Chronic Poverty among Australian Children since 2000 and the Effect of Permanent Income on Completed Schooling

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By

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Certificate of Originality

I, Jessica Todhunter, declare that this thesis, submitted in partial fulfilment of the requirements for the award of Bachelor of Commerce (Honours), in the Department of Economics, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The work contained in this thesis has not been previously submitted for a degree or other qualification at any other higher education institution. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made.

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Date:

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List of Abbreviations

ABS – Australian Bureau of Statistics

CPI – Consumer Price Index

HILDA – Household, Income and Labour Dynamics in Australia Survey

MIAESR – Melbourne Institute for Applied Economic and Social Research (University of Melbourne)

OECD – Organisation for Economic Co-operation and Development

RBA – Reserve Bank of Australia

RHE Wealth – Real, Household, Equivalised Wealth

RHED Income – Real, Household Equivalised Disposable Income

Abstract

The central objective of this thesis is to analyse the extent and nature of child poverty in Australia since 2000, focussing particularly on the extent of chronic child poverty. The research is motivated by empirical evidence which suggests that sustained low income during childhood can have severe and long-lasting consequences in later life. Using six years of data from the Household, Income and Labour Dynamics in Australia Survey, this thesis aims to determine what proportion of annual child poverty in Australia is chronic. This thesis also examines the effect of permanent income during adolescence on a child's probability of completing Year 12 or a trade certificate, as education is regarded as one of the key links between childhood poverty and outcomes in adulthood.

The results show that only half of the children who are in relative poverty in Australia each year are chronically poor, implying that the remaining half experience only transitory poverty. Regarding schooling completion the results show that permanent, household income during adolescence has a positive effect, though parental education and neighbourhood characteristics have considerably more influence.

1. Introduction

1.1. Motivation and Objectives of the Thesis

It is well recognised that poverty during childhood is associated with a host of poorer outcomes in later life, including lower educational attainment, occupational success and adult income. Childhood poverty has been described as, "one of the key factors determining the link between incomes of different generations within families," (Blau 1999, p261). However, the literature also suggests that the most serious and long-lasting consequences of poverty during childhood are felt by those with sustained low household income, rather than children whose household income is only temporarily low (Goodin *et al.* 1999, p159; Duncan *et al.* 1998). In fact, it is common for children's household income to fluctuate and even fall below the poverty line in some years, but in cases where this is only temporary, it is likely to have little or no effect on a child's actual standard of living as the household either consumes past saving or borrows. The motivation underlying this research is to study the extent and nature of *chronic* child poverty in Australia over the period 2000-01 to 2005-06, taking advantage of newly available longitudinal data for Australia. In addition, this thesis seeks to explore the effect of permanent, household income during adolescence on completed schooling: one of the key pathways through which childhood poverty is transmitted to adulthood.

Until recently, studies of the extent of child poverty in Australia have been restricted to static poverty analysis, due to the cross-sectional nature of the data available. Based on such data, it is only possible to comment on the distribution of incomes from one year to another and one cannot discern whether those children who are poor in any given year are in a state of sustained low income or only transitory or temporary poverty. The distinction is crucial as the effects of sustained or chronic poverty are very different to

the effects of transitory poverty, particularly for children. To study the dynamics of *chronic* child poverty requires longitudinal data, such as the Household, Income and Labour Dynamics in Australia (HILDA) Survey which has been collected since 2000-01. By exploiting the panel nature of this data set, this thesis aims to determine to what extent childhood poverty in Australia is chronic and to what extent it is transitory.

The first objective of this thesis, therefore, is to describe the extent and nature of relative child poverty, both annual and chronic, among Australian children over the period 2000-01 to 2005-06. Questions which are addressed include, firstly, what proportion of children were poor over the period and how did this change? In addition, is relative, annual child poverty more intense among particular sub-groups of children? Secondly, how many children in Australia were chronically poor over the period, based on their permanent household, equivalised disposable income and to what degree are those children identified as poor in any given year also in a state of chronic poverty?

The second motivation, or objective, of this thesis is to use the longitudinal nature of the HILDA data to determine the effect of family income during adolescence on a child's probability of completing a 'minimal level of schooling,' defined as Year 12 completion or a trade certificate. Attainment of a minimal level of schooling is regarded as being necessary to function as an adult in Australian society as it is one of the key determinants of labour market success and poverty during adulthood. Furthermore, completing a minimal level of schooling represents a 'human capability', to which all Australian children are entitled. In summary, this thesis is motivated to examine, in depth, the effect of family income during adolescence on schooling attainment: one of

the key pathways through which childhood poverty is transmitted to lower outcomes in later life.

1.2. Data and Methodology

Six Waves of HILDA data, from 2000-01 to 2005-06, are used for the analysis in this thesis. This data set was chosen for a number of reasons. Firstly, it is largest and longest-running longitudinal data set in Australia, providing the annual data necessary to calculate permanent income. Furthermore, it collects a wide range of data from household members, enabling wider familial and household characteristics to be easily incorporated into the analysis. Lastly, when appropriate weighting procedures are used, the sample is representative of the Australian population.

The approach used in this thesis to measure relative child poverty in Australia is unique for a number of reasons. Firstly, the permanent income approach is used to measure the extent of chronic child poverty. Combining these estimates with conventional measures of annual child poverty makes it possible to separate the incidence of chronic and transitory child poverty in Australia. Secondly, the relative poverty lines used in this thesis, both annual and chronic, are regionally tailored in order to take account of the differences in the cost of living across Australia. This technique has not been used in the empirical literature and represents a significant contribution to the study of relative child poverty in Australia.

To examine the effect of permanent, household, equivalised income on the decision to complete a minimal level of schooling, a probit model is estimated based on a sample of approximately 500 people aged 17, 18 or 19 years in 2005-06. The model incorporates a variety of other individual, familial and neighbourhood characteristics which were identified in the theoretical and empirical literature as important determinants of

schooling attainment. By including a range of appropriate variables, this thesis seeks to identify the particular pathway through which permanent, household income affects schooling attainment among Australian children.

1.3. Structure of the Thesis

Chapter 2 reviews a variety of ways by which poverty is conceptualised and measured. Regarding the concept of poverty itself, Section 2.1 focuses particularly on two areas: the differences between relative and absolute concepts of poverty and also the difference between economic and social concepts of poverty. Section 2.2 reviews the approaches to measuring poverty, particularly the measurement of chronic poverty. The chapter concludes with a discussion in Section 2.3 of how dynamic poverty measures can enhance the study of child poverty.

Chapter 3 reviews the literature relevant to the empirical work undertaken in Chapters 4 and 5. Section 3.2 reviews the theoretical models focussed on the transmission of childhood poverty to low schooling achievement including, where appropriate, empirical evidence of such effects. This is followed in Section 3.3 with a review of the extent of annual and chronic poverty, both internationally and in Australia.

Chapter 4 contains the first part of the empirical work of this thesis, examining the extent of child poverty among Australian children since 2000. Sections 4.1 to 4.3 introduce the data and child sample used as well as the measurement conventions. Here, the unique approach of tailoring the relative poverty line by geographical area is explained in detail. Section 4.4 presents the relative, annual poverty rates for Australian children since 2000. Section 4.5 decomposes the change in the relative child poverty rate between 2000-01 and 2005-06 to isolate and compare the change in absolute

poverty over the period with that part of the change in relative poverty that is due to the change in the real value of the poverty line over the period. Lastly, Section 4.6 presents the estimated chronic poverty rate for Australian children since 2000, based on the permanent income approach. This section examines, in detail, the extent of overlap between annual and chronic child poverty in Australia, in order to address the first main objective of this thesis.

Chapter 5 examines the link between permanent, household income during adolescence and the probability of completing a minimal level of schooling. Sections 5.1 and 5.2 clarify the objectives and justify the methodology adopted. Section 5.3 develops the model of minimal schooling, based on utility maximisation theory, likening this to the latent variable in the context of the probit model. This section discusses and justifies the regression sample and the variables chosen. Section 5.4 presents the statistical results and some preliminary sensitivity analysis. This is followed by a presentation of the marginal effects (Section 5.5) and more detailed sensitivity analysis (Section 5.6).

Chapter 6 presents a summary of the findings and conclusions from this thesis and presents suggestions for areas for further research.

2. Issues in Measuring Poverty

This chapter gives an overview of some general issues pertaining to poverty measurement and justifies the approaches taken in this thesis. It is divided into three sections. Section 2.1 discusses some of the ways poverty is conceptualised, including the differences between the relativist and absolutist approaches to poverty (Section 2.1.1) and the economic and social aspects of poverty (Section 2.1.2). Section 2.2 reviews the theory of permanent income and discusses how this can be used to identify individuals with low standards of living. This section also describes the types of poverty indices used in the empirical literature and identifies which will be used for the purpose of this thesis. Lastly, Section 2.3 explains how dynamic measures of child poverty, such as the permanent income approach can improve poverty measurement, particularly child poverty.

2.1. Conceptualising Poverty

Australia, like a number of other industrialised countries has no official poverty line.[1] For the purpose of this thesis, poverty is defined as a situation where a person has insufficient income to meet a basic standard of living, as defined by a relative poverty line. This section briefly explores the absolute and relative approaches to poverty measurement and also distinguishes the economic and social conceptions of poverty.

2.1.1. Contrasting Absolute and Relativist Approaches to Poverty

The absolute and relative approaches to poverty can be contrasted by the method used to set the poverty line and also the method used to update the poverty line over time.

[1] Neither Canada (Kornberger 1991, p1) nor the United Kingdom (Hill and Jenkins 1999, p7) have an officially recognised poverty line though the United States does (Slesnick, 1993, p3).

A relativist approach suggests that poverty line be defined with reference to the incomes of others in the society in any given year, considering the socially-based nature of consumption (Bradbury 2003, p.vii). A poverty line set at half median income is commonly used in the poverty literature (Lloyd, Harding and Payne 2004, p4) as this is said to represent the income necessary to enjoy a 'normal or mainstream lifestyle' in one's country (Headey and Warren 2008, p49). More recently, poverty research, particularly in Europe, has adopted a relative poverty line set at 60% of median annual income. Using a relative poverty approach implies that all people are entitled to a level of income which allows them to participate in the activities, and have the living conditions, diet and amenities that are customary, or at least widely encouraged or approved, by the societies to which they belong (Townsend 1979, p31).

An absolutist conception of poverty, however, argues that some basic level of income is necessary which does not change through time. Broadly speaking, two 'absolute' poverty lines are commonly used in the empirical literature. Firstly, the absolute poverty line can be defined as the minimal level of income necessary to maintain an adequate level of physical well-being. In the United States, for example, the official poverty line represents the minimal cost of a nutritionally balanced diet (Slesnick 1993, p3), based on the calculations of Orshansky (1965). This type absolute poverty line is typically updated over time by changes in the cost of living.[2] Secondly, some adopting an absolutist approach use an 'anchored' poverty line which is typically set at half median income in the initial period and thereafter updated according to changes in the cost of living (Blank 2008, p247). Unlike a purely relative poverty line, which automatically

[2] Though it may also be indexed to changes in household, disposable incomes, giving a hybrid poverty line such as the Henderson poverty line in Australia (Harding and Szukalska 200b, p237).

updates each year as the median income changes, an anchored poverty line does not take account of the changes in the distribution of incomes.

This thesis adopts a relativist approach to measuring child poverty, by defining an individual as poor if their annual income falls below a poverty line set at half median annual income. This approach is common in the poverty literature among developed countries, particularly Australia, where Government welfare ensures that nearly all people have an income which is nutritionally adequate.

2.1.2. Contrasting Economic and Social Concepts of Poverty

Poverty may be conceptualised as either an economic concept, focussed on income and material resources, or as a concept of social deprivation and exclusion in the style of Sen's capability deprivation. This section discusses, and attempts to consolidate, the two contrasting concepts of poverty whilst also justifying the preference in this thesis to focus on income poverty.

Poverty as an economic or financial concept represents a situation whereby a person has insufficient income and resources to meet basic needs. In contrast, the social concept of poverty includes consideration of an individual's participation in the social, economic and political aspects of their community, as well as income poverty. The British Social Exclusion Unit, introduced in 1997, defined social exclusion as a situation where,

> *"people or places suffer from a series of problems such as unemployment, discrimination, poor skills, low incomes, poor housing, high crime, ill health and family breakdown,"* (Daly *et al.* 2007, p.v)

which combined can, "create a vicious cycle," (Daly *et al.* 2007, p.v).

Burchardt (2000) has also defined a person as being socially excluded if,

> *"he or she does not participate to a reasonable degree over time in certain activities of his or her society and (a) this is for reasons beyond his or her control, and (b) he or she would like to participate." (Saunders 2003. p6)*

These definitions highlight that social exclusion, unlike the narrower concept of income poverty, is multi-dimensional and reflects a combination of inter-related factors (Saunders 2003, p6). Furthermore, it is a characteristic of the whole community, not just the individual and focuses on the causes, outcomes and processes of poverty, rather than merely an individual's resources at a point in time (Saunders 2003, p6). Research has shown that there exists only a limited degree of overlap between the two concepts (Bradshaw 2003 in Saunders 2003 p10; Daly *et al.* 2007 pp25-6).

The potential benefits from using a social exclusion concept of poverty is that it broadens one's analysis to include causes and consequences of poverty, as well as opening up dialogue on equality and citizenship and draws attention to spatial aspects of poverty and exclusion (Saunders 2003, p3). All of these are important in the context of child poverty and education. Many factors, apart from low income, may lead a child to be socially excluded and therefore, affect their probability of continuing with education beyond the compulsory level. Bray (2001) argues that multiple hardships, which include not being able to afford heating and meals and asking for assistance from family or community agencies, are particularly important for children under 15 years.

The use of social exclusion as a method of conceptualising poverty has been criticised, however, as the criteria used to judge exclusion are arbitrary and thus vulnerable to bias.

