studies

The low or negative returns for the Diploma qualification found in chapter eight prompt the call for policy initiatives to minimise the losses and reverse worsening trends. Entry into Diploma courses is not as dependent on secondary school qualifications as is entry into university courses. In

addition, the skills and competencies required to successfully complete these qualifications do not require full completion of secondary school (year 13). Moreover, in chapter eight, analysis of the sub-qualifications showed that the earlier the qualification was completed the higher the rate of return. Therefore, policies should aim to promote timely entry into Diploma courses by those secondary students intending to complete a Diploma qualification. A rough guide would be; students intending to pursue a Basic Vocational Diploma or Skilled Vocational Diploma should commence studying after year 11; and, students intending to pursue an Intermediate Vocational Diploma or Advanced Vocational Diploma commence studying after year 12. This renders redundant year 13 for students intending to pursue Diploma qualifications. The goal of such policies while not perhaps leading to a reversal of negative or low returns would at least minimise losses.

As an alternative, students wishing to remain in secondary school could combine school studies (Year 12 or 13) with polytechnic courses. Examples of current programmes of this type are the STAR[6] programme and Gateway programme. Socially this may be more appealing to students as they can remain within their peer group at secondary school. From a returns to education perspective, this may mean that students take longer to complete their diplomas and therefore reduce the level of return. However, as a second-best policy option it is still more desirable than say fully completing secondary school and then commencing studies for a Basic Vocational Diploma or Skilled Vocational Diploma.

9.3.2 Replacing the Advanced Vocational Diploma Qualification

The second policy objective would see the replacement of the Advanced Vocational Diploma qualification with Bachelors Degree. Results from chapter eight showed negative returns for the Advanced Vocational Diploma qualification and a large gain for Bachelors Degree over Advanced Vocational Diploma. Furthermore, the Intermediate Vocational Diploma

[6] Secondary Tertiary Alignment Resource.

outperformed Advanced Vocational Diploma in results shown in chapter eight. The Advanced Vocational Diploma offers no gains over Intermediate Vocational Diploma. As such, the arguments for continuing to offer this qualification are scarce. Policies should then encourage those intending to pursue an Advanced Vocational Diploma to instead pursue a Bachelors Degree. In fact this is already happening in many polytechnics as they increasingly offer degree programmes to their students.

9.3.3 Apprenticeship Schemes

Finally, recent government initiatives have placed renewed emphasis on apprenticeship training schemes. This study concurs with these policies. Basic Vocational Diploma and Skilled Vocational Diploma qualifications showed negative or low returns (again in chapter eight) however, these returns can be mitigated by apprenticeship training. Since apprenticeships are work-based training schemes, students can continue to earn while they train (albeit at a reduced apprentice rate). Therefore, students reduce their forgone earnings. And as explained in section 9.1, any policy that achieves a reduction in forgone earnings can lead to an overall increase in the returns to, in this case, Basic Vocational Diploma and Intermediate Vocational Diploma.

9.4 Measuring the Returns to Education

To make informed policy decisions, returns to education analysis demands a broad approach. Traditionally, the focus has been on rate of return analysis using regression analysis and internal rate of return analysis. These techniques provide results based on point estimates usually the mean. Therefore, they do not give an indication of the distribution of results and additionally do not incorporate the scale of investment into the analysis. This study suggests using net present value analysis to allow education investments of different magnitudes in time and value to be more easily compared. Also, by incorporating the quantile regression technique into the elaborate method, a distribution of results for different

levels of qualification has been produced. This better reflects the level of risk associated with investments in tertiary education and provides useful information for policy-makers.

9.4.1 Social Returns to Secondary and Tertiary Education

Results from the net present value analysis in chapter 8 section 8.3.2, suggest that the internal rate of return method underestimates the social returns to secondary and tertiary education. In fact, the results showed that the social returns to secondary and tertiary education exceed the private returns to secondary and education. This runs counter to the majority of previous studies. Higher social returns challenge previous policy choices based on lower social returns. Therefore, with the new results, policy-makers need to reassess decisions to see if they conform to the new information garnered in the net present value analysis results.

