



Healthy, wealthy and wise?

A review of the wider benefits of education

Grant Johnston

NEW ZEALAND TREASURY
WORKING PAPER 04/04

MARCH 2004



THE TREASURY
Kaitohutohu Kaupapa Rawa

MONTH/YEAR

March 2004

AUTHOR

Grant Johnston
The Treasury
PO Box 3724
Wellington
New Zealand
Email grant.johnston@treasury.govt.nz
Telephone +64 4 471 5167
Fax +64 4 472 4942

ACKNOWLEDGEMENTS

I would like to thank Dean Hyslop, in particular, for patient discussions of methodology, and Bronwyn Croxson, Nick Mays, Simon Chapple, Peter Wilson, Ron Crawford, Veronica Jacobsen, Martin Connelly and Helen Walter for their helpful comments which greatly improved the quality of this paper.

I am also indebted to the staff of the Treasury library for obtaining countless articles and books for me, not all of which made it into this review.

NZ TREASURY

New Zealand Treasury
PO Box 3724
Wellington 6008
NEW ZEALAND
Email information@treasury.govt.nz
Telephone 64-4-472 2733
Website www.treasury.govt.nz

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Abstract

This paper reviews evidence that a greater education causes better outcomes in life, over and above the effects of having a higher-paying job. Comparatively little has been written which draws together evidence on the wider (that is, wider than just earnings-related) benefits of education, although studies which ignore these benefits might considerably underestimate the total return from an additional year of education or an additional qualification. Research suggests that increased education, as measured by the time people spend in formal education or the qualifications they attain, may cause a reduction in cigarette smoking, anxiety disorders, anti-social disorders, suicide, crime, teenage pregnancies, unemployment and reliance on welfare benefits, at least when these outcomes are measured in young adulthood. Education may also have an effect on people's health. The wider benefits of education are difficult to quantify, however, and the degree of uncertainty around them is considerable. Policy-makers would be unwise to rely too heavily on the existence of wider benefits when making decisions about public investment in education.

JEL CLASSIFICATION I21 – Analysis of Education
I31 – General Welfare

KEYWORDS education; returns to education; returns to schooling; wider benefits; social benefits; socio-economic determinants

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Healthy, wealthy and wise?

A review of the wider benefits of education

1 Introduction

Apart from increasing their pay, does more education make a difference to people's lives? This paper reviews evidence which attempts to answer this question.

Economists typically think of education as an investment of current resources in exchange for future benefits. A great deal of research, for example, has looked at how much more people earn, on average, after completing an additional year's education. Empirical studies typically find that, on average, an additional year of education increases an individual's future wages by somewhere between 5% and 15%, depending on the time and country (Temple 2001).

Higher pay, however, is only one of the potential benefits of more education. People also continue their studies to further their personal development and to gain skills that benefit other parts of their lives. As Weiss (1995, p.151) puts it:

Education does not have to be justified solely on the basis of its effect on labour productivity. This was certainly not the argument given by Plato or de Tocqueville and need not be ours. Students are not taught civics, or art, or music solely in order to improve their labour productivity, but rather to enrich their lives and make them better citizens.

This review paper looks at what published evidence is available for these 'wider' (that is, wider than just earnings-related) benefits of education, in a number of different areas of life. The wider benefits of education are defined here as those benefits which are not related to greater earnings, and might include such things as better health, less crime, improved civic participation and greater life satisfaction. Double-counting must be avoided, though. If, for example, the only reason more education leads to better health is by virtue of more-educated people being paid more, and higher-paid people having better health, then this is an example of an earnings-related benefit of education, not a wider benefit.

Surprisingly little has been written which draws together evidence on the wider benefits of education. Haveman and Wolfe (1984) is probably the most cited of a handful of review papers on the wider benefits of education. The evidence presented in these review papers is not wholly satisfactory, however, for a number of reasons. Many of the studies which are cited use data from developing countries and are not easily generalised to New Zealand. Many have only minimal controls for potentially confounding factors (as is discussed further below). The most comprehensive overview of the wider benefits of education is provided by Behrman and Stacey (1997) but this book concerns itself almost exclusively with the economics literature on this topic, ignoring much that has been written in other fields, for example in mainstream health journals.

Why is it important to look at the wider benefits of education? A consideration of how large the *total* benefits of education are, and to whom these benefits accrue, is essential in providing advice on the nature and extent of government involvement in education (Barr 1998, ch.13). Empirical studies of the benefits of education, however, tend to focus solely on earnings-related benefits. If wider benefits exist then these empirical estimates might considerably understate the total benefits of education. Haveman and Wolfe (1984), for example, suggest that the wider benefits of an additional year of education could be of the same magnitude as the earnings-related benefits. It is desirable, therefore, to have at least some knowledge of the wider benefits of education, in order to better inform government policy on education, and in particular to inform decisions on whether putting resources into increasing or improving education is a good investment to make. This paper attempts to provide some of this knowledge.

We already know something of the wider benefits of education. Studies consistently find that more-educated New Zealanders tend to do better on a whole range of outcomes. Fergusson, Poulton, Horwood, Milne and Swain-Campbell (2003b), for example, present unadjusted associations between different measures of educational attainment and a range of early-adult outcomes, using data from both the Christchurch Health and Development Study (HDS) and the Dunedin Multidisciplinary Health and Development Study (MHDS).¹ In these studies, better-educated people were less likely to have some types of mental health disorders; less likely to commit crimes and to have a criminal conviction; less likely to be unemployed; less likely to engage in risky sexual behaviours and to have an early pregnancy; and less likely to show early signs of some health problems. Wilson (2000) also shows, across a range of measures, that better-educated New Zealanders are more likely to be in good health.

For policy purposes, however, what is primarily of interest is the benefits (and costs) of more education across the whole of society, rather than just the benefits (and costs) to the particular individuals who engage in this extra education. Policy makers are also more interested in whether additional education *causes* better outcomes or whether it simply coincides with better outcomes. The studies of Fergusson *et al* and Wilson which are cited above are not able to answer these questions and are not designed to do so.

Section 2 of this paper looks further at the issue of individual and social benefits, and at the issue of causation and coincidence. This latter issue, in particular, is fundamental to the analysis presented in this paper. Section 2 also describes how this review was conducted, and which purported benefits have, and have not, been investigated.

¹ The Christchurch HDS is a longitudinal study of a birth cohort of 1,265 children born in Christchurch in mid-1977. Fergusson (1998) provides an overview of the Christchurch HDS design and key findings, up to the year 18 results. The Dunedin MHDS is a longitudinal study of a birth cohort of 1,037 children born in Dunedin between April 1972 and March 1973. A detailed description of the study and selected results is given in Silva and Stanton (1996).

Section 3 looks at evidence on causal links between greater education and a number of benefits: substance use; crime; welfare dependence; unemployment; mental health; teenage pregnancy; physical health; social connectedness; political participation; children's education; and subjective well-being. Section 4 discusses the conclusions, including policy implications, that can be drawn from this evidence.

2 Concepts and methods

2.1 Individual and social benefits

The individual benefits of additional education are those which are realised by the person being educated. Individuals consider what their own benefits (and costs) are likely to be when they make decisions about whether to continue with their education. Social benefits, on the other hand, are those which fall on all members of society, not just on the individuals who receive additional education. Policy-makers consider what the social benefits (and costs) are likely to be when they make decisions about government investment in education.²

A simple thought experiment may be used to illustrate the nature of social benefits. If 1,000 students stayed at school for an additional year and each received 5 units of benefit as a result, then society as a whole might be expected to benefit by 5,000 units. However, if an individual's additional education benefits other people, for which the individual is not compensated, then it is likely that more than 1,000 people would be better off from this additional year of education and the benefit to society as a whole would be greater than 5,000 units. This might occur if, for example, additional schooling reduced crime rates or increased social capital. The existence of these 'spill-over' benefits to other people constitutes one argument for government involvement in education: individuals under-invest in education from society's point of view because they don't take into account spill-over benefits, and the government could therefore use subsidies to encourage greater investment. Identifying spill-over benefits in a precise way, however, can be extremely difficult.

On the other hand, if education is, at least in part, a signalling or credentialing process, then the benefit to society as a whole might be less than 5,000 units. Signalling and credentialing are effects which have been hypothesised in explaining the earnings-related benefits of education (Weiss 1995; Collins 1979). Collins, for example, argues that education establishes a pecking order for jobs rather than teaching job-relevant skills, which are mostly acquired on the job. This need not concern individual students, since increased education still leads them to higher-paying jobs. However, from the point of view of society as a whole, more resources may be going into education than are necessary to turn out productive workers. There may also be an analogous effect with the wider benefits of education. If the attainment of qualifications is simply a social ranking mechanism, for example, rather than a means of gaining life-relevant skills, then education may benefit individuals far more than it benefits society as a whole.

Table 1 below shows the four combinations of education benefits which result from considering wider benefits as distinct from earnings-related benefits and also by considering social benefits as distinct from individual benefits.

² Unfortunately, there is an ambiguity in some of this literature over the use of the term 'social'. Occasionally, authors (e.g. Behrman and Stacey 1997) use the term 'social benefits' to mean what this paper refers to as 'wider benefits' – that is, the non-earnings-related benefits of education (Haveman and Wolfe (1984) call them 'non-market' benefits). This paper uses the term 'social benefits' to refer to the benefits to society as a whole.