Dependent on a household's location and preferences, not all may consider an inability to heat one's home or afford one night out once a fortnight as indicators of hardship (Saunders 2003, p11). Similarly, access to a motor vehicle may not be indicative of social exclusion if the person has access to reliable and affordable public transport, as is common in major cities (Daly *et al.* 2007, p9).

In contrast with the apparently arbitrary dimensions used to identify social exclusion, income poverty is more transparent and precisely measurable. Moreover, detailed and accurate data on income is more widely available, in particular, in the form of panel data which is necessary for the analysis of chronic poverty. Low income, or financial disadvantage, has been emphasised in the literature as one of the most important determinants of social exclusion (Harding *et al.* 2006, p10) and can be thought of as the base cause of many social exclusion factors. For these reasons, the focus of this thesis will be on poverty in an economic sense, that is, income poverty.

2.2. Measures of Poverty

This section discusses how poverty is typically measured and how the permanent income approach can be used to better identify those with low living standards. Section 2.2.1 begins the discussion of the permanent income hypothesis, which is followed in Section 2.2.2 with a discussion of the poverty indices used in the literature and in this thesis.

2.2.1. The Permanent Income Hypothesis

The permanent income hypothesis, as pioneered by Friedman (1957), argues that annual income is the sum of permanent and transitory components, though *consumption* each period is a constant function of life-time, permanent income. Hence, a short-term,

transitory increase in annual income does not lead to a dramatic change in consumption as life-time income is increased only by a small fraction of this transitory shock. Similarly, though an individual may suffer an unusually large drop in their annual income, they continue to consume at a higher level, by drawing on past savings or borrowing.

This hypothesis suggests that annual income is more volatile than either permanent income or consumption, due to the large variation in transitory income shocks. Such a notion is important for poverty analysis as permanent income more accurately identifies those with low consumption and low standards of living, rather than those who have only temporarily low annual income.

One of the criticisms of the permanent income hypothesis is the notion that individuals on low annual incomes are able to borrow in order to maintain their constant consumption. To facilitate the same level of consumption from one period to another, a person who has suffered a sudden decrease in their transitory income must rely on past savings, or in the absence of accumulated savings, borrow. This may include, for example, young people engaged in higher education or starting a family. Berthoud (2001, p79) has criticised the permanent income hypothesis in its assumption that people can make inter-year transfers, especially for those who are very poor and experience severe liquidity problems. Similarly, Chaudri and Ravallion (1994, pp368-9) also acknowledge these shortcomings of the permanent income hypothesis. However, the authors continue to use average income over the eight-year survey period as a proxy for lifetime income in their analysis of annual and chronic poverty in rural India from 1976 to 1983 (Chaudri and Ravallion 1994). In fact, the method of using permanent

income or a proxy such as average income continues to be widely used in the poverty literature (Rodgers and Rodgers 2006; Berthoud 2001; Duncan *et al.* 1998; Hill and Jenkins 1999).

The empirical work carried out by Slesnick (1993, pp29-31), based on US data, confirms that those at the bottom of the income distribution do dis-save and also consume a large amount of housing and consumer durable services. He finds that, in the group of households with low annual income, there exists an overrepresentation of those with only *temporarily* low income. If consumption is related to permanent, rather than annual income, this would result in high consumption to income ratios and an overstatement of poverty based on annual income (Slesnick 1993, p27). Slesnick finds that consumption-based poverty rates are substantially lower than comparable income based poverty rates (Slesnick 1993, p2). Approximately 40% of those who were income poor were found to be home-owners and 10.5% to 13.5% of total expenditure among those who were poor was consumption of consumer durable services (Slesnick 1993, p30-31). Furthermore, substantial dis-saving exists among the poor, sourced often by the elderly from life-time savings and sourced by young people typically from borrowings. If the sample used by Slesnick accurately reported their income and expenditure, he concludes that the poor must have access to some form of credit (Slesnick 1993, p31).

In 2004-05, the Household, Income and Labour Dynamics in Australia Survey (HILDA) collected data on household expenditure in order to create more detailed household financial accounts. The analysis by Headey and Warren (2008, pp.46-7) showed that, whilst the lowest decile of income earners accounted for only 3.1% of total household

income, their share of total household consumption was more than double that amount. In fact, for the lowest six income deciles, the share of total household consumption for each decile exceeded its share of total household income. In contrast, there was a considerable degree of saving at the top of the income distribution, particularly in the top decile, where individuals earned almost a quarter of total household income but accounted for only 15.4% of total household consumption. The authors highlight that it tends to be young couples or single persons with a 'good' education and thus a reasonable expectation of high future earnings, as well as young single people, particularly women, who typically consume more than their income (Headey and Warren 2008, p.47). Combined, these trends of high dis-saving at the low end of the income distribution and significant saving at the top end, imply that low income earners do in fact have access to funds outside their disposable income, such as drawing on savings, borrowing or subsidies from family members lending support to the permanent income hypothesis.

Given this evidence of substantial saving and borrowing across the income distribution, some researchers have proposed that household expenditure, rather than annual income, is the superior measure of individual's living standards.

According to Bradbury and Jantti (1999, p6), poverty measurement based on consumption is ideal as it allows for dissaving. In their study of child poverty, Bradbury and Jantti (1999, p6) argue income may be a less valid indicator of children's living standards as parents, almost exclusively, choose the proportion of income that will be consumed and saved. Furthermore, of the income saved, the parents are most likely to be the direct beneficiaries in their old age. The authors argue that poverty measurement

should focus on children's living standards and investment in education. However, due to data constraints, the authors use income data to measure child poverty across 25 countries.

Headey and Warren (2008, p49) state that whether a household has an adequate standard of living, however defined, depends on its actual consumption level including its expenditure and consumption of public services and other goods in kind. For example, the poor are a major beneficiary of public housing and rent assistance as well as other public services, and it is difficult to quantify the value of these services, potentially distorting the apparent circumstances of those living in poverty. A households' consumption of consumer durables is also not reflected in income data, misrepresenting the actual standard of living for all level of income earners. Headey and Warren (2008, p49) acknowledge that empirically, there are serious difficulties in measuring low incomes, which is due, to some extent, to under-reporting of Government welfare payments by low income earners (Siminski, Saunders and Bradbury 2003).

Though I accept the notion that consumption data may be more appropriate for the study of poverty and in particular child poverty, HILDA is only in the initial stages of collecting household expenditure data, having collected such information in 2004-05 only. Hence, it cannot be used to study chronic poverty which, in its nature, requires longitudinal data. Therefore, the HILDA income data are the best *available* data for the study of chronic child poverty. Furthermore, relying on the permanent income hypothesis, this thesis will use permanent income as an indicator of the maximum

sustainable level of household *consumption,* which will to some extent, reduce the effect of volatile changes in annual household income.

2.2.2. Poverty Indices

The most simple poverty measure is the head-count ratio which focuses only on the incidence of poverty. The ratio is given by the number of people who fall below the poverty line as a proportion of the total population. Though appealing in its simplicity, it has been described as a "very crude" index (Sen 1976, p219) as it remains unchanged regardless of how far the incomes of the poor fall below the poverty line. It is also highly sensitive to the chosen poverty line due to its dichotomous nature (Harding and Szukalska 2000b, pp241-2) particularly when there is a clustering of incomes around the poverty line as is commonly caused by welfare payments which are approximately equal to half median income. Using a head-count ratio also encourages a Government, aiming to reduce poverty, to target aid to those just below the poverty line and leave those most poor until last (Creedy 1998, p84). However, use of the head-count ratio is advantageous in a number of respects. Not only is the ratio easy to calculate, it also gives a simple and meaningful interpretation. Furthermore, it is additively decomposable making it a flexible index, which can be used to investigate the intensity of poverty among different sub-groups of the population.

Two alternative poverty measures, or indices, have been suggested which are designed to take account of the depth of poverty, that is, the amount by which the incomes of the poor fall below the poverty line. Firstly, the mean poverty gap ratio (Creedy 1998, p87) measures the average amount by which the incomes of those classified as poor fall below the poverty line. This measures satisfies Sen's (1976, p219) monotonicity

axiom,[3] though it does not satisfy the transfer axiom.[4] The second poverty measure, suggested by Foster, Greer and Thorbecke (1984, p763) is associated with the 'squared coefficient of variation' measure of income inequality and satisfies both the monotonicity and transfer axioms. This poverty measure weights the poverty gap of all poor individuals, giving greater weight to those further below the poverty line.

Whilst the two suggested sophisticated poverty measures suggested above are informative of the depth of poverty, and display favourable qualities not possessed by the head-count ratio, they also suffer from a number of weaknesses. Firstly, they require that income be accurately reported, particularly by those with low income. However, it has been recognised that the reported incomes of the poor are unreliable, particularly those which report zero or negative disposable income, both in the ABS Surveys of Income and Housing (Siminski, Saunders and Bradbury 2006) and HILDA (Headey and Warren 2008, p52). In addition, the more sophisticated poverty measures are difficult to compute and interpret.

For the purpose of this thesis, therefore, all poverty rates are based on the head-count ratio and a variety of approaches are used to explore the extent and nature of child poverty. For example, the following chapters use different measures of income to analyse the extent of overlap between annual and chronic poverty and also use different poverty lines to decompose changes in the child poverty rate. In addition, the child poverty rate is compared between different sub-groups of children based on household type. These methods are informative without needing to be overly sophisticated.

[3] A reduction in the income of a person below the poverty line must increase the poverty measure.
[4] The transfer of income from one poor person to a less poor person must increase the poverty measure.

2.3. Static and Dynamic Poverty Measurement

Analysis of Australian child poverty in the past has used static measures almost exclusively, due to the lack of the necessary longitudinal data. The use of cross-sectional data is restrictive as it is difficult to study the causal effects of poverty, and rather, one can only comment on the distribution of incomes from one year to another for either the population as a whole or a particular sub-population. Even repeated cross-sectional data, as produced by the ABS, can only be used to describe by how much aggregate proportions change from year to year. The true shortcoming of static poverty analysis is that it cannot distinguish between chronic and transitory poverty. A short-term rise or fall in one's income, even below the poverty line, is common and may have little or no impact on actual living standards. However, it is long-term, sustained deprivation which has powerful and long-lasting effects and is of most concern for a society (Goodin *et al.* 1999, p159). Such analysis requires repeated data observations on the same individuals as their circumstances change through time.

The significance of the distinction between static and dynamic poverty is highlighted by way of a simple yet powerful example presented by Bradbury *et al.* (2001, p1). Given a static child poverty rate of 10% in a particular year, a researcher cannot discern whether all children in the population are poor for one year in every ten, or rather, if one in ten children are poor throughout ages one to ten years. Given the permanent income hypothesis, it is likely that children living in households that experience only temporary annual poverty are able to maintain their consumption, and standard of living, at a level which is above the poverty line. It is the latter group of children, who are poor throughout their childhood, who are likely to suffer the greatest disadvantage as a result

of their low standard of living and only longitudinal data can help to identify these children.

Such a distinction between current and chronic poverty is also crucial from a policy perspective as evidence suggests it is persistent or chronic poverty, especially in very young children, which impacts most heavily on a child's future life opportunities (Berthoud 2001, p81). Furthermore, transitory and chronic poverty are likely to have different causes and consequences, which warrant different policy treatment (Ravallion 1996, p1337). As highlighted by Ravaillion (1996, p1336), a static measure cannot discern when welfare policies have kept vulnerable people above the poverty line or promoted the poor above it. In order to study the dynamics of poverty, in particular the causes and effects of poverty, panel data and its associated dynamic measurement techniques are required.

Chronic poverty, for the purposes of this thesis, is defined as a situation where a person's permanent income is insufficient to meet basic needs, as measured by a relative poverty line. Drawing on the permanent income hypothesis, permanent income is the maximum sustainable annual consumption level that a person could achieve with their actual income stream over T years, if the agent could save and borrow at prevailing interest rates (Rodgers and Rodgers 1993, p31).

Internationally, the necessary longitudinal data have been available for some time including the Panel Study of Income Dynamics (PSID) in the United States since 1968 and the British Household Panel Survey which has been collected since 1991. This thesis will take advantage of the Household, Income and Labour Dynamics in Australia

Survey (HILDA), a longitudinal dataset which now contains six Waves of data from 2000-01 to 2005-06. There are a number of reasons why this dataset is advantageous for the current thesis. Firstly, as discussed, it is longitudinal in nature, and thus, income and other data can be obtained for children over a number of years in order to study chronic poverty. The panel nature of the data also allows children to be followed through time, in terms of residence, household structure and schooling choices. Secondly, it is possible to match up children with their parents and other household members in order to study the effects of family income and family characteristics on the decision to continue with education. Thirdly, the dataset provides an accurate and reliable measure of household income which has already accounted for taxes paid and welfare benefits received by the household. Lastly, when the appropriate weights are used, the sample is representative of the Australian population.

2.4. Summary and Conclusions

In summary, this chapter has explored a number of conceptual issues surrounding the study of poverty generally and justified the importance of focussing on chronic child poverty. The chapter compared a variety of approaches to conceptualising and measuring child poverty and has justified the focus of this thesis on measuring relative, income poverty among Australian children. A variety of sophisticated poverty indices were considered, though it was concluded to use the head-count ratio due to its simplicity and flexibility and because it relies less strongly on the accurate reporting of low incomes.

The following chapter reviews the literature, both internationally and within Australia, on the link between low household income during childhood and low schooling attainment. In addition, it discusses the results of other studies regarding the extent of

child poverty, paying particular attention to the results and measurement techniques of other chronic child poverty studies. This is done in preparation for the empirical work presented in Chapters 4 and 5.