9.4.2 Labour Force Experience and the Income Effects of Education

Also, results in section 6.1.2 favour the use of potential years of labour experience in the income function. This gives additional support to reassessing policy decisions made on the basis of previously calculated income effects. Section 6.1.2 found that the traditional specification of labour force experience, using age and age squared, underestimated the income effects of tertiary qualifications. Results showed that by using the more intuitively appealing potential years of labour force experience specification, instead of age in the income function, the income effects of tertiary qualifications increased relative to secondary qualifications.

In general, the arguments put forward in section 9.4.1 and this section point towards higher returns to tertiary qualifications. From a policy perspective, this leads to a greater justification for investment in tertiary education than previously thought.

10 Conclusions and Suggestions for Further Research

10.1 Approaches to Measuring the Returns to Education in New Zealand

This study explored the returns to secondary and tertiary education in New Zealand by using two approaches with Census data. The first approach used income function analysis to calculate the income effects of secondary and tertiary qualifications against the No Qualification group as well as the marginal income effects of qualifications. The second approach used the elaborate method to calculate the marginal returns to qualifications under the NPV and IRR criteria. This model was extended to include quantile estimates of the marginal returns to qualifications.

10.1.1 Results from the Income Function Analysis

The results from the income function analysis, reported in chapter six, showed an increase in the income effect of all qualifications against the No Qualification group. The Chow Test confirmed the increase at the 95 percent confidence level for all but a few qualifications. Furthermore, the chapter reported the marginal percentage income effects of qualifications. Overall, the marginal effects exhibited mixed but consistent results over the female and male samples. The results in chapter six also pointed out the income differential between individuals with lower (or no) qualifications and individuals with higher qualifications increased for females and males from 1996 to 2001. In other words, income inequality increased between skilled and unskilled workers.

This study concludes that the income function analysis approach suits the exploration of income inequality and its relationship with education levels by calculating the income effects of qualifications. In contrast, the marginal percentage income effects of qualifications calculated using income function analysis provide less useful information. Education,

particularly at the tertiary level, involves large investments and the investments vary according to the qualification. Income function analysis cannot directly allow for this, hence it is more suited for examining issues such as income inequality.

10.1.2 Results from the Elaborate Method Analysis

The marginal returns to qualifications calculated in chapter eight showed inconsistent results between the IRR and NPV criteria. The two criteria ranked projects differently. Moreover, using the IRR criteria, the private returns normally exceeded the social returns. In contrast, results reported using the NPV criteria showed that the social returns normally exceeded the private returns. The NPV criteria results run counter to the general consensus in the returns to education literature.

This study favours the NPV criteria over the IRR criteria. The IRR criteria gives a result in the form of a percentage return. This allows simple comparison between investments based simply on the value of the return. However, as has been shown the IRR can give misleading results. This is particularly true for investments of different size and investments over different periods of time, characteristics which investments in education display. The NPV criteria, however, incorporates the scale of investment into the calculation. Therefore, it facilitates comparisons of different educational investments such as a three-year Bachelors Degree and School Certificate.

10.1.3 Results from the Quantile Estimates

The quantile estimates of the returns to education, shown in section 8.4, found that the distributions of returns were much larger for Bachelors Degree and Postgraduate Degree than for secondary qualifications and Diploma. In the same way; the distributions of returns were larger for males than for females; larger for 2001 than for 1996; and the distribution of social returns larger than for private returns. The combined effect of larger investments and larger variability in incomes over time for

leads to the larger distribution of returns for these groups. The same principle applies to the distribution of social returns.