Table 1 – Categories of benefits of education

	Earnings-related benefits	Wider benefits
Individual benefits	Higher wages	Healthier individuals Greater life satisfaction
Social benefits	Higher national income	Healthier population Better functioning society

This paper is mostly concerned with the shaded box in Table 1, that is, with the wider benefits of additional education to society as a whole. The paper does this by considering individual benefits across a number of domains and then considering whether simply adding up these benefits, within each domain as well as across all of them, would underestimate or over-estimate the social benefits of additional education.³

2.2 Causality and coincidence

In this review, the term ‘causal’ is used as in the economics literature.⁴ The issue that this review explores is whether, if more New Zealanders achieved a particular qualification or stayed in the formal education system longer, we could reasonably expect to see improvements in health, crime rates, and so on. If greater education merely *coincided* with good outcomes in adulthood then we would not expect this to be the case.

As stated in the introduction above, studies consistently find that more-educated New Zealanders tend to do better on a range of outcomes. The question remains, however, as to whether these associations are causal, or whether educational attainment and other good outcomes simply coincide. It may in fact be the case that a third factor, such as a person’s family upbringing, influences both their schooling decisions and their later life outcomes, thereby giving the (false) impression that education has an effect on later outcomes.

For example, New Zealand children from disadvantaged families are more likely to do poorly at school (Ministry of Education 2002a) and there is evidence from overseas that children from disadvantaged families are also more likely to have poor health as adults (van de Mheen, Stronks, Looman and Mackenbach 1998). Coming from a disadvantaged background might therefore explain both poor school performance and poor adult health. Also, as in studies of education and earnings, there is the potential for confounding by natural ability. Naturally clever, perceptive or determined people might do well both at school and in other areas of life.⁵

³ The alternative strategy is a macroeconomic one which tries to identify an association between aggregate measures of education and aggregate measures of outcomes across different countries. This strategy is common when looking at the earnings-related social benefits of education (Sianesi and Reenen 2000; Topel 1999) but not when looking at the wider social benefits of education (see McMahon (2001) for an attempt at this type of study).

⁴ Causation in the social sciences is a matter of some discussion and debate (see Addison, Burton and Torrance (1984) for example). Social phenomena are complex and adult outcomes are typically affected by a large number of influences, interacting in many different ways or through many different pathways. In addition, the issue of causation rests on fundamental philosophical questions, for example on essential issues of free will and determinism.

⁵ In the area of earnings-related benefits, Card (1999) surveys the recent econometric literature on causal relationships between education and earnings. In this literature, studies which investigate causation tend to focus mainly on the issue of natural ability. Researchers try to determine whether the higher earnings of better-educated workers are caused, at least in part, by their higher education, or whether the observed correlation simply reflects the fact that individuals who are naturally intelligent and hard-working tend to stay longer at school and do better at work. Card concludes that the pre-existing ability of students explains only a small part of the observed benefits of education.

Empirical studies commonly involve regressions of the outcome being measured, such as people's health status, against their level of education, with the inclusion of other background variables (such as family background and child health status) to control for potentially confounding factors. However, most researchers have only a limited number of control variables available to them, and suspicions usually remain of residual confounding from unmeasured, or poorly-measured, influences of family backgrounds, inherited characteristics or childhood experiences.

Three main methodological approaches are used to address this problem, and to test causality. These are the use of longitudinal studies, the use of instrumental variables (IV) models, and the use of information on twins and siblings. Longitudinal studies usually have rich data sets, with information taken from the same participants at intervals over a period of time. Birth-cohort studies, in particular, tend to have good information on the early lives of participants. As a result it is possible to examine the ways in which variations in family and social conditions in childhood are related to an individual's longer-term adjustment and well-being.

In IV studies, researchers try to identify naturally-occurring experiments, where the duration of education varies across individuals for reasons which are not likely to be related to later outcomes in any other way. A number of studies reviewed in this paper use changes over previous decades in state schooling laws in the United States as an instrument for predicting the length of schooling. The reasoning here is that compulsory schooling laws affect the number of years of schooling that people undertake but are not related to outcomes in any other way. Therefore if people who spent their childhoods in states that required them to go to school for longer are more healthy or live longer or commit fewer crimes or are less likely to take drugs, it can be concluded that education influences health or crime or drug use. In particular, education influences health or crime or drug use amongst those people most affected by the instrument, namely those people who would have dropped out of school earlier but were prevented from doing so by the compulsory schooling law.⁶

Twin and sibling studies are a way of controlling for common family backgrounds and genetically inherited endowments. Identical twins who have been brought up together, for example, share 100% of their genes and have essentially the same family background. Adopted children, on the other hand, share the same upbringing as their adoptive siblings, but none of their genes. For the most part, this review discusses twin and adoption studies in the context of determining whether increasing a person's education has a causal effect on his or her children's education.

2.3 Review methods

Section 3 of this review looks at the relationship between educational attainment and outcomes over a range of different areas of life, considering each in turn, and investigating whether there is evidence that increased education causes good outcomes.

Publications were found by searching a variety of databases and on-line collections, including the EconLit database of economic literature, the Medline database of health literature, the ERIC database of education literature, the National Bureau of Economic Research (NBER) website, the full list of Christchurch HDS and Dunedin MHDS

⁶ See Kling (2000), for example, who shows that IV estimates can be considered as weighted averages of causal effects on different individuals or subgroups.

publications, and websites of longitudinal surveys in the United States and United Kingdom. Searches were undertaken using the terms “education” and “schooling” in combination with topic areas such as “health”, “mortality” and “social capital”, and with keywords such as “wider benefits”, “social benefits” and “non-market benefits”. Most literature was found, however, through following up references in publications.

In the areas of substance use, mental health, crime, welfare dependence, fertility and sexual risk-taking, the main sources of information on possible relationships with education were the two New Zealand longitudinal birth-cohort studies: the Christchurch HDS and the Dunedin MHDS. These studies are particularly rich in information on the participants’ early lives, school careers, and outcomes in early adulthood (participants are currently in their mid-to-late 20s). Because of this wealth of information on potentially confounding factors, and because they are studies of young people in New Zealand, the New Zealand birth-cohort studies are accorded particular weight in this review. The results from these studies are tested however, where possible, using evidence from studies using different methodologies or which have been undertaken in different countries.

Outcomes which typically occur later in adulthood have not yet been investigated in the New Zealand birth-cohort studies but have received attention in various overseas studies. Section 3 includes discussions of the relationship between a person’s education and, variously, their physical health, social connectedness, political participation, and the education of their children. Finally, the relationship between a person’s education and an overall measure of benefit, namely their subjective quality of life, is discussed.

Where possible, only the results of longitudinal studies, IV studies or twin and sibling studies are used in this review, for the methodological reasons discussed above. If there was no better alternative, however, then other, less rigorous studies were used, and this is identified in the discussions. Again where possible, only the results of studies which were specifically set up to look at a relationship with education are used.

It is important when interpreting the results of the studies reviewed in this paper to note that an increased, or better, education is measured in these studies in only two ways. One is by measuring the *duration* of education: that is, by recording the number of years that a person spent in formal education, or the age at which they completed their education. The second is by measuring their educational *attainment*: that is, by recording the highest qualification they held, or their attainment of particular qualifications (whether or not, for example, they passed School Certificate). Therefore studies do not look, for example, at the effects of going to a better-funded school, having better teachers or being in a smaller class. The effects of changes in school quality have been investigated to some extent in the literature on earnings-related benefits of education (e.g. Card and Krueger 1992), but not in the literature on wider benefits.

In addition, this review does not look at the potential consumption benefits of education (that is, enjoying or benefiting from education at the time that it is undertaken) and does not look into all the aspects of life which authors of other review papers have discussed. This review does not discuss, for example, non-wage job benefits; efficiency of labour market searching; productivity in the home; efficiency of consumer decision-making; charitable giving; higher rates of savings⁷; improved sorting in the marriage market; effects of education on one’s spouse; effects on one’s children (other than on the children’s education); attainment of desired family size; efficiency in contraceptive use; effects on the ageing process; effects on enjoyment of entertainment; democratisation, human rights

⁷ A reviewer has also pointed out that education may improve the quality of investment decisions.

and political stability; environmental equality; racial tolerance; support for authority; political cynicism; and membership of the local PTA.⁸ This was in part because these areas are less well-studied than others. Also, to keep this review from becoming unmanageable, it was necessary to limit the number of aspects of life which were investigated. Any outcomes which are not specifically discussed should in any case be captured under the general category of 'life satisfaction' in section 3.9.

⁸ These are all benefits referred to, variously in the reviews of Haveman and Wolfe (1984), Wolfe and Haveman (2001), McMahon (2001), Behrman and Stacey (1997), Bynner and Egerton (2001), Bynner, Dolton, Feinstein, Makepeace, Malmberg and Woods (2003), and Schuller, Bynner, Green, Blackwell, Hammond, Preston and Gough (2001). At least in part, education seems to have been linked with a large number of outcomes because the length of time that a person has spent in formal education, or the highest qualification they hold, is a common control variable when investigating outcomes later in life (along with, for example, age, gender and income). The regressions reported in many studies therefore show, indirectly, that increased education has a positive relationship with good outcomes.