3. Child Poverty – A Review of the Literature

3.1. Why focus on child poverty?

There are many reasons why child poverty is of particular concern to a society and warrants independent consideration. Firstly, it has been stated that children represent an 'investment' in the future and thus, a society is obliged to ensure that children's opportunities are not lost due to a lack of present available resources (Bradbury 2003, p15). Society also has an innate feeling of protection towards children as they are seen to have no control over their situation and this leads much of the political discourse on poverty. Another reason, which forms the focus of this thesis, is the strong evidence to suggest a link between childhood poverty and later outcomes, particularly a child's chances of being income poor as an adult. Childhood poverty "is one of the key factors determining the link between incomes of different generations within families," (Blau 1999, p261) as it limits the chances for educational attainment and in turn, limits a family's chances of escaping poverty (Engle and Black 2008, p243; Levy and Duncan 2000, p19; Buddelmeyer and Verick 2007, p17). From a philosophical perspective, "reducing child poverty is a measure of progress towards social cohesion, equality of opportunity, and investment in both today's children and tomorrow's world," (UNICEF 2005, p3).

This chapter firstly examines each of the key theories regarding how income poverty is transmitted to low educational achievement in later life (Section 3.2). Secondly, in the context of child poverty more generally, this chapter reviews the extent of child poverty both in Australia and internationally, paying particular attention to other chronic child poverty studies (Section 3.3).

3.2. Child Poverty and Children's Schooling Outcomes

3.2.1. The Theoretical Models

The variety of models explaining the link between income poverty of children and educational outcomes in later life can be broadly categorised under two contrasting analytical paradigms – the economic theories and the socialisation theories (Haveman, Wolfe and Spaulding 1991, p135). The former focuses on income poverty and the choice to continue with education as a question of efficiency whereby a family or household has a given amount of income and time resources which they must allocate between consumption and investment activities, including the children's schooling. The family's choices regarding how to allocate their scarce resources is the means by which poverty is transmitted to poor outcomes of children in later life. The second analytical paradigm, socialisation theory, emphasises the potential effects of parental or other role models' behaviours and achievements on children's own aspirations and performance (Haveman, Wolfe and Spaulding 1991, p135).

The economic models that will be examined in this section include the human capital investment model, the home environment model and the outside home care model. The socialisation models include neighbourhood effects models, Mayer's (1997) good parent theories, the working mother hypothesis, the intergenerational welfare transmission mechanism and the family stress models. The models here have been broadly categorised though many encompass both economic and socialization theory aspects.

Human capital investment model

The human capital investment model (Becker 1981; Becker and Tomes 1979) is based purely on the economic theory of efficient resource allocation. It assumes that families

maximise a utility function spanning several generations constrained by family resources of both time and money. Parental utility depends on both consumption and the quantity and quality of one's children. Parents know that their children's income, influenced by genetic endowments, abilities and luck, is increased with the accumulation of human capital including schooling, but such investment requires that parents forego current consumption. The greater the value of parental resources in any generation, the larger is the potential investment in a child's human capital and the greater the child's scholastic and vocational achievement in later life. Hence, families that are income poor are constrained in their potential education investment as their budget must be allocated to other necessities. This leads to less human capital accumulation and poorer outcomes for the children in income poor households.

The human capital investment model has been applied widely in the child poverty literature, by analysing the effect of family income on children's educational achievement. Corcoran (2001, p143) states that 'poor' children, whose income to needs ratio is less than unity, average 1.4 fewer years of schooling and are more than three times as likely to have dropped out of school compared to non-poor children. Males who were poor during childhood were found to work fewer hours per week and have lower annual earnings as adults. Corcoran (2001, p143) also found that, "poor children have higher poverty rates (24% versus 4%) and lower incomes ($21,514 versus $36,003) in their mid-twenties than do non-poor children," which is evidence of the existence of a poverty cycle.

Children with an average household income[5] of $15,000-$25,000 average 0.82 extra years of schooling and are four times more likely to complete high school than a child with an average household income of less than $15,000 (Duncan *et al.* 1998, pp414-5). The effects are larger for wealthier children, with those on incomes of $25,000-$35,000 completing 1.4 extra years of school and those on average incomes of $35,000 to $50,000 completing 1.7 extra years of school, relative to children whose averaged household income is less than $15,000. Children whose average household income exceeds $50,000 completed, on average, at least 2 extra years of school compared with children on less than $15,000. Regarding high school completion, children whose average household income is at least $35,000 are more than 10 times as likely to complete high school compared with children on less than $15,000 (Duncan *et al.* 1998, p415). All of these estimates were significant at the 5% level. Duncan *et al.* (1998, p414) also found that a $10,000 increase in average household income for low income children made them over seven times more likely to complete high school.

Blau (1999, p268) showed that permanent changes in the household budget have a bigger impact on a family's investment in education compared with transitory shocks. By estimating three fixed effects models, for individual, household and 'grandparent' fixed effects, the author found that a $10,000 increase in total current income increased a child's math score by 12.1% of a standard deviation and increased reading score by 13.5% of a standard deviation at age five. Using average income, however, more than doubled these estimated effects, implying that households which experience permanent increases in income are better able to plan for long-term investments in their children's education. This is similar to the findings of Dahl and Lochner (2005, p28). For this

[5] Annual real, household, equivalised, disposable income was averaged over all the years of childhood (0-15 years inclusive), or where a particular stage of childhood is considered, it is averaged over those ages (Duncan *et al.* 1998, p412).

reason, the focus of the econometric work in this thesis is on the effect of family *permanent income*, rather than annual income, on a child's schooling attainment.

The human capital investment model has also been applied by a number of authors to determine in which stage of childhood, such as early childhood or pre-adolescence, income has the greatest effect and whether short-term and long-term changes in income have different effects on educational achievement. Levy and Duncan (2000) estimate a fixed effects model using sibling data based on Becker and Tomes' (1986) utility maximisation model. In order to increase schooling by 0.5-1 year, the authors find that a child's household income must be increased by 2.7 times for the first 15 years of a child's life (Levy and Duncan 2000, p16). They also found that the timing of poverty was important, with early childhood (0-4 years) emerging as the stage when investment in education produces the greatest returns (Levy and Duncan 2000, p18).

Duncan *et al.* (1998, p407) find that increases in income have a larger impact for children aged less than 5 years. For these children, a $10,000 increase in average household income is associated with an additional 0.12 years of schooling, compared with only 0.05 years for 11 to 15 year olds (Duncan *et al.* 1998, pp416-7). The effect is even greater for very young children on low incomes. Based on the results of a 2-segment spline function, Duncan *et al.* (1998) find that for children whose household equivalised, average income is less than $20,000, a $10,000 increase in family income is associated with 1.3 extra years of completed schooling compared with only 0.13 extra years for children whose household income exceeds $20,000.

In contrast, Haveman, Wolfe and Spaulding (1991, p143) find that income poverty during adolescence (12-15 years) has the greatest impact on educational achievement and this is the focus of the econometric work in this thesis.

The allocation of household resources is also affected by the size of the household and children living in families with more siblings have a significantly lower probability of completing high school, emphasising the importance of efficient income allocation for a child's human capital accumulation (Haveman, Wolfe and Spaulding 1991, p143).

Home environment model

The home environment model emphasises the physical condition of a home, the warmth of mother-child interactions and the opportunities to access learning resources, as prime mechanisms through which poverty can affect a child's life outcomes (Duncan and Brooks-Gunn 2000, p190; Garret *et al.* 1994). Examples of opportunities for learning include age-appropriate learning oriented toys and experiences, reading to children and access to a library card (Duncan and Brooks-Gunn 2000, p190). The strongest determinant of the quality of a child's home environment is parental income (Kornberger 1999, p21). Hence, children living in wealthier households are at an advantage from a very early age as they are more likely to be surrounded by an environment conducive to learning and development. Several studies cited by Duncan and Brooks-Gunn (2000, p190), found that differences in children's home learning environments account for up to half of the effect of income on the cognitive development of preschool children and between one quarter and one third of the effect of income on the achievement scores of elementary children. Furthermore, evidence suggests these differences in cognitive ability at the time children commence school have long-term consequences in terms of educational achievement. Engle and Black

(2008, p244) state that any gap in cognitive ability which is present when children enter primary school tends to widen over time and failures in early school lead to increased likelihood of a child dropping out (Engle and Black 2008, p244).

Quality of care outside the home

Another transmission pathway identified by Duncan and Brooks-Gunn (2000, p190) is the quality of care a young child receives outside the home. A child that has access to high quality, developmentally appropriate child care is likely to have, "enhanced social, emotional and in some cases, linguistic competence," (Duncan and Brooks-Gunn 2000, p190). This model can help to explain how children in wealthier families who have access to high quality after-school care or tutoring have higher cognitive development and schooling achievement. In summary, children from families with limited resources have reduced access to learning experiences both within and outside the home, leading to poorer outcomes in later life, including lower school completion and human capital accumulation.

Neighbourhood model

One of the most widely used socialisation models is the "neighbourhood" model. It postulates that, "individuals and families self-segregate into neighbourhoods based on their preferences for local public goods and taxation," (Jensen and Seltzer 2000, p18) and also due to income constraints on their choice of neighbourhood and schools (Duncan and Brooks-Gunn 2000, p190). This results in a segregation between wealthy neighbourhoods with high employment rates and educational attainment and poor ghettos characterised by, "social disorganisation (crime, many unemployed adults, neighbours who do not monitor the behaviour of adolescents), and few resources for child development [such as] playgrounds, child care, health-care facilities, parks, [and] after school programs" (Duncan and Brooks-Gun 2000, p190). Typically, these poorer

suburbs also have fewer available jobs, lower-quality schools and fewer job networks (Jencks and Mayer 1990; Engle and Black 2008, p247).

The day to day activities which surround children in their neighbourhood can have long-lasting consequences. For example, the collective socialisation or "contagion" models emphasise the importance of strong role models for youth in the community whose example they are likely to follow. Children in a wealthier suburb, who interact with professionals and skilled tradespersons and see them, travelling to and from work, form a strong connection between education and meaningful employment, with the effect that they are more likely to invest in their own human capital. In contrast, children who live in suburbs where they are surrounded by welfare dependence, high drop-out rates, unemployment, crime, drug use and idleness are unlikely to perceive this connection, resulting in high school drop-out rates (Jensen and Seltzer 2000, p17). Furthermore, Jensen and Seltzer (2000, p19) cite a number of studies that identify personal connections as the most widely used and successful job search method. Children growing up in poor suburbs, though, lack this network of personal connections leading to lower actual or expected labour market success, and hence, less motivation to continue with education.

Jensen and Seltzer's (2000) results, based on Victorian data, confirm that a child's neighbourhood is an important pathway for transmitting poverty to low school achievement. A neighbourhood unemployment rate of only 1% implies a 64.92% chance of a student continuing his or her education beyond secondary school, compared with a probability of 52.99% if the neighbourhood unemployment rate is 5% and only 37.75% if the child's neighbourhood has an unemployment rate of 10% (Jensen and

Seltzer 2000, pp25-6). The authors also find that the mean neighbourhood income and an ABS index of educational attainment and occupational groupings are positively and significantly related to the probability of continuing one's education. The authors argue, based on their results, that there is the possibility of a vicious cycle if low geographical mobility means children raised in suburbs with high unemployment have restricted educational opportunities, thereby generating further negative externalities and lower incomes in future (Jensen and Seltzer 2000, p26). Jensen and Seltzer acknowledge, however, that there are some shortcomings in their work. For example, the data on student's intentions for post-school qualifications was taken from surveys of Year 12 students in Melbourne and students were found to be overly optimistic about their future qualifications and professional careers (Jensen and Seltzer 2000, p21). In addition, the sample included only students studying in Year 12, though many students who planned not to continue with tertiary education would likely have left school after Year 10.

Duncan, Brooks-Gunn and Klebanov (1994, p309) found similarly, that having more affluent neighbours is associated with higher age-5 IQ while having more low income neighbours is associated with more externalizing problem behaviour, such as destroying one's own things and temper tantrums. The authors did not find that having more poor neighbours significantly decreased age-5 IQ, though they acknowledge that it may be more important as children enter school and particularly when they reach adolescence (Duncan, Brooks-Gunn and Klebanov 1994, p313). The authors state, however, that family income differences were more powerful predictors of age-5 IQ than neighbourhood income differences (Duncan, Brooks-Gunn and Klebanov 1994, p313).

Other authors have found that a child's neighbourhood is not significant or at least less important than family characteristics in explaining one's likelihood of continuing with education. Engle and Black (2008, p247) state that community-level variables typically account for less variance in children's academic performance than family related variables. This is reinforced by the results of a residential relocation program in New York which gave vouchers to some families with children, enabling them to move from high-poverty to low-poverty neighbourhoods (Leventhal, Fauth and Brooks-Gunn 2005). After five years, the initial benefits for boys who had moved were no longer evident and in fact, youth who had moved to low poverty neighbourhoods had lower achievement scores than those who remained in high poverty neighbourhoods (Engle and Black 2008, p247). The incomes of those families that moved remained unchanged, indicating that one's neighbourhood, of itself, was insufficient to change children's outcomes.

Role model theories

The socialisation aspects of poverty transmission are clearly demonstrated in the general 'role model' theories. These postulate that parents set an example which their children tend to follow. Hence, children whose parents are more highly educated, and thus, less likely to be poor, are encouraged to achieve the same outcomes (Haveman, Wolfe and Spaulding 1991, p134). This theory focuses on role models within the family, as compared with the neighbourhood model which is directed at role models outside the home.

The empirical literature confirms that parental educational achievement is a strong and significant predictor of a child's outcomes (Buddelmeyer and Verick 2007, p12). Haveman, Wolfe and Spaulding (1991, p145) state that the "quantitative effect of the

educational orientation of a child's family is strikingly large." They found that having a father who has some college education increases the probability that a child will graduate high school by 14% and having a mother with some college education makes such an outcome a "virtual certainty," (Haveman, Wolfe and Spaulding 1991, p145). Having a father who is employed at the age of 14 also makes one less likely to be poor in adulthood (Buddelmeyer and Verick 2007, p13) further emphasising the importance of parents in setting an example for their children. Based on this strong theoretical and empirical evidence, educational achievement of parents is considered as a key variable in the empirical analysis of student's schooling completion in Chapter 5.