This demonstrates the limitations of point estimates based on the mean as calculated in the simple elaborate method and in the income function analysis. Qualifications reporting the same return at the mean have been shown that they can have a vastly different distribution of returns. Therefore, by displaying the distribution of returns, the quantile estimates give an indication of the risk associated with the qualification. This kind of information enriches the returns to education literature and has the potential to enhance policy making.

10.2 Results from the 2001 Census Data

10.2.1 Overall Returns to Education

Overall, the returns to secondary and tertiary qualifications in New Zealand remain positive and relatively stable. The impacts of increased participation, higher tuition fees and less government funding per student are not apparent in the results of this study. Therefore, with the possible exception of some Diploma qualifications, from both the private and social viewpoint, investment in secondary and tertiary qualifications remains desirable.

Results form chapter six showed that in general the income effects of all qualifications increased against the No Qualification group from 1996 to 2001. The expanded Chow Test confirmed the increases for the majority of qualifications. Also, the marginal percentage income effects rose on the whole[7] from 1996 to 2001. In contrast, the results from chapter eight show a less discernable pattern of change.

[7] Excluding comparisons with Bursary, Postgraduate Degree and School Certificate for females.

10.2.2 Diploma Breakdown

Results from both chapter six and eight showed a diverse range of returns for the Diploma qualification. Testing in chapter six concluded that the four sub-Diploma qualifications should be calculated separately. Chapter eight reported poor returns for all the Diploma qualifications, especially for females. Recommendations to alleviate this included: promoting timely entry into Diploma courses from secondary school; and the phasing out of the Advanced Vocational Diploma courses, so that it is replaced with Bachelors Degree programmes.

10.2.3 The Bursary Qualification

Chapter six found that the income effects of Bursary increased and converged towards that of Sixth Form Certificate. Previous studies concluded that Bursary functioned as a stepping stone to university. The increase in returns to 2001 reveals that Bursary can now be viewed as a stand alone qualification[8].

10.2.4 Sensitivity Analysis

Sensitivity analysis, reported in section 8.2.6, found that the returns to a Bachelors Degree were sensitive to the level of forgone earning and length of study. In contrast, the returns were less sensitive to the level of tuition fees and the timing of entry into university.

This study then suggests policies to promote combinations of study and work. In particular, it finds that the public funding of SJS enhances the private and social investment in education. Also, the current student allowance scheme places an absolute limit on weekly income. This runs counter to the suggested goal of reducing the amount of forgone earnings. Therefore, chapter nine suggests raising the limit or introducing an abatement scheme for earnings above the current limit. Finally, chapter nine discusses policy options to promote lifelong learning.

[8] The introduction of the NCEA qualifications framework takes this one step further in that completing NCEA to level 3 is equivalent to, for example, high school graduation in the United States.

10.3 Suggestions for Further Research

Returns to education research provides valuable information which can be used for policy evaluation in government. It also provides information to tertiary institutions, students and their families as well as for other stakeholders. Therefore, there is a need for both general and more specific information on the returns to education. It then makes sense to extend the basic models to include the examination of: the returns to education in various fields of study; the returns to education of various ethnic groups; and the returns to education in various industries.

Also, alternative data sources to the Census provide the opportunity to explore various aspects of the returns to education. As mentioned in chapter two, studies using twins have been able to control for ability and family background. Furthermore, The Household Labour Force Survey as used by Maani and Maloney (2004) offers enhanced capability for analysis through the data on earnings (and hours of work) rather than data on income. In addition, longitudinal data sets, currently under development by Statistics New Zealand, offer a rich source of information ideally suited to analysis of returns to education.

Finally, the distribution of the returns to education remains an area where there is much scope for further research. This study has attempted to add to the literature with the calculation of the elaborate method model using quantile estimates. However, quantile regression analysis remains a relatively new tool in the field of returns to education. Its use and application in the area are sure to expand over time. Alternatively, microsimulation models are well-suited to examining the returns to education, especially if combined with a data source such as a longitudinal survey.

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