3 Evidence on each outcome

3.1 Substance use

Of the Christchurch HDS cohort, 19% left high school without any formal qualifications: that is, they had not achieved at least one C grade in a School Certificate subject. Nationally, about the same proportion of students leave school with no qualifications (Ministry of Education 2002b).⁹

Using the Christchurch HDS, Fergusson, Swain-Campbell and Horwood (2002) investigate the association between leaving school without qualifications and clinically-defined dependence on alcohol, cigarettes and illicit drugs between the ages of 18 and 21.¹⁰ To account for factors occurring before the participants sat School Certificate, which might confound the relationship between education and substance use, Fergusson *et al* control for a wide range of background variables. In particular, they control for gender, for deviant behaviours and conduct disorders in childhood, for parents' use of drugs or alcohol, and for level of family disadvantage. Each of these factors is believed to put young people at greater risk of alcohol and drug abuse (Stewart 1997; Chetwynd 1997). Fergusson *et al* also control for prior cigarette smoking – although not prior alcohol or drug use – and for natural ability by means of an IQ test in childhood and a test of general scholastic ability at age 13.

Fergusson *et al* find no persistent link between leaving school without qualifications and dependence on alcohol or drugs. There was, however, a persistent link between school qualifications and nicotine dependence. Other studies have also shown relationships between education and smoking. Hu, Lin and Keeler (1998), for example, in a study of Californian teenagers, find that young people who did better at school were less likely to take up smoking, and more likely to try to quit, even after controlling for other socio-demographic factors.

Mensch and Kandel (1988) look at the connection between alcohol and drug use and dropping out of high school in the United States. To complete high school in the United States requires staying at school until approximately age 18. Mensch and Kandel use data from the National Longitudinal Survey of Youth (NLSY), a survey of over 12,000 young people, who were aged 14-21 when first interviewed. They find a higher use of cigarettes and illicit drugs, but not alcohol, amongst high school drop-outs, after adjusting for socioeconomic, behavioural and personality factors known to be related to early school leaving. Their interest, however, is in determining whether drug use contributes to dropping out of school, rather than whether dropping out contributes to drug use. By looking at the age at which drug use was initiated, Mensch and Kandel find that the use of cigarettes, marijuana and other illicit drugs predicts early school leaving. Furthermore, the younger the initiation into drugs the greater the likelihood of a student leaving school without a high school diploma.

⁹ School Certificate was a national qualification for Year 11 students in New Zealand. Students were able to sit School Certificate in up to six subjects, with a written end-of-year examination for each subject. In 2002 it was replaced by another national qualification, the National Certificate of Educational Achievement (NCEA) Level 1.

¹⁰ In New Zealand, marijuana use and use of other illicit drugs peaks amongst 18 and 19 year olds (Field and Casswell 1999). Most adult cigarette smokers have started by the time they are 18 (Ministry of Health 2002). Alcohol abuse also has a higher prevalence amongst younger people, who are more likely to be binge drinkers (Habgood, Casswell, Pledger and Bhatta 2001).

It appears, therefore, that young people who are at risk of later alcohol and drug use also tend to leave school without qualifications, and this explains the apparent association between educational achievement and later drug use. Some drug use during adolescence may in fact make it more likely that users leave school without qualifications. The exception may be for cigarette smoking, where Fergusson *et al*, along with other studies, find a persistent link between education and later smoking habits. Fergusson *et al* consider that smoking may have become an accepted pastime for young people who are not working or participating in further study or training. The link between education and reduced smoking rates may also be due to greater understanding of the health risks of smoking (Sander 1995a; 1995b).

3.2 Mental health

From the Dunedin MHDS, Miech, Caspi, Moffit, Entner Wright and Silva (1999) study the relationship between educational attainment and mental health disorders at age 21. Since mental disorders are potentially both a cause and a consequence of poor educational performance, Miech *et al* also take account of pre-existing disorders at age 15. The mental disorders they consider at both ages are anxiety disorders, depression, and antisocial disorders (that is, a pattern of disregard for, and violation of, the rights of others).¹¹ Educational attainment was measured by passing School Certificate and Sixth Form Certificate, and by attendance at university.

At age 21, study members with low educational attainment reported significantly higher levels of anxiety, a finding which persisted after controlling for anxiety at age 15, parental socio-economic status and gender. The relationship between educational attainment and anxiety was monotonic: increases in anxiety between ages 15 and 21 were highest amongst those with no school qualifications and progressively declined with higher educational attainment.

Study members with low educational attainment were also more likely to meet clinical criteria for conduct disorder and antisocial personality disorder, after controlling for conduct disorder at age 15, parental socio-economic status and gender. As with anxiety, the relationship between antisocial behaviour and education was monotonic. Increases in antisocial behaviour were highest amongst those with no school qualifications and lowest amongst those who had been to university. There was no significant relationship, however, between depression at age 21 and educational attainment. Furthermore, Miech *et al* found that depression at age 15 did not appear to influence subsequent educational attainment.

From the Christchurch HDS, Fergusson, Beautrais and Horwood (2003a) identify factors which promote vulnerability and resilience to suicide amongst young people with major depression. Overall, 38% of the sample met clinical criteria for major depression at least once during the interval from 14-21 years; 29% reported having suicidal thoughts at some time during this period; and 7.5% reported having made a suicide attempt. Most of the suicide attempts were not medically serious, however. From an initially wide range of individual, family, peer and school factors, Fergusson *et al* construct a reduced-form model of significant risk factors affecting the likelihood of suicide attempts. These results show that rates of suicide attempt, but not suicidal thoughts, were higher amongst those young people with fewer School Certificate passes. Rates of suicide attempt were also higher amongst young people with depression, who had a family history of suicidal

¹¹ These mental health disorders are helpfully defined and discussed, in a New Zealand context, in Sullivan and Bulik (1997), Bushnell (1997), McGeorge (1997) and Mulder (1997).

behaviour, who had been sexually abused as children, who had deviant peer affiliations, and whose personality tended towards novelty seeking and neuroticism.

In another South Island study, although in this instance a case-control study rather than a longitudinal study, Beautrais (2003) compares three groups of young people: a group of 60 who had committed suicide, a group of 125 who had made serious suicide attempts requiring hospital treatment, and a randomly-selected control group of 151. Comparisons were made on a series of measures, including socio-demographic, childhood, family, psychiatric, and psychosocial factors. Information was collected from each participant's 'significant other'. Poor school performance was found to be a significant risk factor for suicidal behaviour. Young people who had committed suicide were much more likely than people in the control group to have left school with no qualifications, even after controlling for all the background factors. Young people who had made a serious suicide attempt were also much more likely to have left school with no qualifications.

The findings from these studies suggest that poor school performance, and, in particular, leaving school without qualifications, may increase anxiety disorders and foster antisocial disorders in young people. It may also increase a young person's risk of attempting, and also completing, suicide. Poor school performance does not appear, however, to increase the likelihood of depression.

3.3 Crime

Rates of conviction in New Zealand peak amongst young people, and in particular amongst young males (Spier 2002). The 2001 census of prison inmates showed that almost two-thirds of prison inmates had had their first conviction for any offence while in their teens (Department of Corrections 2003).

From the Christchurch HDS, Fergusson *et al* (2002) investigate the association between leaving school without qualifications and three self-reported measures of juvenile offending between the ages of 18 and 21. These measures are a history of violent offending, property offending, and being convicted of an offence. Almost 12% of sample members had a conviction between ages 18 and 21. To account for factors occurring before the study members sat School Certificate, and which might confound the relationship between education and juvenile offending, Fergusson *et al* control for a wide range of background variables. In particular, they control for gender, for deviant behaviours and conduct disorders in childhood, for deviant peer affiliations, for parents' criminal behaviour, and for level of family disadvantage. After controlling for these factors there was no persistent link between juvenile offending and leaving school without qualifications. Young people who were already at risk of later crime also tended to perform poorly at school; these outcomes simply shared the same predictors.

In contrast, using the Dunedin MHDS cohort, Henry, Caspi, Moffitt, Harrington and Silva (1999) found that the longer that male students (although not female students) stayed at school past the minimum leaving age of 15 years the lower their chances of criminal behaviour in young adulthood. Criminal behaviour was measured by self-reports of criminal offences together with official information on criminal convictions. Furthermore, the relationship between time at school and criminal behaviour was strongest amongst those young men who had demonstrated behaviour and attention problems as young children. These problems are known predictors of anti-social behaviour in later life. The relationships remained significant after controlling for the effects of socio-economic status,

IQ, family disruption, and adolescent delinquency. These results suggest a causal link where continued school attendance provides a constraint on criminal behaviour.

Looking further ahead into adulthood, Lochner and Moretti (2001) use the public versions (one percent samples) of the 1960, 1970 and 1980 United States Censuses to identify male prison inmates aged 20-60 and to compare their characteristics with the non-imprisoned male population of the same age. After controlling for age, state of birth, state of residence, cohort of birth, and year effects, they find that years of education are negatively associated with the probability of imprisonment. In particular, they find a marked decline in the probability of imprisonment at 12 years of schooling, which in the United States generally corresponds to graduation from high school. This suggests that there may be a benefit from holding a high school diploma which is more than would be expected from simply completing an extra year of education. Therefore there may be a degree of credentialing or signalling in evidence here, similar to that sometimes suggested for the earnings-related benefits of education (Weiss 1995; Collins 1979). To account for unobserved characteristics of criminals, which might be different from those of non-criminals, Lochner and Moretti also use state compulsory schooling laws as an instrument for high school graduation. The resulting IV estimates continue to show a significant inverse relationship between education and imprisonment.