Mayer (1997) stresses the importance of unobservable parental traits, such as diligence, reliability, genetics, values and a strong work ethic as important predictors of children's educational and labour market outcomes. Mayer found that as parents' income increases, so too do children's living standards but these have little influence on children's test scores, behaviour, educational or labour market success. Once basic needs are met, parental income is relatively less important compared with having parents who are good role models. The "good parent" theory suggests that parents who spend more time at work in order to increase household income may in fact be jeopardising their children's outcomes by investing less quality time in caring for and helping their children's development. One would expect, based on this model, that there exists a non-linear relationship between parents' work hours or household income and children's outcomes. For low levels of household income, increasing the parent's work hours raises the household income, leading to greater investment in the child's education. However, above some upper limit, any further time away from one's children has a negative effect on educational achievement. The timing of the parent's work,

particularly the mother's work, may also explain the different effect of parent's work on children's outcomes. The implication from Mayer's 'good parent' theories, that too much time spent by parents working and earning income may lead to negative child outcomes, is in contrast with the economic models, which postulate that increasing household income will continue to have positive effects for children's outcomes.

Empirical modelling of Mayer's 'good parent' theory is complicated as parent's unobservable characteristics cannot be easily measured. Some studies have overcome this difficulty by using panel data techniques, such as estimating random and fixed effects models which are able to control for unobservable characteristics including parent's attitudes to education, which do not change through time. Authors have also suggested that measurable characteristics can serve as proxies or signals of the unmeasured traits (Haveman, Wolfe and Spaulding 1991, p135). For example, educational and vocational achievements and labour earnings can be considered as signals of a parent's genetic endowments, motivation, farsightedness, strong work ethic and diligence. This theory, combined with the human capital investment and role model approaches, provides a comprehensive basis for the empirical literature that finds parent's educational and other characteristics significantly affect a child's probability of completing a minimal level of schooling.

Working mother hypothesis

Aspects of Mayer's 'good parent' theories are also reflected in the 'working mother' hypothesis which suggests that two opposing factors exist when a mother chooses to work. On the one and, a working mother increases household income, reducing parental stress and enabling parents to provide a higher quality home environment as well as providing a stronger role model for children, communicating a greater sense of independence (Kornberger 1999, pp13-4). These factors positively affect household

income and a child's educational outcomes. On the other hand, the mother's absence from the home, "may be the source of developmental problems in children, manifested in reduced achievement in a variety of dimensions," (Haveman, Wolfe and Spaulding 1991, p135) including lower schooling achievement. *A priori*, it is not known which of these effects dominates or how a mother's employment transmits income poverty to child's outcomes.

Kornberger (1999, pp14-5) states that the positive effects of maternal employment on a child's schooling are, "mainly experienced by two parent families where a working mother's second income can significantly boost family income." Haveman, Wolfe and Spaulding (1991, p148) find that a mother's years of employment is a significant and positive predictor of high school completion, especially when the child is an adolescent. They conclude that, "both the 'absence from the home' and 'contribution to family income' aspects of the working mother hypothesis are reflected in their estimates, though only the latter is statistically significant," (1991, p143).

Intergenerational welfare transmission mechanism

The intergenerational welfare transmission mechanism is another widely used model linking childhood poverty and lower outcomes in later life. It proposes that welfare dependency leads to feelings of lower personal adequacy, independence and self-esteem on the part of the parent, which has harmful flow-on effects for children's own aspirations and their capacity for independent actions (Macaulay 1977; Murray 1984; Haveman, Wolfe and Spaulding 1991, p135). Furthermore, when parents use welfare heavily and work only intermittently, the stigma associated with welfare diminishes and a 'welfare culture' emerges whereby parents develop self-defeating work attitudes and poor work ethics which are again passed on to their children (Corcoran 2001, p141). In

this manner, childhood poverty and welfare dependency is transmitted to low life outcomes as the child is less confident and motivated to achieve.

Kornberger's (1999) work utilises the welfare transmission hypothesis in explaining the diversity of outcomes among poor children. The author postulates that being dependent on welfare presents a different set of possibilities and constraints compared to a working poor family (Kornberger 1999, p7). Kornberger acknowledges that *both* working poor and welfare dependency environments have potential positive and negative effects for child development. For example, parents who work for a low wage may not portray to their children a strong link between education and meaningful, well-paid employment. This counter argument implies that parent's employment may not necessarily have a positive impact on children, relative to parents who are unemployed and/or welfare dependent.

There exists extensive empirical literature in support of the intergenerational welfare transmission mechanism. After controlling for family income, children growing up in welfare dependent homes have significantly lower mental age and IQ at age five, compared with children in working poor families (Korberger 1999, p39). Welfare dependency, either within one's family or one's neighbourhood, is also associated with significantly lower labour market outcomes, including hourly wage, earnings and family income (Corcoran *et al.* 1992, p.589). Children whose parents received welfare acquire fewer years of schooling (Corcoran 2001, p147) and are significantly less likely to graduate from high school, especially when welfare dependency is experienced during adolescence (Haveman, Wolfe, and Spaulding 1991, p143). These authors found that being poor and in a welfare family for three years between age 12 and 15 decreases the

probability of graduating high school to 73%, which was 11 percentage points lower than the sample probability of 82% (Haveman, Wolfe and Spaulding 1991, p148). Furthermore, a child whose household was poor and dependent on welfare between the ages of four and 15 was 20% less likely to graduate compared with a child whose household income was not simultaneously poor and on welfare during the same period (Haveman, Wolfe and Spaulding 1991, p145).

Family stress model

Finally, the Family Stress Model (Conger and Conger 2002) is useful in explaining how the social and emotional environment in a household can lead to worse outcomes for a child in later life. The model asserts that poverty leads to increased family stress and has a negative impact on parental emotional well-being and mental health, thereby undermining parenting behaviour and stopping parents from meeting the emotional, cognitive and care giving needs of their children (Engle and Black 2008, p246). For example, parents in economic disadvantage may become more pessimistic about their children's chances of completing higher education and thus, put less effort into steering their adolescents into protective environments and helping them to map out future opportunities (Crosnoe, Mistry and Elder 2002, p700). Furthermore, the financial pressure of poverty creates conflict between parents and children, increasing children's levels of stress which is detrimental to the child's self-confidence and achievement, particularly that of boys (Duncan *et al.* 1998, p409). From the opposite perspective, Crosnoe, Mistry and Elder (2002) argue that parents who see themselves as more efficacious may in fact buffer adolescents from the negative consequences of economic disadvantage by remaining optimistic and pro-active during times of low income.

Poverty itself, or the uncertainty from unemployment or welfare dependency, can cause parents to feel overwhelmed or depressed, as well as stressed, and this is known to be associated with increased levels of psychological distress and behavioural problems in children (McLoyd and Wilson 1991; Harnish, Dodge and Valente 1995). Duncan and Brooks-Gunn (2000, p190) cite a number of studies which find the conflict between parents and children caused by the stress of poverty is associated with fewer learning experiences in the home and lower school grades. Kornberger (1999, p39) finds that a higher parental depression score significantly reduces a child's development outcomes at age five. Other stressful events associated with poverty, such as location moves and changes to the family composition also significantly reduce a child's likelihood of completing school (Haveman, Wolfe and Spaulding 1991, pp142-3).

It is possible, though, that parent's who are more efficacious can mediate the negative effects, such as stress, brought on by economic disadvantage (Crosnoe, Mistry and Elder 2002, p696). Crosnoe *et al.* (2002, p696-7) found that the negative impact of economic disadvantage on a child's probability of college enrolment is reduced when parent's have more optimistic assessments of their child's chances of attending college. Parents who were more optimistic about their children's educational chances were also more likely to place their children in advantaged schools (Crosnoe, Mistry and Elder 2002, p697). Thus, poor parents who are nevertheless optimistic of their child's chances are likely to exhibit behaviours which encourage the child to continue with their education, such as moving to safer neighbourhoods with greater resources or putting children into advantaged schools where higher proportions of students continue their education to the college level.

In summary, there is strong theoretical and empirical literature in support of the existence of a strong link between a child's income poverty status during childhood and adolescence and their education achievements in later life. Furthermore, there is evidence to suggest that children who are poor are more likely to be poor as adults because poverty is transmitted through low educational attainment. This highlights the importance of schooling and education in breaking the poverty cycle.

3.3. The Extent of Child Poverty

3.3.1. Child Poverty Internationally

Bradbury and Jantti (1999, pp18-19) carried out cross-national comparisons of child poverty rates across 25 industrialised countries and found countries could be ranked into broad poverty categories which were similar, based on rankings of absolute and relative poverty. Nordic countries had the lowest rates of child poverty along with Northern European countries. However, southern European and English-speaking countries, including Australia, had much higher rates of child poverty. Within the 25 country ranking, Australia ranked 5th highest in terms of relative child poverty based on a conventional poverty threshold of half median equivalised income and 6th highest based on a poverty threshold set at half median income among Australian children. The child poverty rate in Australia in 1994 was 17.1% based on the poverty line of half median income and 11% based on the 'fully relative' child poverty line (Bradbury and Jantti 1999, p18). In both rankings of relative child poverty, Australia had lower poverty than Russia, the United States and the United Kingdom, though it had higher child poverty than Germany, France and all Nordic countries included in the analysis. Australia fared better in terms of absolute poverty, measured by the US official poverty line, ranking 11th highest out of the 25 countries. The absolute child poverty rate of 20.7% based on the US official poverty line, however, was still high. As highlighted by the authors,

more than one fifth of children in Australia and the United Kingdom had a standard of living that was lower than the US official poverty line, based on the country's data published in 1994 and 1995. Between 1981 and 1994, relative child poverty in Australia increased by 0.1-0.2 percentage points per annum whether the poverty line was set at half median income for all Australians or only Australian children. The absolute child poverty rate decreased over the same period by 0.3 percentage points per annum (Bradbury and Jantti 1999, p.23).

The aim of Bradbury and Jantti's (1999) research was to determine the factors which accounted for the variation in child poverty rates and living standards across nations. Whilst lone-motherhood makes a child more likely to be poor, it explained only a small part of the variation in poverty levels across nations (Bradbury and Jantti 1999, p30). Similarly, savings rates across countries, measured by levels of home ownership, explained only a small amount of the variation (Bradbury and Jantti 1999, p53-4). The authors found that in general, "there is a qualitatively significant relationship," between a country's share of GNP spent on social expenditure and its poverty rate," such that countries which invested relatively more in social expenditure achieved lower child poverty rates (Bradbury and Jantti 1999, p58). Interestingly though, English-speaking countries, which have high poverty rates and generally low social transfer payments as a proportion of GNP, target their transfers more specifically to the most needy children (Bradbury and Jantti 1999, pp58,68). If child income were restricted only to social transfers, relative poverty in Australia, Ireland and the United Kingdom would be lower than that of Sweden, which had the fourth lowest poverty rate (Bradbury and Jantti 1999, p68). The authors conclude that the low child poverty rates in the Nordic countries are a result of high market incomes. One cause of Australia's mid-range

ranking in the report could be the high proportion of children living in households without a working adult as reported by Bradbury (2003). This implies that Government policy in Australia should be aimed at reducing rigidities in the labour market and creating incentives for those on low incomes to work (Bradbury and Jantti 1999, p72).

Bradbury *et al.* (2001), using panel data from Britain, Germany, Hungary, Ireland, Russia, Spain and the United States found there to be considerable mobility into and out of poverty during the mid 1980s to 1990s. Whist approximately 40 to 45 per cent of children aged less than 18 years in Britain and the United States were below a relative poverty of half median income in at least one year, only 9% of US children and 6-8% of children in Britain, Germany and Hungary were poor in all give years of analysis (Daly 2006, p5).

The extent of *chronic* child poverty has been analysed in a number of countries internationally which have the necessary panel data. For example, the Panel Study of Income Dynamics (PSID) in the United States and the British Household Panel Survey. The results of studies using both sources illustrate that, whilst transitory child poverty is common, there is a small, core group of children who are persistently poor from year to year or 'chronically poor' in terms of permanent income.

Based on the PSID, Berthoud (2001, p78) found that just over 40% of US children fall below the poverty line at some point. Of these, one third experienced only transient or occasional poverty, that is, no single poverty spell lasted for more than one year. However, the median poverty spell for these children was 1.3 years indicating that they experienced multiple, short-term poverty spells. Of children who were ever in poverty,

10% experienced chronic or permanent poverty that lasted the length of their childhood. Based on duration of time spent below the poverty line, children in chronic poverty accounted for 26% of total time spent poor. Whilst only 4% of children experienced chronic poverty, they account for a substantial amount of the total time that children spend in poverty. Berthoud concludes that a high proportion of poverty spells end quickly, within one year, but those children that remain poor for more than one year face much higher likelihood of being long-term or chronically poor.

The presence of chronic and transitory poverty in British children has also been studied by Hill and Jenkins (1999) using the first six years of the British Household Panel Survey. Though the focus of this study was not the link between poverty and educational achievement, it provides valuable information on the incidence of chronic poverty amongst British children. The authors used a permanent income approach, classifying individuals as poor if their average household, equivalised income over the six years fell below an anchored poverty line of half 1991 mean income. A relative poverty line was also used for cross-sectional estimates, which was set at half annual mean equivalised income. The study covered 6,824 persons with the population divided into six age brackets, 0-5 years, 6-11 years, 12-17 years, 18-29 years, 30-59 years and 60+ years.

The authors found that children were over-represented at the bottom of the income distribution with very young children, aged 0-5 years, experiencing the most and deepest poverty, based on average normalised poverty gap (Hill and Jenkins 1999, p10). Secondary-school aged children were better off than most of the other groups in the population, with the exception of adults aged 30-59 years. However, these children did

experience increased poverty in the latter part of the survey period, presumably caused by entry to the labour market with little education or experience (Hill and Jenkins 1999, p11). Based on annual income, the authors found that approximately 30% of adults and approximately 40% of children are poor in at least one year. The results also show that 24.3% of all children are poor for one to two years, 12.6% are poor for three to five years and only 1.4% of all children were poor for all six years of the survey (Hill and Jenkins 1999, p24). This implies that although transitory poverty is common amongst children, there is a much smaller group of chronically poor children.

Using smoothed incomes, Hill and Jenkins (1999, p24) found that 8.8% of British children aged under 18 years were 'chronically poor'. Since only 1.4% of children were poor in all six years based on current income, this implies that a large number of children were only just above the poverty line in non-poor years or were in very deep poverty in the years they were poor. Secondly, there is evidence to suggest that if families were able to smooth their income between years, they would avoid poverty. Whilst 61.7% of children were never poor based on annual income, 91.2% were not poor based on smoothed or permanent income implying that almost 30% of British children who were annually poor lived in households which, theoretically, could have smoothed their income in order to escape chronic poverty. Thirdly, the authors found that chronic poverty, based on permanent income, was most severe amongst very young children with 14% of 0-5 year olds classed as chronically poor. The figure was also high for 6-11 year olds with 8.2% classified as chronically poor though only 2.9% of 12-17 year olds were below the permanent income poverty line. It is possible that the lower poverty rates among the adolescent cohort is due to the increased flexibility for parents, allowing them to return to work as their children reach this age. The authors conclude

that both total and chronic poverty are sizeable amongst British children, especially very young children (Hill and Jenkins 1999, p19).

Using an average, normalised poverty-gap index, Hill and Jenkins (1999) found that throughout all age groups, the majority of the poverty gap was experienced by those in transitory poverty. For children under six years, only 37% of the total poverty gap was due to chronic poverty. The rates were lower for older children, with 30% for 6-11 year olds and only 8% for 12-17 year olds.

3.3.2. Child Poverty in Australia

The ability to study the incidence and effects of chronic poverty in Australia has been hampered by the lack of necessary longitudinal data. To date, most cross-sectional studies of child poverty in Australia have been based on the ABS Surveys of Income and Housing. In recent years, the Household, Income and Labour Dynamics in Australia (HILDA) Survey, conducted by the Melbourne Institute of Applied Economical and Social Research, has made such analysis possible and a number of studies have used the data set to analyse chronic poverty among Australians (Rodgers and Rodgers 2006; Heady *et al.* 2005).

Headey *et al.* (2005), using three waves of HILDA, from 2000-01 to 2002-03, found that far fewer Australians experience chronic poverty, as compared to transitory poverty in any given year. Setting the poverty line at half median annual, equivalised, disposable income, 24.3% of Australians experienced poverty in at least one year whilst only 4.2% of Australians were poor in all three years. Of those who escaped poverty, their incomes only rose slightly above the poverty line (Headey *et al.* 2005, p548). The authors found that annual poverty rates for children were typically higher than the adult

population. In 2002-03, the annual poverty rate was 13.2% among children less than 16 years, compared with 8.1% among 'prime-age adults' aged 25-54 years. Furthermore, 3.7% of children were poor in all three years compared with 2.5% for prime-age adults. This reinforces the results of Hill and Jenkins (1999) based on British children, that only a small proportion of those children who are poor in any given year are also chronically poor.

Harding and Szukalska (2000b) studied trends in child poverty in Australia, comparing static results from ABS income surveys in 1982 and 1995-96. The authors used a variety of poverty lines, including the Henderson poverty line and half mean and median annual income for the Australian population. Using a poverty line of half median income, 14.2% of children in Australia under the age of 19 were poor in 1982 compared with only 11% in 1995-96 (Harding and Szukalska 2000b, p239). This represents a 23% decrease in the child poverty rate. Based on a poverty line set at half mean annual income, which is a more reliable poverty threshold according to the authors, the poverty rate for Australians aged less than 19 years fell by 27% from 18.4% in 1982 to 14.5% in 1995-96.

Harding and Szukalska presented separate results for dependent and non-dependent children, where a child is classed as dependent if he or she is under the age of 15 or between 16-24 and still studying full time (Harding and Szukalska 2000b, p237). In 1995-96, non-dependent children still living with parents were four to five times more likely to become poor compared with dependent children (Harding and Szukalska 2000b, p243). However, the authors note that low incomes in this group may disguise very substantial transfers from parents. Whilst the 27% fall in the child poverty rate,

based on a poverty line set at half mean income, was encouraging, the authors commented that it masks the underlying trend that dependent children have fared far better over the period, whilst non-dependent children still living at home have fared far worse (Harding and Szukalska 2000b, p243).

In their conference paper, Harding and Szukalska (2000a, p26) identify two factors, namely increased social security payments and the introduction of the child support scheme, as the main reasons for the lower child poverty rates in Australia over the 1980s and 1990s. Government spending on social transfers increased from approximately 6% of GDP in 1982 to approximately 7% in 1998 (Harding and Szukalska 2000a, p10). The authors showed that for many families with children, these increased payments pulled them above the poverty line in the mid 1990s, when the poverty threshold was set at half the mean or median income (Harding and Szukalska 2000a, pp12-14). The introduction of child support in 1988 and gradual increase in payments to triple their 1982 levels by 1997-98 (Harding and Szukalska 2000a, p16), also reduced child poverty rates. The authors recalculated 1997-98 poverty rates, assuming that average child support payments were at the same level as in 1982 and found that child poverty would have been 1.2 per cent higher, but for the introduction of the Child Support Scheme (Harding and Szukalska 2000a, p 17).

Some research has also been done concerning income mobility in Australian children, signifying the probability of an individual moving out of their current income bracket in the coming year(s) (Abello and Harding 2006). The authors used three waves of data from the Survey of Employment and Unemployment Patterns, a longitudinal study published by the ABS for 1995, 1996 and 1997 (Abello and Harding 2006, p32). The

authors use real, equivalised, household *gross* income as their measure of income and calculate poverty rates for two groups of children: all dependent children[6] and children under 15 years only (Abello and Harding 2006, p34). Children were classified as 'poor' if they fell within the lowest quintile or lowest decile of equivalent family gross income for all Australian children in each wave. The authors conclude that whilst the majority of children in the lowest income decile are likely to move up the income distribution within two years, their incomes do not increase substantially.

Abello and Harding (2006) found that approximately two-thirds of all dependent children moved income deciles in one or two years but did not move far. Indeed, 76% of dependent children in one year and 70% within two years either remained in the same decile or one immediately above or below (Abello and Harding 2006, p36). An even higher proportion of dependent children, 89%, remain within their income quintile over a two-year period. For children in the lowest income decile, approximately one in four are still in this decile one year later and 72% of dependent children remain in the lowest income quintile after one year (Abello and Harding 2006, p37). The rates are approximately the same for the sample of children under 15 years. These results indicate that the majority of children move out of severe financial disadvantage, defined as being in the lowest income decile, but are unable to increase their incomes sufficiently to move above the lowest income quintile. In terms of persistent financial disadvantage, only 1% of Australian dependent children had incomes in the lowest decile in all three years of the study. Poverty rates were slightly higher for children aged less than 15 years. One in five children under 15 years were in the lowest decile in at least one year though only 1% experienced severe financial disadvantage, meaning that their income

[6] This included all children aged under 15 years (dependent children) as well as dependent students: those aged 15 and over living with their parent(s) and studying full time at either school or a tertiary institution.

was in the lowest decile, in all three years of the study (Abello and Harding 2006, pp41-42).[7]

Buddelmeyer and Verick (2007), using four waves of HILDA, find that relatively low income mobility exists amongst Australian children, which is in line with international evidence (Gottshalk and Danziger 2001, p142). Though most children are able to escape severe financial disadvantage, their incomes do not move far along the income distribution, usually only moving to an adjacent decile. Of those children who were in the lowest decile in 2000-01, 23% remained the following year and 12% remained two years later. The proportions are even higher when considering movements between income quintiles. Of those children in the lowest quintile of the income distribution, 71% remain in this quintile in Wave 2 and 67% remain in Wave 3. This implies that children who do find themselves in poverty or severe-financial disadvantage face a high likelihood of remaining poor for long periods compared to the total population, a finding which is consistent with the conclusions of Abello and Harding (2006, p42). Based on the evidence of income mobility among Australian children, Abello and Harding (2006, p44) conclude that whilst a large proportion of children will move into and out of poverty, there is a small pool of children who tend to remain poor. It is this group who is likely to be most affected in terms of educational outcomes later in life.

Daly *et al.* (2007) have used Australian census data to analyse the extent of social exclusion, a concept which is closely related to income poverty. The authors used

[7] Buddelmeyer and Verick (2007) found similar results regarding income mobility for the adult Australian population. The authors, also using the HILDA dataset, found that only 4.5% of the working age population fall into poverty in any given year but of those already in poverty, only 53.4% exit poverty in the next period. In this study, the poverty threshold was defined as half median income of the working age Australian population. The authors also found that only 1% of the adult population in this study remained poor in all four years of the survey, which is similar to the results of Abello and Harding (2006) in regards to children.

census data to calculate the proportion of children within each statistical local area who were in sole parent families where no-one had completed year 12, and also the proportion living in public housing or where no parent was working. Information on computer usage, motor vehicle ownership and household income in the local areas was also used. The authors used principal component analysis to create an index of "child social exclusion" for each local area with those areas ranked lowest representing the greatest risk of social exclusion. Queensland and Tasmania were found to be over-represented in the bottom quintile, and also South Australia and the Northern Territory to a lesser extent (Daly *et al.* 2007, p14). New South Wales and Victoria were under-represented in the bottom quintile, indicating children in these states were at lower risk of being socially excluded. States that ranked at the bottom, in particular Queensland and Tasmania, had an over-representation of single-parent families where no adult in the family was working and families where no member had completed Year 12 (Daly *et al.* 2007, p18).

Daly *et al.* (2007 p25) compare the rankings of local areas based on child social exclusion and income poverty and find that only 65% of children are in the same quintile based on the two measures of disadvantage. This suggests that children may experience social exclusion for reasons other than being income poor which may also affect the decision to continue with education beyond the compulsory level. Harding *et al.* (2006, pp25-6), using a similar approach to compare social exclusion and income poverty, find an overlap of 75%. They also find that children at the highest risk of social exclusion are more likely to come from single-parent families, or from a "blue collar" family where no member has completed Year 12 (Harding *et al.* 2006, pp22-3).

Children living outside a capital city are also at a higher risk of social exclusion (Harding *et al.* 2006, p19).

3.4. Summary and Conclusions

The literature reviewed in this chapter was guided by the two main objectives of this thesis: the link between household income during childhood and completed schooling and the extent of annual and chronic child poverty.

The literature reviewed in Section 3.2 reveals the multitude of ways childhood poverty is transmitted to low schooling achievement. This included both economic models, focussed on efficiency in household resource allocation, and socialisation models, which take account of the effect of role models and neighbourhood resources on a student's schooling completion. The results, both internationally and in Australia, showed that lower household income negatively affects a child's educational outcomes. Importantly, it is permanent changes in household income, rather than temporary changes, which have the strongest and most long-lasting consequences (Duncan *et al.* 1998; Blau 1999; Dahl and Lochner 2005). The evidence is conflicting regarding whether poverty has a larger effect when experienced in early or late childhood, and for the purpose of this thesis, the focus is on the effect of poverty during adolescence. Based on the theoretical and empirical literature presented, a number of other variables were also found to be important in determining completed schooling. These included neighbourhood resources and role models, household welfare dependence and parental characteristics such as education, employment and parents' attitudes and behaviour in stressful financial situations. The empirical model of completed schooling, presented in Chapter 5, incorporates aspects of many of these theoretical models in order to

determine which are most important in the context of Australian children's completed schooling.

The second part of this chapter reviewed the empirical studies, both internationally and in Australia, regarding the extent of relative, annual child poverty and chronic child poverty. The evidence suggested that a large proportion of children fall into annual poverty at some point, though a much smaller proportion of these children experience persistent or sustained poverty, based either on the length of their poverty spell or average household, equivalised income during their childhood. For example, Hill and Jenkins (1999, p25) find that approximately only 40% of annual poverty among British children throughout 1991 to 1996 was chronic and the remaining children were only in a state of transitory poverty. However, whilst the evidence suggests there is only a limited degree of overlap between annual and chronic child poverty, those children who are chronically poor are found to account for a substantial amount of the total time children spend in poverty (Berthoud 2001). This reinforces that the strongest and most long-lasting effects of poverty are likely experienced by those children who are in chronic poverty.

The review of the theoretical and empirical literature undertaken in this chapter forms the basis for the analysis in the following two chapters. Firstly, Chapter 4 calculates the extent of annual child poverty in Australia since 2000 and determines what proportion of these annually poor children are in a state of chronic poverty. Chapter 5 then presents the results of the probit model, used to analyse the effect of household permanent income, among other factors, on the probability of completing a minimal level of schooling.

4. The Extent of Child Poverty in Australia since 2000

4.1. Introduction

This chapter uses both traditional, cross-sectional measures of poverty and dynamic techniques to addresses the question: to what extent are children in Australia poor each year and is this poverty largely chronic or transitory?

Sections 4.2 and 4.3 introduce, in more detail, the data which is used and also the measurement techniques used, drawing particular attention to those which are not conventionally used in the child poverty literature. Section 4.4 then presents the calculated relative annual, poverty rates among Australian children and compares this with the relative poverty rate among the Australian population generally. Section 4.4.4 then examines the effect of household type on the intensity of child poverty in Australia. Section 4.5 uses a unique approach to decompose the change in relative child poverty, decomposing this into a change in poverty due to a change in the concentration of children in the lower end of the income distribution and a change in poverty that is due to a change in the real value of median income.

Section 4.6 presents the calculated rate of chronic child poverty among Australian children since 2000, addressing the first main objective of this thesis: to what extent are those children identified as poor in any given year, based on annual household income, also in a state of chronic poverty? And, to what extent is child poverty in Australia merely transitory?