The studies reviewed in this section, and in particular the findings from the Christchurch HDS and Dunedin MHDS, seem to show conflicting results. However, this is not necessarily the case. In a review of the effects of education on crime, Witte (1997) concludes that studies which measure education by means of test scores or the receipt of qualifications (of which Fergusson *et al* is an example) generally find that these variables are not significantly related to future crime. However, those smaller number of studies which have the use of time as an explanatory variable (of which Henry *et al* is an example) generally find that both time spent at school and, to a slightly lesser extent, time spent working, are associated with a significantly lower level of criminal activity. Inactive teenagers are those at highest risk of committing crimes. One interpretation of this association is that schooling has a protective function, regardless of any qualifications obtained, simply by keeping young people occupied and off the streets. Another, however, might be that young people with criminal tendencies would rather be on the streets committing crimes than working or at school. Lochner and Moretti's IV study suggests that increased education reduces the probability of going to prison for males in the United States, at least for students compelled to stay in school through compulsory schooling changes. It is difficult to know, however, how much this result can be generalised to contemporary New Zealand since, for example, their study includes people who were in prison more than 40 years ago, and were at school some years before this.

3.4 Fertility and sexual risk-taking

New Zealand has one of the highest teenage birth rates in the industrialised world, trailing only the United States and the United Kingdom (Statistics New Zealand 2001). From the Christchurch HDS, Fergusson and Woodward (2000) examine the effect of teenage pregnancy on educational achievement, rather than the other way round. However, data from this study show that 32% of young women who left school without qualifications had become pregnant before age 18, compared to only 4% of women who had school qualifications. These figures are not, however, adjusted for any potentially confounding individual or family antecedents of teen pregnancy; nor do they take into account which came first: teen pregnancy or gaining school qualifications.

Manlove (1998) investigates potential confounding, and the timing of pregnancy, when examining the relationship between dropping out of high school and teenage motherhood (defined in this study as a pregnancy prior to the age of expected high school completion). She uses data from the United States National Education Longitudinal Study of 1988 – a sample of eighth-graders (14 year olds), who were resurveyed in 1990, 1992 and 1994. Dropping out of school was found to have a significant effect on the risk of teenage motherhood among White and Hispanic, but not Black, women. The risk of teenage motherhood among White and Hispanic dropouts was one-and-a-half times that of women who stayed in school, despite controlling for a wide range of potentially confounding family, individual, and school and classroom characteristics (including grades and test scores). Moreover, the longer that White and Hispanic students remained in school the lower their risk of having a school-age pregnancy. High grades in the first year of high school, high scores on maths and English tests, and plans for future training or study were all significantly associated with a reduced risk of teenage motherhood.

These results suggest that staying in school, and perhaps also completing school qualifications, reduces the probability of young women becoming pregnant in their teens. There remains, however, a question about how applicable the results of a United States study on high school dropouts is to New Zealand.

3.5 Welfare dependence

Reducing unemployment and other forms of welfare dependence are considered here as potentially wider benefits of education, since they may have costs to individuals and to society that are over and above those of lost earnings and production. Unemployment, for example, might be seen as a poor outcome in its own right, promoting feelings of worthlessness or detachment from society, for example, and may also be a factor linking education to other poor outcomes in adulthood (so that, for example, education may cause unemployment which in turn causes criminal behaviour).

From the Christchurch HDS, Fergusson *et al* (2002) investigate the association between leaving school without qualifications and being in receipt of a Social Welfare benefit at age 21. At this age, 18% of the cohort was receiving a benefit: 9.3% received an Unemployment Benefit, 4.3% received a Domestic Purposes Benefit, and 5.1% received other types of benefits. Fergusson *et al* also looked at whether sample members had taken part in any tertiary education or training after they had left school.

To account for factors occurring before the study members sat School Certificate, and which might confound the relationship between education and welfare dependence, and between education and further training, Fergusson *et al* control for a wide range of background variables, including gender, deviant behaviours and conduct disorders in childhood, childhood IQ and school achievement, and level of family disadvantage. Fergusson *et al* find a persistent link between leaving school with no qualifications and being on a Social Welfare benefit at age 21. They also find a persistent link between leaving school with no qualifications and not going on to tertiary education or training. This is not necessarily a poor outcome in itself, and is not discussed in the following sections, but it does suggest that poor basic skills may close off the possibility of further investments in education.

Further, more detailed, evidence on the relationship between poor school performance and unemployment is available from the Dunedin MHDS. Caspi, Wright, Moffitt and Silva (1998) find that leaving school with no qualifications, and poor reading achievement at

age 15, were predictive of later unemployment. After controlling for a range of individual, family and school variables, measured when participants were aged 15, young people without any School Certificate passes were 17% more likely than others to be unemployed between the ages of 15 and 21, and young people with poor reading skills were 12% more likely than others to be unemployed. Further analysis showed that there was also a benefit to simply staying at school. About a third of the effect of getting School Certificate was accounted for by the corresponding increase in the *duration* of education, suggesting that young people who did not get School Certificate were at risk for unemployment, in part, because they left school at an earlier age. For the most part, though, not having School Certificate, and having poor reading skills, appeared to have a direct impact on employment in later adolescence.

Looking further ahead into adulthood, Oreopoulos (2003) considers the effect of changes to compulsory schooling laws in the United States, Canada and the United Kingdom on the likelihood of being unemployed. The datasets he uses are different for each country but all include adults aged 25 to 64. Oreopoulos shows that in each of these three countries an additional year of schooling was associated with a reduction in the probability of being unemployed. In addition, in the United States (the only country where this was measured), an additional year of schooling was associated with a reduction in the probability of receiving a welfare benefit.

The results from the New Zealand birth cohort studies, and from the IV study of Oreopoulos (2003), therefore suggest that staying at school and achieving basic school qualifications reduces an individual's risk both of being unemployed in young adulthood and of being reliant on a welfare benefit.

3.6 Physical health

Of all the wider benefits of education, the association with physical health has probably been the most widely studied, particularly within an extensive medical literature on the socio-economic determinants of health. There have been, for example, a large number of studies which look at the individual and combined effects of different socio-economic variables on adult mortality. By far the largest of these is the United States National Longitudinal Mortality Study (NLMS). This study takes its sample from nine Current Population Surveys conducted between 1979 and 1985.¹² Respondents aged 25 years and over were matched to the United States National Death Index to determine deaths occurring from the date of the initial survey up to 1989. A total of 530,507 men and women were included in the study, of whom 54,304 died during the follow-up period.

Using the NLMS, Sorlie, Backlund and Keller (1995) estimate the relative risk of mortality for men and women in different age groups. They find, after adjusting for individual year of age, that a longer education (measured by years completed) is associated with lower mortality in men and for women, with the strongest relationships in the 25 to 44 year age group and the weakest relationships in the 65 and over age group. Adjusting for socio-economic variables (race, employment status, family income, marital status and household size) reduces this association, showing that a good part of the relationship between education and mortality is due to socio-economic factors such as income. There still remains, however, a general pattern of declining mortality risk with increasing years of

¹² The Current Population Survey is a monthly national survey of the non-institutionalised United States population which is conducted by the Bureau of the Census. The emphasis of the survey is on labour force data, like New Zealand's quarterly Household Labour Force Survey.

education.¹³ This suggests that education has an effect on mortality which is independent of other socio-economic factors.

Other, smaller studies also show a relationship between mortality and years of education, after adjusting for demographic and social factors, although not all agree that this relationship is independent of income. Lantz, House, Lepkowski, Williams, Mero and Chen (1998) and Behrman, Sickles, Taubman and Yazbeck (1991), for example, find in their studies that the apparent effect of education on mortality is fully explained by the association between education and income.

Backlund, Sorlie and Johnson (1999) build on the work of Sorlie *et al* by describing the functional form of the relationship between education and mortality in the NLMS, using data on people aged 25 to 64. In particular, Backlund *et al* test whether there is a monotonic relationship in which more years of education leads to progressively lower risks of mortality. In fact they find that the best-fitting model for both men and women is a step function, where the steps correspond to the attainment of a high school diploma, at 12 years of education, and a college degree, at 16 years of education. This pattern of results suggests a credentialing or signalling effect: that the year spent getting a high school diploma (year 12), for example, is more valuable in the United States than completing year 11 or year 13, since at the end of year 12 the student leaves with a significant and status-defining qualification.

Persistent relationships between increased length of education and health have also been found when health is defined in terms of morbidity, risk factors for diseases, or self-assessed health status. Most of these studies are from the United States. For example, in a six-year follow-up study of almost 10,000 adults aged 51-61 years, Wilson (2001) finds that years of education is significantly associated with the incidence of four out of eight common chronic diseases which he monitors, after controlling for age, gender, race, household wealth, and some early life variables. In a cross-sectional study, Winkleby, Jatulis, Frank and Fortmann (1992) find that years of education is significantly associated with a set of cardiovascular disease risk factors (blood pressure, cholesterol, and cigarette smoking), after controlling for age, income and occupation. In another cross-sectional study, Ross and Mirowsky (1999) find that years of education is significantly associated with self-reported physical functioning and perceived health status, after controlling for age, gender, race, marital status, parents' education and a range of employment and income variables.