4.2. The Data

As discussed previously, the study of chronic child poverty requires longitudinal data which observes the same children through time as their circumstances change. Two large-scale, longitudinal data sets currently exist in Australia, which collect information on children. These are the Longitudinal Survey of Australian Children (LSAC) and the Household, Income and Labour Dynamics in Australia Survey (HILDA). The HILDA dataset will be used throughout this thesis rather than LSAC for two reasons. Firstly, the HILDA sample includes children of all ages as opposed to LSAC which follows two cohorts of children, aged 0-1 and 4-5 years in 2003 (Sanson *et al.* 2002, p8). Therefore, HILDA will be able to give more reliable estimates of the extent of poverty amongst all children in Australia aged less than 16 years. Secondly, HILDA has more years of available data, having collected data since 2000-01, two years prior to the commencement of the LSAC survey.

The Household, Income and Labour Dynamics Survey was commissioned by the Australian Government Department of Family and Community Services and is conducted by the Melbourne Institute of Applied Economic and Social Research at the University of Melbourne (Headey and Warren 2008, p.v). It began in 2001 with a large national probability sample of Australian, privately occupied dwellings, covering 7,682 households and 19,914 individuals, of which, almost 6,000 were children (Headey and Warren 2008, p. vi; Watson 2008, p3). Each year thereafter, those who were present in the initial sample as well as their spouses and children are re-interviewed. Any persons living with sample members are also interviewed.

All sample members aged 15 and older, termed 'responding persons,' are administered a questionnaire each year. Data for children younger than 15 are collected by way of a household questionnaire which is typically completed by a parent. The questionnaires cover areas including family, income, employment and general well-being.

4.3. Measurement Conventions

4.3.1. The Income Measure

The choice of appropriate income measure is crucial for the analysis of poverty. For the purpose of this chapter, annual, real, household, equivalised disposable income (annual RHED income) is used, as is common in the poverty literature.

The household is assumed to be the income and cost sharing unit. This implies, firstly, that income is shared equally among all members of the household and thus, income per person depends on the combined income of all household members. This is a common assumption in the poverty literature and necessary in the context of this thesis as children rely on their parents for income. Secondly, it implies that the household shares costs in order to take advantage of economies of scale such that the costs of living increase less than proportionately with household size. An appropriate equivalence scale must be used in order to compare the incomes of those living in households of different size and structure. In this thesis, as is common in the literature, the modified OECD equivalence scale is used. This appoints a weight of one to the first adult in the household, a weight of 0.5 for each extra adult and a weight of 0.3 for each child in the household aged under 15 years. Dividing aggregate household disposable income by the equivalence scale gives household income *per adult equivalent*.

In Australia, Government redistribution of income through the welfare system plays a large role in determining the extent of poverty, particularly for disadvantaged groups such as single parents (Headey and Warren 2008, p57). Therefore, disposable income, which is provided in the HILDA data set, is used as the income measure in this chapter. Disposable income takes account of public and private transfers, family tax and childcare benefits, as well as income tax payable, but excludes windfall incomes in order to obtain a measure of 'usual' income (Melbourne Institute 2008a, pE9).

Annual disposable income per adult equivalent was converted into real terms using the Consumer Price Index such that all incomes were in 2005-06 dollars (ABS Cat. No. 6401.0, 2008)[8].

A household is then classified as poor or non-poor by comparing their annual, RHED income to a relative poverty line. All persons in the household are either poor or not poor. However, poverty rates focus on the individual, rather than the household, meaning that the poverty rate reflects the proportion of *individuals* which are poor. This approach is also commonly employed in the poverty literature.

4.3.2. The Poverty Line

The approach taken by this thesis in defining the poverty line differs from common practice in that it is geographically focussed to take account in the differences in the cost of living across Australia. This represents a significant contribution to the Australian child poverty literature.

[8] The author took a weighted average of the quarterly CPI over the financial year (in line with the each HILDA Wave) where the weight applied was derived from the number of days in the quarter.

The annual poverty line is defined as half median, annual RHED income of all individuals living in each of three *regional areas*, as distinguished by the Accessibility and Remoteness Index of Australia (ARIA). Individuals in the sample were separated into three geographical regions: major city, inner regional area or outer regional and remote areas. A poverty line was then set for each of the three regions, at half median RHED income for those living in the area. Individuals were classified as poor if their annual RHED income fell below the poverty line in their regional area. Having classified all individuals as poor or not poor, a single poverty rate was calculated for all Australians and for Australian children, based on the head count ratio.

This approach not only takes account of the differences in the cost of living across Australia but also closely aligns with the concept of 'relative' poverty, given that individuals would ordinarily compare themselves to others facing similar prices and similar access to goods and services. In the absence of an Australian spatial index, which measures the difference in the relative cost of living across Australia, this method is a simple way to address the differences in the cost of living across Australia.

The Accessibility and Remoteness Index of Australia (ARIA) was chosen as the method of distinguishing regional areas as it utilises purely geographical information in determining one's access to goods, services and social interaction. The score is generated by calculating the road distance to the nearest five types of town centres, where the type of centre is based on the facilities available (ABS Cat.No. 1244.0, 2000, p9). The size of the population in each service centre acts as a proxy for the availability of a range of services and similarly, the road distance is a signal of the degree of remoteness from those services (ABS Cat. No. 1244.0, 2000, p9). Another advantage of

using ARIA to distinguish regional areas, rather than an individual's State or closest major city, is that by measuring the degree of remoteness, it groups individuals according to the prices they are likely to face for goods and services commonly bought by those with similar living standards. Furthermore, HILDA derives the ARIA index for all sample members based on their Census Collection District, making it a precise measure of remoteness (Melbourne Institute 2008b, pD1).

In the HILDA dataset, ARIA is divided into five regions or 'remoteness areas': major city, inner regional, outer regional, remote and very remote Australia.[9] Due to the small sample of individuals living in remote and very remote Australia, these categories were combined with outer regional to give a total of three remoteness areas. The distribution of the general population and children across the regional areas is very similar between the six Waves. Approximately 60% of individuals (and children) live in major cities, 25% live in inner regional areas and 15% live in outer regional or remote areas in each year. Hence, even the smallest geographical region contained a reasonable sample of individuals for calculating the local poverty line.

Appendix A presents a breakdown of the poverty line in each regional area for each year (see Table 8.1) and a breakdown of the sample size in each geographical region (Table 8.2).

For the purpose of comparison, annual poverty rates were also calculated using the conventional approach, namely a poverty line set at half median income of all individuals in the sample. These results are presented for the purpose of comparison but are not very different from those based on a regional poverty line.

[9] One adult was dropped from the 2003-04 annual sample as their ARIA classification was 'Migratory'.

The choice to set the poverty line at half median income, rather than another arbitrary value such as 40% or 60% of median income, was made to maintain comparability with most other Australian and International poverty studies. It is acknowledged, though, that more recently, the European Union and some of its member Governments have moved towards a poverty line set at 60% of median income (Headey and Warren 2008, p49). [10]

4.4. Annual Child Poverty

4.4.1. Defining "Child"

For the purpose of this chapter, a 'child' is defined as any person aged up to and including 15 years. This has been chosen for two reasons.

Firstly, for most Australians, schooling is compulsory until the age of 16 years.[11] One of the aims of this thesis is to analyse the relationship between income and schooling and hence it is logical to begin with an enquiry into the extent of poverty among "school-aged" children. Secondly, 16 years is the age at which most Australian children can commence work without the need for a permit from their state's education department.[12] It signifies the age at which a child can begin to take control of their financial situation, to some extent, which is especially important in the study of poverty. At age 16,

[10] The author acknowledges here that the modified OECD equivalence scale weights a person aged 15 years as if they were an adult, though this thesis has defined a person aged 15 years as a child. This can be rationalised as the extra cost of living represented by a 15-year old may be equivalent to that of an adult though for the reasons stated in this section, they are best classed as a child for the purpose of calculating poverty rates in Australia.

[11] The school leaving age is 16 years in Victoria (*Education and Training Reform Act 2006* s 2.1.1), Queensland (*Education (General Provisions) Act 2006* s 176), South Australia (*Education Act 1972* s 75) and Tasmania (*Education Act 1994* s 4). In Western Australia, the school leaving age was lifted from 15 to 16 in 2006 and then to 17 in 2008, though children are permitted to substitute vocational or other training once they have completed Year 10 (*School Education Act 1999* s 6). The exception to this rule is New South Wales (*Education Act 1990* s 22), the Australian Capital Territory (*Education Act 2004* s 9) and the Northern Territory (*Education Act 1979* s 21) where the school leaving age is 15 years.

[12] Children can commence work at age 16 in Queensland (*Education (General Provisions) Act 2006* s 230(1)), South Australia (*Education Act 1972* s 78) and Tasmania (*Education Act 1994* s 82) and can commence work at age 15 in New South Wales (*Education Act 1990* s 25), Victoria (*Child Employment Act 2003* s 9), the Australian Capital Territory (*Education Act 2004* s 13) and the Northern Territory (*Education Act 1979* s 30).

children are no longer wholly dependent on their parent's income and can commence work if they wish, be it casual or structured such as an apprenticeship or traineeship.

For these two reasons, I have chosen to define a 'child' for the purpose of this chapter, as any person aged less than 16 years. I note that this is slightly different to the Australian Bureau of Statistics' definition of child as a person aged less than 15 years (ABS Cat. No. 6523.0, 2004, p15).

4.4.2. The unbalanced sample and cross-section weights

The first part of this chapter calculates and compares annual poverty rates for the general Australian population and Australian children separately. For this purpose, an unbalanced sample is used. This sample consists of individuals in each year whose reported annual RHED income is *positive*, meaning it must be greater than zero. This unbalanced panel contains different numbers of individuals in each Wave as shown below in Table 4.1. See Appendix A, Table 8.2 for a breakdown of the sample size for each regional area.

Table 4.1 Unbalanced Panel Sample Size

Wave	All Persons	Children
1	19,809	5,058
2	18,237	4,563
3	17,579	4,334
4	17,134	4,166
5	17,407	4,167
6	17,387	4,069

Households were dropped from each annual sample if their aggregate disposable income was zero or negative following concerns by the Melbourne Institute regarding the reliability of such income data (Headey, Warren and Harding 2006, pp42, 47; Headey and Warren 2007, p37; Heady and Warren 2008, p52). As stated by Headey, Warren and Harding (2006, p47), "households have access to economic resources,

including wealth and benefits in kind, which are not adequately reflected in measures of financial year income." While this affects the reliability of income data collected from all individuals, it is "most serious" for those households reporting non-positive incomes (Headey, Warren and Harding 2006, p47).

Panel surveys such as HILDA have been criticised as not being representative of the population as the samples in the second and all subsequent years are non-random. As time passes, attrition occurs and the demographics of the general population change. Consequently, there is the potential that later waves will no longer reflect the characteristics of the general population. However, this problem can be solved, at least partially, by using appropriate weights. Applying the cross-sectional and longitudinal weights ensures that the HILDA sample, "constitutes a representative sample of all Australians living in households in non-remote areas, both in cross-section and over time," (Goode and Watson 2007, p77-8). It is important to note that, like most surveys, HILDA does not collect data from those who are homeless, and this would likely result in calculated poverty rates underestimating the true extent of poverty in Australia.

In this section, all calculations based on the unbalanced panel have used enumerated person cross-section weights.

4.4.3. Annual Child Poverty Rates

Table 4.2 presents the annual poverty rates for the Australian population generally and Australian children.

Table 4.2 Annual Poverty Rates by Wave: Regional Poverty Line[1]

Year	Annual Poverty Rate	Annual Child Poverty Rate
2000-01	12.6%	10.7%
2001-02	12.6%	10.2%
2002-03	11.8%	10.4%
2003-04	11.2%	9.0%
2004-05	12.4%	12.4%
2005-06	10.9%	9.3%

[1] Regional poverty lines presented in Appendix A, Table 8.1.

The estimated child poverty rates are within the range found in similar studies by Harding and Szukalska (2000b), Headey *et al.* (2005) and Headey and Warren (2008), where the latter two studies were also based on HILDA data.

The general trend is for annual poverty for both the general population and children to fall over the period, with the exception of 2004-05. It is noteworthy that the annual child poverty rates are consistently lower than the poverty rate for the general population, except in 2004-05 where they are approximately equal. This is unlike the findings of other authors in Australia and internationally. Rodgers *et al.* (2008, pp32, 38) for example, using ABS Surveys of Income and Housing, found that the poverty rate for dependent children aged less than 15 years was higher than the poverty rate of the general population in both 1995-96 and 2002-03, using a poverty line set at half median income. Saunders and Bradbury (2006, pp351-2) found similarly that the child poverty rate was higher than the poverty rate for the Australian population overall. However, the results of Headey and Warren (2008, pp.50, 53) are consistent with those presented above based on HILDA data from 2000-01 to 2004-05 and a relative poverty line set at half RHED median income. The authors also found that the poverty rate among Australian children was lower than for the general Australian population.

In order to account for the lower child poverty rate, the poverty rates were recalculated using a more conventional approach. The sample included individuals whose annual RHED income was zero or negative and the poverty line was fixed at half median income of all Australians rather than regionally tailored. The results are presented Table 4.3.

Table 4.3 Annual Poverty Rates by Wave: National Poverty Line[1]

Year	Poverty Line ($2005-06)	Annual Poverty Rate	Sample	Annual *Child* Poverty Rate	*Child* Sample
2000-01	14,021	13.7%	19,914	11.0%	5,072
2001-02	14,191	13.2%	18,295	10.5%	4,569
2002-03	14,472	13.2%	17,691	11.6%	4,356
2003-04	14,904	12.6%	17,209	10.3%	4,173
2004-05	15,429	13.8%	17,469	13.5%	4,171
2005-06	16,070	12.1%	17,457	10.3%	4,072

[1] Annual poverty line is half median income of all sample members in each Wave. Note that sample includes individuals whose annual RHED income is zero or negative and therefore, the annual sample is greater than those presented in Appendix A, Table 8.2.

The rate of child poverty, however, remained lower relative to the general population in all Waves. The poverty rates based on the conventional, national poverty line are higher than the poverty rate based on a regionally tailored poverty line. This is consistent with *a priori* expectations, as the poverty lines in outer regional and remote areas were considerably lower than the overall, national poverty line. Although individuals in regional and remote areas have incomes far below those in major cities, there is relatively less inequality in each regional area.