Studies also try to uncover mediating factors – other than employment and income – which could explain a causal link between education and health. Amongst these, for example, are: better knowledge of, and practice of, health behaviours like exercise, smoking and diet (Schrijvers, Stronks, van de Mheen and Mackenbach 1999; Leigh 1983; Sander 1995a; Kenkel 1991); job sorting leading to less exposure to occupational hazards (Kemna 1987); a greater sense of personal control and social support (Ross and Mirowsky 1999); and more appropriate use of medical care. There is, however, no consensus in the literature on the relative contribution of these mediating factors. Studies look at different mediating factors using different datasets and, not surprisingly, get different results.

Two recent NBER papers use IV methods to investigate the relationship between education and health. Lleras-Muney (2002) tries to account for unobserved characteristics

¹³ These relationships were not always consistent or statistically significant at the one percent level. However, since death is a rare event amongst younger people there will always be a problem when studying premature mortality in attaining sample sizes with enough power. For example, there were only 1,366 deaths out of 133,560 women aged 25-44 in the NLMS.

by using state compulsory schooling laws as an instrument for years of education. She applies this instrument to a sample from the 1960 United States Census of white people who were 14 years of age between 1915 and 1939, and observes a similarly-defined group in the censuses of 1970 and 1980. This allows her to calculate death rates for synthetic cohorts defined by gender, year of birth and state of birth. Lleras-Muney presents several IV estimations, each of which shows a statistically significant association between years of education and a 10-year probability of dying. This association suggests a reasonably large causal effect of education on mortality: an additional year of education is estimated to lower the probability of dying in the next 10 years by at least 3.6 percentage points. Further adjusting for income or occupation reduces this association but does not remove it, implying that education has an impact on mortality which is independent of any association with socio-economic status in adulthood.

Oreopoulos (2003) also uses state compulsory schooling laws as an instrument for years of education, and applies this instrument to data on people aged 25 to 84 in the 1990 and 2000 United States Censuses. These two Censuses asked questions about physical and mental health limitations. Oreopoulos finds that an additional year of compulsory schooling lowers by 1.7 percentage points the likelihood of reporting a disability that limits personal care, and lowers by 2.5 percentage points the likelihood of reporting a disability that limits daily activity. Oreopoulos also uses changes to the school leaving age in the United Kingdom as an instrument, and applies this to data from General Household Surveys in the 1980s and 1990s. This survey asked respondents to say whether they were in good, fair or poor health. Oreopoulos finds that a one-year increase in schooling lowers the probability of reporting being in poor health and raises the chances of reporting being in good health. He does not, however, adjust for income, so it is not clear whether education's impact on mortality is independent of the effects of being better-paid.

In summary, the evidence from a wide range of longitudinal and cross-sectional studies in a number of countries, using different methods, different measures of health, and different control variables, indicates that better-educated people experience better health. This finding generally holds when the greater earnings of better-educated people are taken into account. Even the best of these studies, though, are plagued by a lack of control variables for early life factors, which may potentially influence both educational decisions and outcomes later in adulthood. Studies showing an association between education and health are therefore likely to have overstated the strength of this relationship, but it is almost impossible to know by how much, and whether this is significant. The sheer weight of studies showing a positive association makes a persuasive argument for saying that education has a causal effect on health, although it is not at all clear how great this effect is. It is also difficult to say what mediates education's effect on health, and many different explanations have been proffered. It may be that there are many different channels operating.

Other pieces of evidence also point to a causal relationship between education and health. We might expect to see a relationship, for example, since education seems to be related to cigarette smoking (section 3.1) and smoking is the leading cause of preventable death in New Zealand (Ministry of Health 2002). IV studies also point to a causal relationship, at least for students compelled to stay in school through compulsory schooling changes. Because of the way they are designed, IV studies such as that of Lleras-Muney (2002) avoid the problems of omitted variables which plague longitudinal and cross-sectional studies. However, as with Lochner and Moretti's (2001) study on imprisonment (section 3.3), there is a question over how generalisable they are to contemporary New Zealand. For example, Lleras-Muney's sample was of people who were affected by compulsory schooling policies in the United States between 1915 and

1939, and it is not clear that her results can be generalised to New Zealand in 2004, with a completely different education system and where students already receive a minimum of ten years schooling.

3.7 Social connectedness and political participation

Social capital refers to the stock of active connections between people, as constituted by participation in, and knowledge of, civic affairs; trust in other people; and reciprocal help and support in the community. Interest in social capital has been motivated by apparent associations between levels of social capital and social and economic outcomes (Putnam 2000). Bynner and Egerton (2001) use the National Child Development Study, a longitudinal study of all children born in Britain in one week in 1958, to investigate associations between educational attainment, measured by qualifications, and later life outcomes, measured at age 33. After controlling for some parental and socio-economic variables, they find a persistent association between qualifications and membership of organisations, and also between qualifications and the likelihood of voting in local and general elections. These results suggest that education may help to build social capital.

Plausible mechanisms can be thought of to explain the connection between education and social capital. Without a basic level of literacy, for example, it would be difficult to know about public events or public resources, to read the newspaper, or to know what is going on in the community. Schools are also places where students are inculcated with similar knowledge and values, and where they learn to interact with children of different backgrounds (Heyneman 2001).

Brehm and Rahn (1997) develop and test a model in which individuals contribute to social capital by having a degree of trust in other people and by being members of groups and organisations. Using data from the annual United States General Social Surveys between 1972 and 1994, Brehm and Rahn find that duration of education is strongly related to membership of groups, after accounting for measures of psychological engagement, resources and social conditions. Education was also related to feeling that other people could be trusted, after accounting for measures of demographics, family background, resources, being a victim of crime, and life satisfaction. Better-educated respondents belonged to more groups and were more trusting of other people; increased education may therefore contribute to social capital.

Voluntary work is a manifestation of help and support in the community and increased volunteering may therefore contribute to social capital. Wolfe and Haveman (2001) include increased volunteer work as one of the wider benefits of education, but the studies they refer to may have been biased by failing to account for unobserved family characteristics which might affect both school achievement and an individual's willingness or ability to do voluntary work. Gibson (2001) uses data from a New Zealand sample of identical twins to test whether this is the case. Using identical twins brought up together accounts at one stroke for both inherited ability (since identical twins have the same genetic structure) and shared family background. Gibson finds that increased education in fact significantly *reduces* the probability of volunteering. In addition, for those who do volunteer, increased education significantly decreases the number of hours of volunteer work that are performed.

Karp and Banducci (1999) look at voter turnout in New Zealand using the New Zealand Election Study, which is held after each general election. Controlling for age, ethnicity, political leanings and party preferences, they find that increased educational qualifications

were significantly associated with a greater probability of voting, in both the 1990 election (under first past the post) and the 1996 election (under proportional representation).

Two recent NBER papers on voter participation use instruments for the quantity of education, in an attempt to control for unobserved characteristics. Using different datasets and different instruments, Milligan, Moretti and Oreopoulos (2003) and Dee (2003) both find that educational attainment has a large and statistically significant effect on subsequent voter participation in the United States.¹⁴ Voter turnout in the United States is poor, however, so the results of these studies may not be generalisable. With regard to voting, New Zealand is more like the United Kingdom, where people are legally required, and actively assisted, to register as voters and where there is a reasonably high turnout in general elections. Milligan *et al* (2003) investigate voting behaviour in the United Kingdom, using data from British Election Studies between 1964 and 1997. Normal regression estimates, controlling for gender and age, show that an extra year of education has only a small effect on the probability of voting, increasing this by about one percentage point. Instrumental variables estimates – again using compulsory schooling laws as an instrument for years of education – are similar in magnitude but statistically insignificant.

In summary, the evidence for a causal connection between education and social capital seems relatively weak, mainly because studies tend to lack information on early life factors. Apparent associations between education and later behaviour may therefore be confounded by unobserved family or other background characteristics. For example, parents who encourage their children to pursue more education might also tend to nurture strong civic virtues. The best study in this regard is the twin study of Gibson (2001), which in fact shows that increased education *decreases* a person's likelihood of doing volunteer work. The results of IV studies showing a strong effect of education on voting in the United States may not be transferable to the United Kingdom or to New Zealand. In general, it is not apparent that one more year of education significantly adds to the social skills, civic values, collective responsibility, etc., inculcated during 10 or 11 years of compulsory schooling.

3.8 Children's education

Studies throughout the world find that better-educated people tend to have children who experience better outcomes: their children are healthier, for example, do better at school and commit fewer crimes. Young people in the Christchurch HDS cohort whose mothers had low levels of education were at greater risk of many poor outcomes in childhood and adolescence.¹⁵ It may be, therefore, that an increased education benefits not only the individual who receives it but also their children. This section looks at evidence for one particular causal relationship, that between parents' education and their children's education.¹⁶

¹⁴ Milligan uses data from the United States National Election Studies from 1948 to 2000, and uses compulsory schooling laws as an instrument. Dee uses data from the longitudinal High School and Beyond study, and uses two instruments – availability of junior and community colleges, and teen exposure to child labour laws.

¹⁵ They were at greater risk, for example, of having conduct and peer relationship problems in childhood (Fergusson and Horwood 1998; Woodward and Fergusson 2000), being multiple problem adolescents (Fergusson, Horwood and Lynskey 1994), and leaving school without qualifications (Fergusson *et al* 2002). As a result, Christchurch HDS studies invariably treat maternal education, and sometimes paternal education, as a potentially confounding factor in all relationships under investigation.

¹⁶ Of all the possible intergenerational relationships, this is the one which is most often discussed, and for which there is also the best evidence. The only other area which has received serious attention is the link between parent's education and children's health (Grossman and Kaestner 1997; Currie and Moretti 2002).

Haveman and Wolfe (1995) review studies on the family and neighbourhood determinants of children's years of education and of high school graduation. They find that in virtually all of these studies, parents' education is statistically significant and quantitatively important, no matter how it is defined. This is the case despite controlling for other parental, family and neighbourhood characteristics such as income, occupation, family structure, and maternal age. Mothers' education was found to be more closely related to the attainments of the children in these studies than fathers' education. There are plausible explanations for these relationships. More educated parents, and particularly mothers, might be better at encouraging their children to study, setting high expectations, being role models of possible careers, reading to their young children and helping them with their homework.¹⁷ Better education of children might therefore begin a cycle, where succeeding generations also do better at school.

These explanations ignore the effect of genetic inheritance, however. It might be that more naturally able parents do better at school and that this natural ability is in turn genetically transmitted to their children, who also do better at school.¹⁸ Well-educated mothers might also marry more able men, and as a result of this assortative mating might improve the genetic endowments of their children. Adoption studies, twin studies, and studies of increases in education by young mothers all attempt to control for these genetic factors.

Adoption studies

Adoption studies take advantage of the fact that adopted children share only their parents' environment, and not their parents' genes. Any relationship between the education of adopted children and their adoptive parents is therefore driven by the influence that parents have on their children's environment, and not by parents passing on their natural ability. Sacerdote (2000) and Plug and Vivjerberg (2001) both find that parents' education has a sizeable and significant effect on their adopted child's education. An additional year of mother's education, for example, is associated with an extra 0.22 years of schooling for the child (0.26 years in Plug and Vivjerberg). Children adopted by a mother with a college degree have a 40% higher chance of graduating from college themselves (19% in Plug and Vivjerberg). Both studies control for basic demographic variables.

Sacerdote also looks at the effect of parents' education on their adopted child's *test scores*, as well as on their quantity of schooling. He finds that the effect on test scores is relatively small, suggesting that family environment is able to influence educational attainment and college attendance to a greater degree than test scores. This result suggests that test-taking ability relies more heavily on genetic endowments whereas college attendance relies more heavily on parental expectations. Plug and Vivjerberg examine the effects of assortative mating, by controlling for the effect of mother's and father's education together. This did not influence the relationship between the education of fathers and their adopted children, but it strongly reduced the relationship between education of mothers and their adopted children to the point of statistical insignificance. This result suggests that a mother's education improves her child's schooling indirectly, through her choice of marriage partner. Plug and Vivjerberg also include family income in their models, but this has little effect on the coefficients, suggesting that education has a direct effect rather than acting through increased income.

¹⁷ They might also, for example, be able to afford books, or access to better schools, although these are properly examples of labour market benefits of education. For analyses of the effect of parental income on children's outcomes, including educational outcomes, see Mayer (1997).

¹⁸ The term 'natural ability' does not include only IQ, but also traits such as inquisitiveness, reliability, determination, communication, and perseverance.

Adoption studies tend to be hampered by small sample sizes, since relatively few children are adopted. Sacerdote uses a sample of only 170 children from the NLSY; Plug and Vivjerberg use a sample of 610, although 40% were still at school and had not completed their education. Sacerdote also admits the possibility that adopted children may not have been randomly assigned to parents and that high-ability parents may have been able to select, or may have been matched to, children from high-ability birth mothers. Furthermore, neither of these two studies controls for characteristics of parents which might be associated with their own educational performance and also with their parenting ability – characteristics such as patience, communication, diligence, and intelligence. For this reason, the effect of parents' education on their adopted children might well be overestimated in the adoption studies discussed above.

Twin studies

Twin studies take advantage of the fact that identical twins raised together are extremely similar: they share 100% of their genes, and grow up in the same family.¹⁹ Behrman and Rosenzweig (2002) look at the difference in the years of education completed by pairs of identical twins, and then relate this to the difference in years of education completed by their eldest children (who are therefore cousins). Identical twins are assumed to have the same natural ability and also the same innate childrearing ability.

Surprisingly, Behrman and Rosenzweig show that the child of the more-educated sister in each pair of female twins tended to complete *less* education. A one-year increase in a mother's education was associated with a *decrease* in her child's education of about a quarter of a year, although this was only significant at the 10% level. On the other hand, the child of the more-educated brother in each pair of male twins tended to complete more education. A one-year increase in a father's education was associated with a statistically significant increase in the child's education of about a third of a year. For both female and male twins, adding their husband's or wife's education and ability into the model, and therefore controlling for assortative mating, had little effect on the observed relationships.

These findings suggest that increasing men's education would raise the level of education of the next generation by a small amount, while raising the level of education of women would not, and might even lower it. Behrman and Rosenzweig consider that these findings might be explained by reference to women's time in the home: women with more education tend to spend less time at home with their children, and this negatively affects their children's learning. As with adoption studies, however, sample size is an issue which plagues twin studies. Behrman and Rosenzweig claim to have used a sample of 212 female and 122 male twin-pairs but Antonovics and Goldberger (2003) allege that relatively few twin-pairs in the study had children who had actually completed their education.

Studies of increases in mothers' education

Two studies take advantage of the fact that young mothers sometimes return to formal education after the birth of a child or between the births of their first and subsequent children. Both studies use an extension of the NLSY which surveys the children born to women in that cohort.

Kaestner and Corman (1995) associate young children's improvements on tests of reading and mathematics, two years apart, with increases in their mother's formal

¹⁹ Bound and Solon (1998) provide a good discussion of the strengths and weakness of twin studies.

education over this period. They control for other changes in the children's lives over this period which might have affected their test results, such as their health status, mother's labour force participation, family structure and family income. Factors which did not change over this time, such as the children's ability or their mother's innate parenting ability, were common to both points in time and therefore implicitly controlled for in the model. Kaestner and Corman find no effect of increased maternal education on children's achievement scores.

Rosenzweig and Wolpin (1994) look at differences in test scores between earlier-born and later-born pairs of siblings, relating these differences to increases in their mother's formal education over the intervening period. A quarter of the sample had continued their education after the birth of their first child. Rosenzweig and Wolpin control for a number of factors which might vary between the earlier- and later-born children, and which might affect cognitive development, such as the use of prenatal care, birth-weight, mother's smoking and drinking, home teaching, television watching and frequency of reading to the child. Family and parental factors were common to both children and therefore implicitly controlled for in the model (although the children, not being identical twins, might have differed in other unobservable ways). Rosenzweig and Wolpin find that an additional year of maternal education has a modestly positive and marginally significant effect on their children's achievement in reading and mathematics tests, although not on a measure of verbal IQ. Each additional year of education obtained by the mother prior to the birth of a child increases achievement test scores by 2.4%.

Both of these studies have reasonable sample sizes to work with, but both consist of relatively young women and their children. The oldest respondent in Kaestner and Corman's study at the time of the second assessment was only 34 years old, with a child aged between 7 and 9. Rosenzweig and Wolpin's sample was made up of women who had had at least two children by age 25 (for the maths and reading sample) or by age 27 (for the vocal IQ test). Half of these mothers had first given birth between the ages of 17 and 19, which explains their high rates of school continuation. The samples are therefore not representative of all families with children and this limits the generalisability of the results.

Instrumental variables studies

Two recent NBER papers use changes in compulsory schooling laws as an instrument for parents' education, in an attempt to determine whether an increase in parents' attainment affects their children's attainment. Historical changes in compulsory schooling laws are used because they affect the length of time that parents are at school without affecting their innate abilities. Black, Devereux and Salvanes (2003) look at the effect of an increase in the duration of compulsory schooling in Norway from 7 to 9 years. This reform was introduced in different municipalities at different times between 1960 and 1972. Black *et al* use these differently-timed law changes as an instrument for parental education, and find little evidence of a causal relationship between the length of fathers' education and the length of their children's education. They do, however, find a small, but statistically significant, relationship between a mother's education and her son's (but not her daughter's) education. These findings suggest that the high correlations between parents' and children's education are due primarily to family characteristics and inherited ability.

Oreopoulos, Page and Stevens (2003) come to a different conclusion. Their study uses changes in compulsory schooling laws across different states of the United States as an instrument for parental education, and they apply this instrument to data from the 1960, 1970 and 1980 Censuses. In contrast to Black *et al*, Oreopoulos *et al* find that a one-year

increase in the education of either parent reduces the probability that a child repeats a grade at school by between two and seven percentage points. Among 15 to 16 year olds living at home, Oreopoulos *et al* also estimate that parental compulsory schooling significantly lowers the probability of dropping out of high school. These findings suggest that an increase in parents' education may cause an increase in their children's educational attainment.