4.4.4. Poverty Rate by Household Type

Having calculated the annual child poverty rate, it would be valuable to examine the characteristics of children who are poor. A number of dimensions such as race, parental employment or education or household location would be informative. However, for the purpose of this thesis, only one dimension is investigated in detail: the effect of household type. The question posed is whether children living in couple-parent

households have a *significantly* higher poverty rate than children living in single-parent households?

The sample of children is narrowed to include only those living in couple-parent and single-parent households. Children living in 'other related families,' group households or multi-family households are excluded. This caused approximately 2% of children in each year to be excluded. The size of the child sample used for this section is shown in Table 4.4. In all Waves, approximately 81% of children in the sample lived in couple-parent households, whilst 19% of children lived in single-parent households.

Table 4.4 Unbalanced Child Sample Size by Household Type

Year	Unbalanced Panel		
	Couple-parent	Single-parent	Total
2000-01	4,075	861	4,936
2001-02	3,666	812	4,478
2002-03	3,437	805	4,242
2003-04	3,280	796	4,076
2004-05	3,270	800	4,070
2005-06	3,214	743	3,957

To determine if the poverty rate among children living in single-parent households was *significantly* higher than the poverty rate among children living in couple-parent households, standard errors for the annual poverty rates were calculated using the jackknife procedure described by the ABS (Cat. No. 6541.0, 2005, pp.10-11). It was necessary to use this procedure as the HILDA sample represents a complex, rather than simple random sample of Australian households. The procedure is described in the context of this analysis and the HILDA data set in Appendix B.

The poverty rate for children in couple-parent and single-parent households, and the associated confidence intervals, are presented in Table 4.5.

Table 4.5 Annual Child Poverty Rates by Household Type[1]

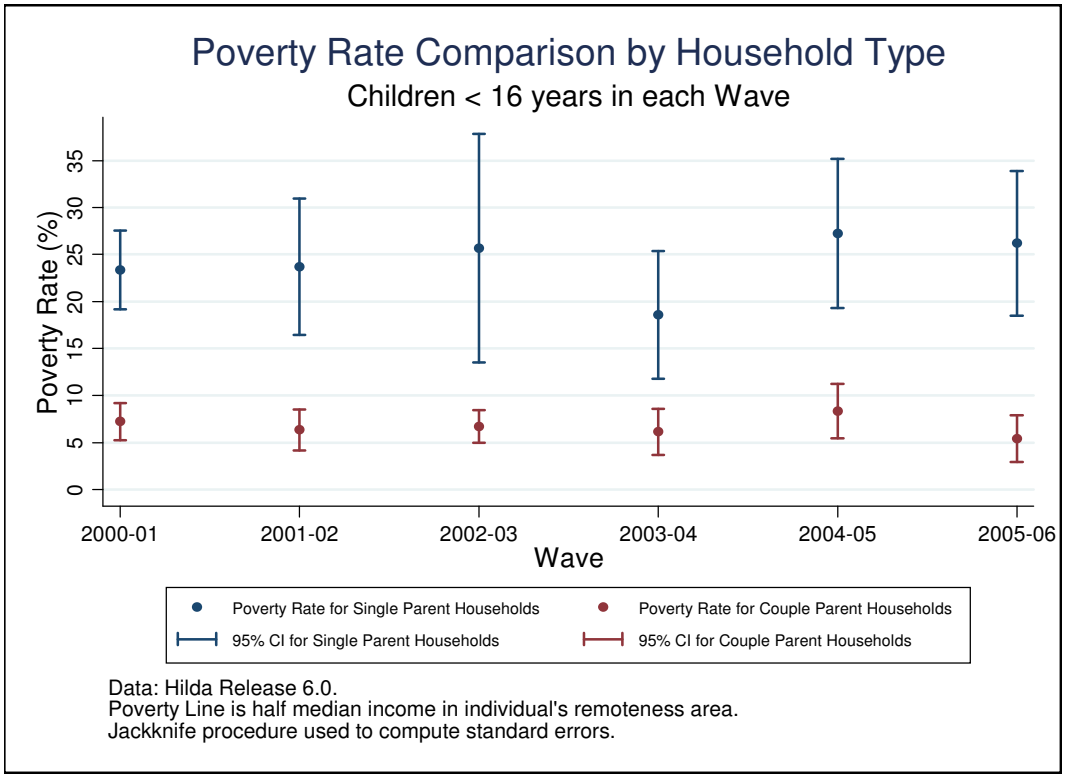
Year	Couple-parent			Single-parent		
	Poverty Rate	95% Confidence Interval		Poverty Rate	95% Confidence Interval	
2000-01	7.2%	5.3%	9.3%	23.4%	19.2%	27.5%
2001-02	6.3%	4.2%	8.5%	23.7%	16.5%	30.9%
2002-03	6.7%	5.0%	8.5%	25.7%	13.5%	37.8%
2003-04	6.2%	3.7%	8.6%	18.6%	11.8%	25.4%
2004-05	8.3%	5.4%	11.2%	27.3%	19.3%	35.2%
2005-06	5.4%	2.9%	7.9%	26.2%	18.5%	33.9%

[1] Annual, *regional* poverty line used. See Appendix B, Section 9.1 for an explanation of how the poverty line and poverty rates were calculated using the jackknife procedure.

The general trend which emerges from the results in Table 4.5 is for the child poverty rate for children living in couple-parent households has decreased between 2000-01 and 2005-06 whilst the poverty rate for children living in single-parent households has increased over the same period. In both cases, there is a sizeable jump in the child poverty rate in 2004-05, which also occurred for the overall child poverty rate discussed earlier.

Figure 4.1 illustrates the difference between the poverty rate for children living in couple-parent and single-parent households.

Figure 4.1 Annual Child Poverty Rates for Couple-Parent and Single-Parent Households



As expected, the poverty rate among single-parent households is far higher than the poverty rate for children living in couple-parent households. In fact the poverty rate is at least three times as great for children in single-parent households in each Wave. Given that the 95% confidence intervals do not overlap in any year, one can conclude that the poverty rate for children living in single-parent households is *significantly* higher than that for children living in couple-parent households throughout the period 2000-01 to 2005-06.

4.5. Changes in Annual Child Poverty Rates from 2000-01 to 2005-06

4.5.1. Why decompose?

Two potentially confounding factors can cause a change in the relative poverty rate: firstly, changes in the distribution of income and secondly, changes in the real value of the poverty line itself. If one uses an anchored poverty line, which fixes the real value of the poverty line at a point in the income distribution in the initial year, changes in the calculated poverty rate in subsequent years represent a change in 'absolute' poverty. This reflects the fact that only the distribution of incomes has changed between the initial and subsequent years, representing a change in the concentration of individuals below the poverty line. The relative poverty rate between two years may also change if the real value of median income changes, thus causing the relative poverty line to change. In the case that the real value of the median income changes over time, the poverty rate in subsequent periods will be different if measured using an anchored poverty line and a fully relative poverty line. For the purpose of this thesis, a change in relative poverty caused only by a change in median income is termed a 'residual' change in poverty.

Based only on a relative, annual poverty rate, such as those presented in the preceding sections, it is not possible to discern whether relative poverty has changed due to absolute changes in poverty, or residual changes in poverty. Furthermore, one cannot determine whether or not an apparent decrease in the measured relative poverty rate, as was found for children over the period 2000-01 to 2005-06, is masking an increase in absolute poverty as the real incomes of poor children fall. In this case, it is possible that fewer children are on incomes well below their peers though there is also an underlying

increase in the concentration of children in the bottom end of the income distribution. In the opinion of some authors, the increase in the poverty rate caused by falling real incomes is of greater concern for a society, as it reflects an increase in the proportion of people unable to maintain a basic living standard, rather than changes in income inequality (Saunders 2007, p62).

For the purpose of this thesis, both relative and absolute concepts of poverty are considered informative (Rodgers *et al.* 2008, p3). This section aims to *decompose* the change in relative child poverty between 2000-01 and 2005-06 into absolute changes in poverty and residual changes in poverty, in the style of Rodgers *et al.* (2008, pp9-17). This technique allows one to isolate the two sources of change in the poverty rate, thereby separating the potentially confounding effects, allowing a more detailed examination of how children have fared over the period 2000-01 to 2005-06.

4.5.2. Decomposing the Poverty Rate

The method for decomposing changes in the relative poverty rate is taken from Rodgers *et al.* (2008).

Firstly, the poverty rate is calculated for 2000-01 based on a relative poverty line of half median 2000-01 RHED income in each regional area. The poverty rate for 2005-06 is also calculated based on a relative poverty line set at half median 2005-06 RHED income in each regional area. The difference between these two poverty rates represents the overall change in relative poverty over the period.

Secondly, the poverty rate is calculated for 2005-06 based on an anchored poverty line set at half median 2000-01 RHED income in each regional area. Given that all incomes

are in real, equivalised terms, the difference between this poverty rate and the 2000-01 poverty rate, reflects a change in *absolute* poverty as the poverty line is anchored, whilst the distribution of incomes is different in 2000-01 and 2005-06.

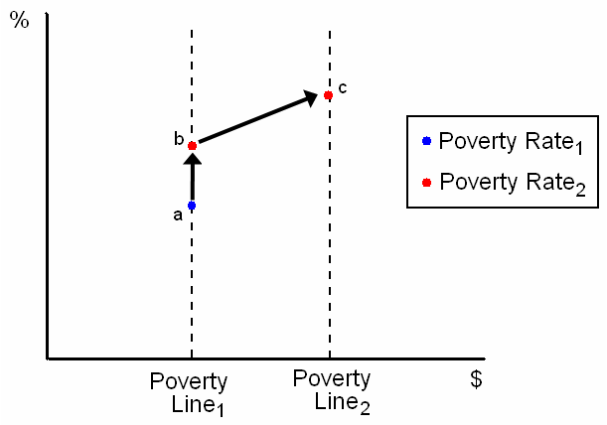
Lastly, the poverty rate in 2005-06, based on the relative poverty line minus the poverty rate in 2005-06 based on the anchored poverty line is computed. This will be called the 'residual' change in the poverty rate. It is caused by a change in the real value of the poverty line from its anchored value in 2000-01 to its relative value in 2005-06.

The change in relative poverty is thereby decomposed, isolating firstly the change in absolute poverty and secondly, the residual change in poverty. There are six potential ways that the relative poverty rate could change over the period, based on absolute and residual changes in poverty. These are explained in turn, considering firstly the case of an increase in relative poverty and secondly, a decrease.

4.5.3. An increase in relative poverty

Firstly, it is possible to have both an absolute and residual increase in poverty as shown in Figure 4.2.

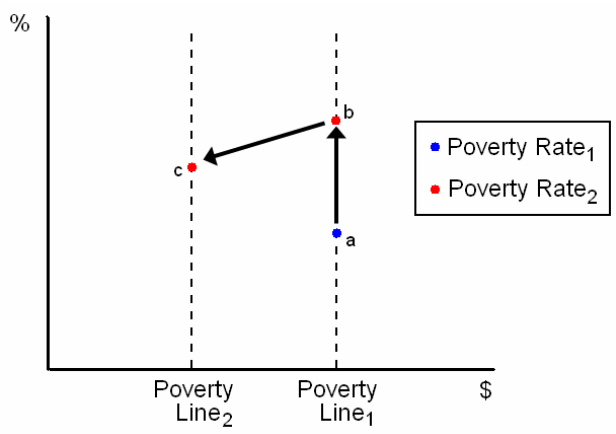
Figure 4.2 Increase in relative poverty: I



If, firstly, the real incomes of the poor fall, the poverty rate increases between period one and period two, based on the anchored poverty line: a movement from point a to b in Figure 4.2. This reflects an increasing concentration of individuals at the lower end of the income distribution. Secondly, the poverty rate in period two may increase if the relative poverty line in period two is above the anchored poverty line: a movement from point b to c in Figure 4.2. This reflects an increase in poverty caused merely by an increase in the real value of the relative poverty line between periods one and two. In summary, the relative poverty rate is certain to increase between periods one and two, from point a to c.

Secondly, it is possible that an increase in relative poverty is the result of a large increase in absolute poverty (a movement from point a to point b in Figure 4.3) which outweighs a smaller decrease in residual poverty as the value of the relative poverty line falls in the second period (a movement from point b to c in Figure 4.3).

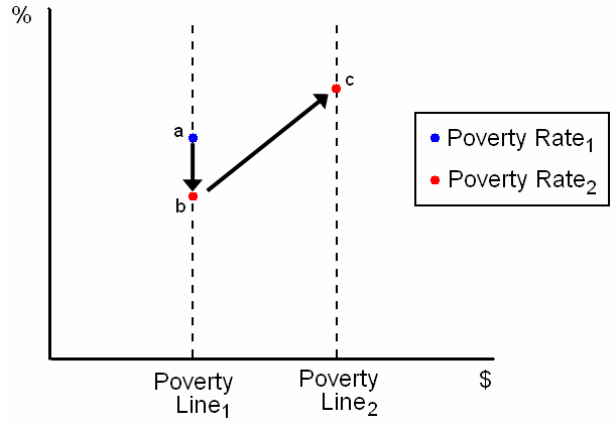
Figure 4.3 Increase in relative poverty: II



The large decrease in real incomes of those at the bottom of the income distribution has caused absolute poverty rate to increase, more than offsetting the residual decrease caused by the lower relative poverty line. The results is an increase in the relative poverty rate from point a to c.

Thirdly, an increase in relative poverty may occur when the decrease in absolute poverty (movement from point a to b in Figure 4.4) is less than the residual increase in poverty caused by an increase in the poverty line (movement from point b to c in Figure 4.4).