Summary

The evidence on the relationship between parents' education and their children's education is conflicting. Most of the studies discussed above find some evidence of a causal relationship, but differ as to whether this applies to both parents (e.g. Oreopoulos *et al* 2003), to fathers only (e.g. Behrman and Rosenzweig 2002), or to mothers only (e.g. Black *et al* 2003). In addition, the evidence from adoption studies, twin studies, and studies of increases in education by young mothers is difficult to interpret because of methodological complexity and problems such as the small sample sizes in most of the studies.

3.9 Subjective quality of life

Studying the overall subjective well-being of people with different levels of education takes into account the contributions of improved health, less unemployment, less substance abuse, and so on, while also avoiding any double-counting of benefits. Studies of well-being typically show that better-educated people have a greater level of well-being than their less-educated counterparts. Blanchflower and Oswald (2000) find, using data from the United States and from the United Kingdom, that this conclusion also holds when income is taken into account.

The largest, most comprehensive study of subjective well-being is the World Values Survey. This survey asks the question: "All things considered, how satisfied are you with your life as a whole these days?" and measures responses on a 10-point scale. Helliwell (2002) analyses this measure of subjective well-being with data from three successive waves of the Survey – 1980-82, 1990-91, and 1995-97. In total, over 87,000 people were interviewed, from 46 different countries (although not from New Zealand). As well as measuring life satisfaction, the Survey gathers information about the characteristics of respondents, including the age at which they finished their full-time education.

Helliwell (2002) uses the results of the World Values Survey, including both individual and national-level variables, to construct a number of multivariate regression models to explain subjective well-being. When the education variables alone are regressed against well-being there is a strong association (as other studies have found) between increasing well-being and increasing duration of education. People who invest more in their education are more satisfied with their lives. In this model there also appears to be a small positive spill-over effect from greater education. People who live in countries with a higher average level of education tend to be slightly more satisfied than their counterparts in less-educated countries.

When the other individual and national variables are introduced into Helliwell's model, however, the association with education falls away. This suggests that the effect of education on well-being is wholly expressed through other mediating variables. More educated people are more satisfied with their lives because they are healthier, earn higher incomes, are less likely to be unemployed, and are better socially connected (as the

above sections have shown). Similarly, with regard to national-level variables, people from countries which have a better-educated population are more satisfied because their countries are richer and have greater levels of social capital.

In this study, however, there are no controls for potentially confounding personality traits, dispositions, family backgrounds, neighbourhoods, social environments, and so on, which might affect both a person's decisions about their education, and their later feelings of life satisfaction. The direction of the relationship between life satisfaction and the proposed mediating variables is also unclear from Helliwell's models. It might be, for example, that happier people are more likely to stay married, or to join groups, or to keep jobs, rather than the other way round.

Ross and van Willigen (1997) trace pathways from education (measured by the number of years completed) to subjective well-being, using two United States national telephone surveys. They find that education reduces psychological distress largely because better-educated people have jobs where they can exercise some control, have a variety of work to do and are able to use their skills. As a result, better-educated people have a greater sense of personal control: an expectation that outcomes are contingent on their own choices and actions. They also find that the other, less important, channel through which education reduces distress is by increasing the level of social support which a person receives, particularly through intimate relationships. Ross and van Willigen conclude that education shapes life chances, which affect people's subjective quality of life. Again, however, there are no controls in this study for early life factors which might be associated with both educational attainment and with later life outcomes, including psychological distress. The only controls in the study are those for age, gender and race. An alternative view is therefore that other, unobserved factors shape both life chances and educational choices.

In summary, both Helliwell (2002) and Ross and van Willigen (1997) show an association between education and well-being, and suggest some mediating factors, but neither study is designed to show that this association is causal. It is therefore not possible to say on the basis of these studies that more education causes greater life satisfaction. Also, even if education does cause greater life satisfaction for individuals, it might do so through influencing perceptions of status relative to others. More-educated individuals might be genuinely more satisfied with their lives than their less-educated neighbours, but in part this could be because of their increased social status. If this were the case, an increase in education might not significantly improve the well-being of society as a whole.

4 Discussion

This paper looks for evidence of the wider benefits of education in a number of different areas of life. As a whole, the literature on the wider benefits of education appears considerably less advanced than the literature on earnings-related benefits. Some areas, most notably the links between education and health, are reasonably well-researched, but it is probably true to say that there are more high-quality studies on the effects of education on wages than there are on all the other 'wider' areas put together. However, it does appear that the wider benefits of education is becoming a more popular topic in the literature, as evidenced, for example, by the number of recent NBER studies cited in this paper.

The research discussed in this paper suggests that greater education, as measured by either the time a person spends in formal education or the qualifications they attain, may cause a reduction in cigarette smoking, anxiety disorders, anti-social disorders, suicide, crime, teenage pregnancies, unemployment and reliance on welfare benefits. The evidence in these particular areas is largely based on the results of the Christchurch HDS and Dunedin MHDS, whose strengths are that they study young New Zealanders (and so are relevant to this country), have been recently conducted (the cohorts were at school in the early 1990s) and control for a relatively large number of early life factors. These studies measure outcomes between the ages of 18 and 21. It is less clear whether the benefits of education in terms of cigarette smoking, etc., persist into adult life, although some evidence from instrumental variables studies suggests a causal link with adult outcomes in these areas.

The evidence for later adult outcomes in terms of physical health, social connectedness and political participation is less convincing than it is for the adolescent outcomes covered by the New Zealand birth-cohort studies. However, the large number and variety of studies which show a positive association between education and health does suggest that education has a causal influence on a person's health. Studies which look at whether a person's education benefits the next generation, in terms of their children's achievement at school, yield conflicting results, although most find some evidence of a causal relationship between the generations.

Some of the studies suggesting a causal relationship between education and later outcomes do so by comparing the outcomes of people who have School Certificate, for example, or a high school diploma, with the outcomes of people who do not. Since these two groups are very broadly defined, it is not possible to estimate how much benefit a marginal increase in education would confer. In particular, these studies may appear to overstate the benefits of an individual gaining School Certificate or a high school diploma. Other studies compare groups of people with progressively higher qualifications or progressively longer education. These studies typically show that the more qualifications a person holds, or the longer they are in formal education, the greater the probability of good outcomes in later life. Even here, though, it is difficult to settle on the marginal benefits of increased education. Studies present their results in a variety of ways and, in any case, give differing results which are hard to reconcile. In general, however, it does seem that the marginal benefits of an additional year of education, or of an additional qualification, are relatively modest. In their review of the literature, Behrman and Stacey (1997) claim that the percentage of the variation in social outcomes explained by education is much smaller than the percentage of the variation in earnings explained by education.

Ideally, a comprehensive study of the wider benefits of education would not only provide estimates of the marginal benefits in each area of life, but would also go on to express these benefits in a common unit, so that the *total* wider benefits of an increased year of education, or of an additional qualification, could be measured. This would be extremely difficult to achieve, although Haveman and Wolfe (1984) do attempt it. They present a method for quantifying some of the wider benefits of education using information on the costs of alternative ways of obtaining better health, lower levels of crime, children's attainments, and so on. In this way they come to their estimate that the total annual value of the wider benefits of education is of the same order of magnitude as the earnings-related benefits. Haveman and Wolfe admit, though, that theirs is a very rough and speculative estimate of the value of additional education.

To heap ideal upon ideal, the perfect study would also take into account the interactions between benefits in different areas: that unemployment might increase mental health problems; that smoking might contribute to health problems; that crime might decrease social connectedness; that anti-social disorders might increase crime; and so on. Double counting of benefits would then be avoided, although it would be extremely difficult to control for all these interactions in an empirical study. It is possible to cut through this difficulty, however, by measuring people's self-assessed well-being – assuming that it captures the value to them of all the possible benefits of education – and then comparing the well-being of individuals (or the average well-being within countries) with different levels of education. As discussed in this paper, Helliwell (2002) shows a positive association between education and self-assessed well-being, but his study includes only minimal controls for early life factors and cannot therefore establish a convincing causal association.

The literature on the wider benefits of education does not give a good indication of whether benefits are greater at particular times, for particular people or for particular skills. Following Mincer (1974), wage models typically assume that the marginal return to education is constant, so that an additional year of education has the same percentage benefit in graduate school as it does in primary school. It is not clear, however, that such an assumption is justified when considering the wider benefits of education. If the payoffs to increased education diminish as the level of education gets higher, then an additional year of schooling at age 16 will be more valuable than an additional year of university study, and the attainment of School Certificate will be more valuable than the attainment of a PhD. There might also be different benefits accruing from different courses of study, for example from attending vocational training rather than academic courses. The literature gives little guidance here, although some studies suggest that completing a year of education which results in a significant qualification is more valuable than completing a year which doesn't.

While the literature gives little guidance in this area, it is tempting to think that significant benefits could be realised by increasing the educational attainment of the very lowest achievers, since a basic level of literacy and communication would seem to be necessary in order to find something in a newspaper, read to children, understand what is written on a medicine bottle, use a phone book, interpret a nutrition label, and so on. In other words, a minimum level of educational attainment may be necessary to avoid social exclusion. Also, since people with the poorest attainment at school tend to have the worst outcomes in adulthood, focusing on improving the achievement of the lowest achievers might help to reduce disparities in adult outcomes.

Why should greater education cause good outcomes later in life? This review has not attempted to systematically uncover the factors which might mediate between educational

performance and early adult outcomes, although it is worth considering what some of these factors might be. The association between educational achievement and unemployment should be relatively straightforward to explain, since employers want workers with a proven level of basic skills and attitudes. It is also possible that the association between school achievement and poor outcomes in early adulthood springs from this: that is, that adolescent substance use, crime, sexual risk-taking, etc., are a consequence of unemployment or, more generally, a consequence of not being gainfully occupied either at school or at work. The juvenile crime literature, for example, suggests that school attendance, rather than achievement of qualifications, might provide a constraint on criminal behaviour by keeping young people gainfully occupied. For the most part, however, the Christchurch HDS and Dunedin MHDS studies do not test for these mediating factors. We also know that studies showing causal relationships between school achievement, unemployment and early adult outcomes cannot always be interpreted transitively, for whatever reason.²⁰

Alternatively, it might be the case that the associations between education and poor outcomes between 18 and 21 are mediated by income. What we consider to be the wider benefits of education for young adults may in fact be due simply to higher earnings. The New Zealand birth-cohort studies did not test for this. It is unlikely, however, that better-educated people would have earned significantly more than less-educated people by ages 18 to 21, especially since people who continue with formal education are usually not in full-time paid employment.

Other explanations rely more on psychosocial factors. Miech *et al* (1999) mention a number of possible mediating factors which might explain the effect of education on mental health. These factors are stress, poor social or psychological coping resources, and lack of occupational direction, control and planning. Ross and van Willigen (1997) highlight the importance of a sense of personal control and the ability to form close relationships. They consider that these factors are affected by access to work and in particular to non-alienating work. For outcomes later in life, it is probably true to say that education affects outcomes through a whole range of mechanisms, which differ for different people in different circumstances. The effect of increased education at age 16 on increased health at age 66, for example, will necessarily be complex, involving many intervening factors across this 50-year period.

Causality and coincidence

Section 2 of this paper discussed the issues of causation and coincidence, and of individual and social benefits. These are key issues for policy-makers and so are worth revisiting.

The discussion above refers to studies ‘suggesting’ a causal association between education and later outcomes. This might be considered an unnecessarily guarded way of describing these relationships, especially where high-quality, New Zealand-relevant studies have demonstrated a persistent link between educational attainment, or participation, and subsequent outcomes. However, while much of this appears to be good evidence it is as well to be cautious in ascribing causality. Even in the richest of longitudinal studies, for example, controls inevitably remain incomplete and critics always have the opportunity of suggesting potentially confounding factors that are not included in

²⁰ For example, there is a persistent association between leaving school without qualifications and unemployment (Caspi *et al* 1998) and there is also a persistent relationship between unemployment and drug abuse (Fergusson, Horwood and Woodward 2001). However Fergusson *et al* (2002) found no persistent relationship between leaving school without qualifications and drug abuse (see section 3.1).

the analysis and perhaps could never feasibly be included. Fuchs (1982), for example, suggests that the observed relationship between education and health could reflect personality factors differing between individuals and in particular their rate of time preference. People with a low rate of time preference will tend to invest both in education and in health for the longer-term payoffs that these provide; people who by their nature live for the now will not be prepared to sacrifice current pleasures in such a way.

The instrumental variables studies reviewed in this paper avoid this problem of omitted variables. However, they do raise questions about generalisability to contemporary New Zealand. All the IV studies cited here are from overseas, and a number look at the effects of changes in compulsory schooling laws from as long ago as before the Second World War. In all cases, the people affected were those who otherwise would have left school, but who were forced to stay for an extra year or two by the changes in schooling laws. Therefore, while the estimates from IV studies are unbiased by omitted variables, how much weight should we place, for example, on a study of pre-war students in the United States who were compelled to stay at school until they were 13 instead of leaving to work on a farm at age 11? Twin and adoption studies also avoid some of these problems of omitted variables, but have demanding sample requirements and are difficult to execute well, as section 3.8 on children's education illustrates. Therefore, while some study designs are better than others, none are perfect. In any case, even the best study of the link between education and outcomes over people's lives would effectively be 50 or 60 years out of date when it reached its conclusions, since formal education mostly occurs in a person's youth and several important outcomes, such as mortality, occur (usually) after a long intervening period.

Individual and social benefits

As discussed above, this paper draws together evidence suggesting that people who choose to further their education are likely to experience (some) better outcomes in later life, and are therefore likely to gain a benefit from this greater education. Following the framework set out in section 2.1, we can also consider whether adding up the benefits to individuals of increasing their own education would under-estimate or over-estimate the benefits of additional education to society as whole.

If the benefits resulting from increased education have significant spill-overs then the sum of individual benefits might under-estimate the benefits to society as a whole. Spill-over, or 'external', benefits occur when an individual's increased education provides benefits to other people, and there is no market for these benefits. What might some of these spill-over benefits be? If education causes a decrease in cigarette smoking then the spill-over benefits might include a reduction in the harm done to their babies by pregnant women who smoke, or the harm done to others through passive smoking. Similarly, spill-overs from a decrease in criminal activities will include the reduction in resource costs to other members of society. Spill-overs from a decrease in mental health problems, suicide, teenage pregnancy, and other outcomes are likely to include a reduction in the distress suffered by family and friends. If increased education has benefits for an individual's children then this would seem to be an intergenerational spill-over. By definition, social capital is a property of a community, so if an individual's education increases their membership of groups, trust, volunteering, etc., then a resulting increase in social capital is a benefit shared by the rest of the individual's community.

Pinning down what exactly constitutes a spill-over, however, is difficult, and some of the examples given above are disputed. For example, it is not clear whether benefits which accrue to members of an individual's own family should be considered as spill-overs

(Behrman 1997). Grossman and Kaestner (1997) consider that spill-overs include costs or benefits that the decision maker imposes on himself or herself but neglects due to imperfect information. Manning, Keeler, Newhouse, Sloss and Wasserman (1991) question whether maternal and passive smoking are in fact spill-overs. In general, the difficulty is that spill-over (external) benefits and costs are defined in a precise way in microeconomic models (e.g. Buchanan and Stubblebine 1962) but in real-world situations are much less clearly identified. It does seem, however, that some good outcomes arising from increased education, such as a reduction in crime, plainly have some spill-over benefits and therefore that the benefit of education to society as a whole might be greater than the sum of individual benefits.

On the other hand, the benefit to society as a whole might be *less* than the sum of individual benefits if, at least to some extent, education promotes good outcomes through social stratification, rather than solely through the skills, knowledge and behaviour that are developed. In other words, if the lasting effect of education is the status it confers on people, such as being known as a university graduate, then it may confer relative benefits (being better off than the next person) but not absolute benefits to society as a whole (since the other person is now worse off than you). Even early in adulthood, people who do not have educational qualifications may be being selected into lower social strata. Being low in the social hierarchy may lead to psychosocial stress, which could have physical or mental health effects. Better-educated people might also be able to work 'the system', for example by knowing how to get preferential treatment from health providers. This paper provides some evidence in favour of this social stratification hypothesis, from United States studies showing that the risks of mortality, or of being in prison, decline markedly upon the completion of a high school diploma or a college degree (Backlund *et al* 1999; Lochner and Moretti 2001). Obtaining a key qualification may confer an additional benefit, over and above the skills, knowledge, etc., that are developed during an additional year of education.

Conclusion

In summary, the literature points to a number of areas where greater education might improve outcomes, over and above the benefits that accrue from being better paid. Knowledge of these wider benefits of education should complement discussions on the link between education and individual earnings, and the link between education and economic growth. The wider benefits of education are difficult to quantify, however, and the degree of uncertainty around them is considerable. It would be unwise, with our present knowledge, to consider education as the springboard for widespread social change, especially since New Zealand already mandates compulsory schooling for 10 or 11 years.²¹ Greater education seems likely to improve outcomes such as health and crime, but may do so only modestly. If this is the case then there are two policy implications: firstly, the wider benefits of education may not be great enough, on their own, to justify large increases in public spending on education and secondly, greater education may not be the most cost-effective way to improve outcomes in the areas of health, crime, etc. These implications need to be considered in more specific research.

Furthermore, the literature gives little guidance on where improvements in education would be most effective (let alone most cost-effective) in promoting wider benefits. It may be that the greatest benefits could be realised by increasing the educational attainment of the very lowest achievers, although this is more a product of speculation than of empirical

²¹ Schooling is compulsory in New Zealand from ages 6 to 16 but almost all children start school at age 5. A growing number of students now leave school at age 15, however, having been granted an early leaving exemption.

evidence. The literature also cannot tell us whether the benefits of education to society as a whole are more or less than the sum of benefits to individual students. While this seems a vague and unsatisfying conclusion, it is worth noting that the evidence on whether the earnings-related benefits to society as a whole are more or less than the sum of individual benefits is also unclear, despite being more closely studied (Temple 2001). Additional education, on top of current levels of provision, probably does make us healthier, wealthier and wiser but the evidence for health impacts, as well as for other wider benefits of education, leaves a lot of questions yet to be answered.

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