Figure 4.4 Increase in relative poverty: III



Anchoring the poverty line in period one, absolute poverty has decreased as the real incomes of the poor have risen between periods one and two. However, this is

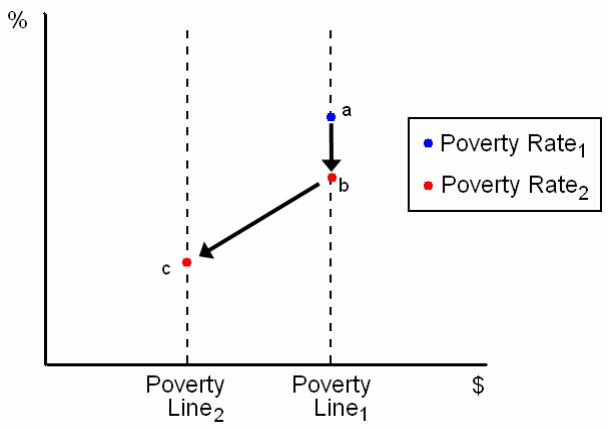
outweighed by the increase in relative poverty caused by rising median income which pushes more people into poverty in 2005-06. Such was the finding of Rodgers *et al.* (2008, pp14, 16-7) for both the general population and child population in Australia over the period 1995-96 to 2002-03.

4.5.4. A decrease in relative poverty

The three potential decomposition outcomes presented in Figures Figure 4.5, 4.6 and Figure 4.7 relate to the case where relative poverty decreases from point a to c, as occurred for the child poverty rate between 2000-01 and 2005-06, based on the results presented in Table 4.2.

Firstly, it is possible that both absolute and residual poverty rates decrease.

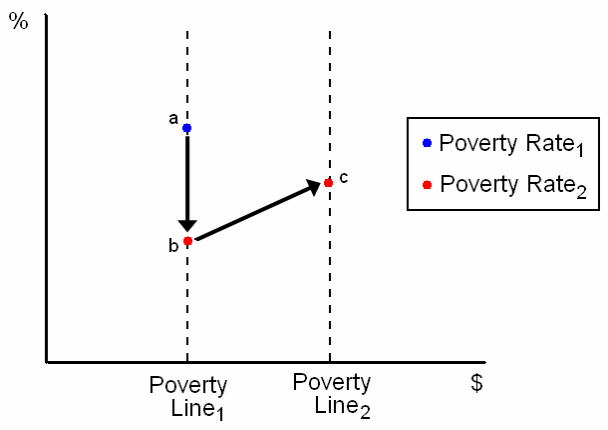
Figure 4.5 Decrease in relative poverty I



Based on the anchored poverty line in the initial period, a rise in the real incomes of those at the bottom end of the income distribution will cause the poverty rate to decrease in period two (a movement from point a to b in Figure 4.5). If the relative poverty line in period two is lower than the anchored poverty line, this will cause a residual decrease in the poverty rate (a movement from point b to c in Figure 4.5). Combined, the relative poverty rate will certainly decrease overall.

The second possibility is that absolute poverty decreases by more than the residual increase in poverty as depicted in Figure 4.6.

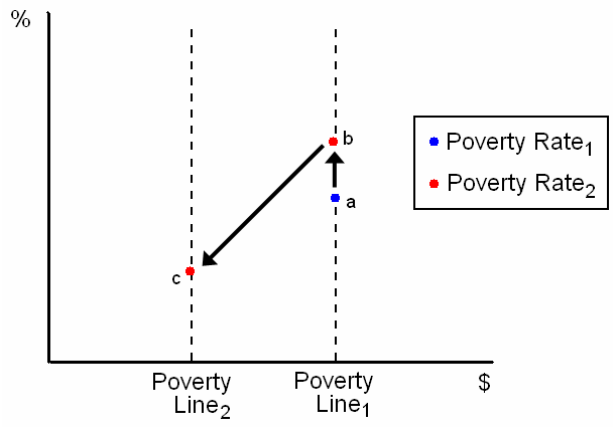
Figure 4.6 Decrease in relative poverty: II



If real incomes rise for those in the lower tail of the income distribution, absolute poverty falls (movement from a to b in Figure 4.6). Furthermore, as the relative poverty line increases in real terms, residual poverty increases by a small amount to point c. The residual increase in poverty, however, does not outweigh the large decrease in absolute poverty, causing relative poverty to decrease overall.

Lastly, an increase in absolute poverty (movement from point a to b in Figure 4.7) may be outweighed by a larger residual decrease in poverty (movement from point b to c in Figure 4.7), thus causing an overall decrease in relative poverty.

Figure 4.7 Decrease in relative poverty: III



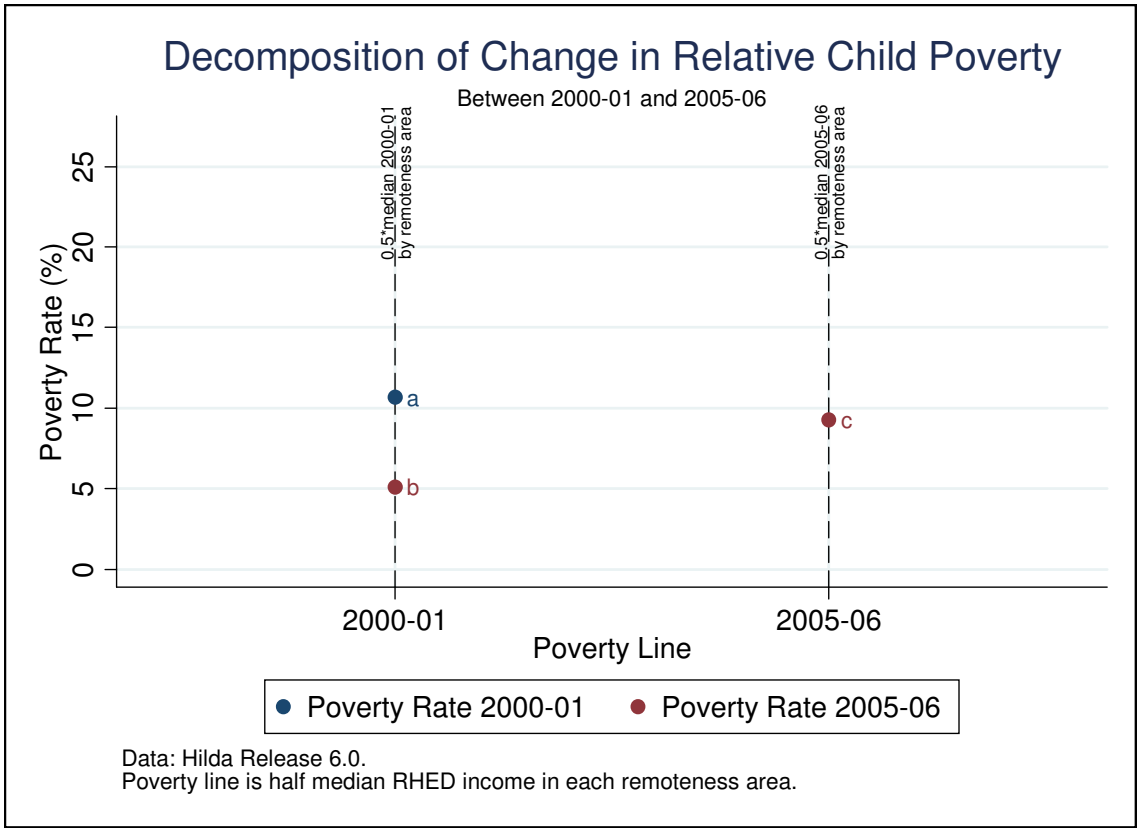
4.5.5. The Results

The results of the decomposition calculations are presented Table 4.6 and Figure 4.8.

Table 4.6 Child Poverty Rate Decomposition: Regional Poverty Line

	Poverty Rates	
Poverty Line	2000-01	2005-06
Half median income, 2000-01 (by remoteness area)	10.7%	5.1%
Half median income, 2005-06 (by remoteness area)		9.3%

Figure 4.8 Child Poverty Rate Decomposition: Regional Poverty Line



Overall, the relative child poverty rate has decreased by 1.4 percentage points from 10.7% in 2000-01 to 9.3% in 2005-06. Initially, based on the anchored poverty line set at half median 2000-01 RHED income in each remoteness area, absolute poverty has deceased by 5.6 percentage points from 10.7% (point a) to 5.1% (point b). However, there has also been a residual increase in child poverty, as the real value of median

income, and thereby the poverty line, increased between 2000-01 and 2005-06. The poverty rate in 2005-06 based on the 2005-06 relative poverty line is 9.3%, shown as point c in Figure 4.8. This represents a residual increase in child poverty of 4.2 percentage points. Combined, the decrease in absolute poverty has outweighed the small residual increase in child poverty, causing relative child poverty to decrease overall by 1.4 percentage points.

In practical terms, the results of the decomposition indicate that the reduced concentration of children at the lower end of the income distribution, reflected by the large decrease in absolute poverty, has more than outweighed the residual increase in child poverty resulting from rising median income. By decomposing the change in relative poverty, it can be concluded that the observed decrease in relative poverty is not masking an increase in absolute poverty, or equivalently, it is not masking an increased concentration of children below the anchored poverty line. In fact, the fall in absolute child poverty is what underlies the lower relative child poverty rate. Children's RHED incomes over the period 2000-01 to 2005-06 were not rising as fast as the median income, causing a small residual increase in child poverty.

The change in the relative child poverty rate, based on a relative, *national* poverty line is presented in Appendix C. These estimated poverty rates were based on the same sample of children as those in Table 4.2: those whose annual RHED income was greater than zero. Thus, the relative child poverty rates are slightly lower than those presented in Table 4.3 where the sample included children with zero or negative annual RHED income. Essentially, the result is the same: absolute poverty decreased by more than the residual increase in poverty, causing the relative child poverty rate to decrease overall.

4.6. Chronic Child Poverty

4.6.1. Why focus on chronic poverty?

The preceding sections of this chapter have examined the extent and nature of annual child poverty in Australia. However this analysis, like any measure based on cross-sectional data, cannot discern whether those children who are poor experience long-term, sustained poverty or only transitory poverty. Such a distinction between chronic and transitory poverty is crucial, particularly in the study of child poverty, as research has shown that it is long-term sustained poverty which has the most powerful and long-lasting effects on a child in terms of educational outcomes and future earnings (Goodin *et al.* 1999; Berthoud 2001; Duncan *et al*. 1998). Short-term changes in income, even those which cause one to move below the poverty line, are likely to have little effect on living standards if individuals rely on past savings or borrow in order to maintain their standard of living. Studies have also shown that although only a small proportion of children who are ever poor experience long-term, persistent poverty, they account for a large proportion of the total time children spend in poverty (Berthoud 2001).

In conclusion, independent analysis of chronic poverty amongst Australian children is worthwhile as chronic poverty is likely to have the most powerful impact on children's outcomes and require different policy interventions.

4.6.2. Approaches to measuring chronic poverty

Chronic poverty has been analysed using a variety of methods in the child poverty literature. These methods have included frequency, or tabulation approaches, studies of 'poverty spells', and the use of averaged or smoothed income.

Firstly, a simple method of identifying the chronically poor is to focus on those who are repeatedly in annual poverty, known as the tabulation approach. This method has been used by Blank (1997) when studying the frequency of poverty in the United States over a 13-year period from 1979 to 1991 and also by Headey, Marks and Wooden (2005) to study child poverty using the first three Waves of HILDA. The approach tabulates the proportion of individuals or children who are annually poor in *x* out of the *n* available years of data. This may include the proportion of children who are never poor, the proportion poor in one of *n* years, up to and including the proportion of children poor for all *n* years. A judgment call is made by the author regarding the number of years poor which constitute 'chronic' poverty. All children who are poor for at least this many years are chronically poor, implying the remaining children who were annually poor are in 'transitory' poverty only. The limitation in this approach is that whilst some children only marginally escape poverty in most years and experience severe poverty in only a few years are classified as only transitorily poor, their standard of living is much lower than other children whose RHED income is only marginally below the poverty line in all years. Furthermore, if the data covers only a short time span, it may not accurately reflect individuals' frequency in annual poverty given that income tends to be lower at particular points in an individual's lifetime, such as adolescence and after retirement.

A second approach to studying chronic poverty is to study 'poverty spells,' or unbroken bouts of annual poverty (Berthoud 2001; Bane and Ellwood 1986). Poverty persistence, or chronic poverty, is represented by the proportion of spells which are 'long' and transitory poverty calculated as the proportion of 'spells' which are short (Rodgers and Rodgers 1993, p28).This approach, however, suffers from three main problems. Firstly, multiple poverty spells, which are equally important if an individual's income rises only

marginally above the poverty line, are difficult to incorporate. Secondly, the number of years chosen to delineate a poverty spell as 'chronic poverty' is arbitrary. And thirdly, duration measures potentially suffer from both a right and left censoring problem as one who is observed to be poor in either the first or last periods of analysis may be merely ending or beginning a 'spell'. Thus, the length of the poverty spell observed does not accurately reflect its true duration.

Rather than studying chronic poverty in terms of poverty persistence or frequency, this thesis uses the permanent income approach of Rodgers and Rodgers (1993) which is analogous to the averaged or smoothed income approaches used by Hill and Jenkins (1999) and Chaudri and Ravallion (1994). Permanent income is used as it reflects, 'probably the principal influence on people's living standard,' (Rainwater 1981, p5). It not only treats poverty spells and repeated bouts of poverty in a meaningful way, but also takes account of the depth of poverty experienced over a number of years (Rodgers and Rodgers 1993, p30). Duncan *et al*. (1998) and Hill and Jenkins (1999) have studied the incidence of chronic poverty by using average income over a number of years. Hill and Jenkins (1999), for example, averaged the incomes of British children between 1991 and 1996, and defined the chronic child poverty rate as the proportion of children whose average income fell below an anchored poverty line. The difference between this chronic poverty rate and the average annual child poverty rate over the period represented transitory poverty.

The 'smoothed' income approach does, to some extent, remove the effect of short-term fluctuations in income and improves the measurement of actual living standards. However, it does not take account of the costs and benefits of transferring income

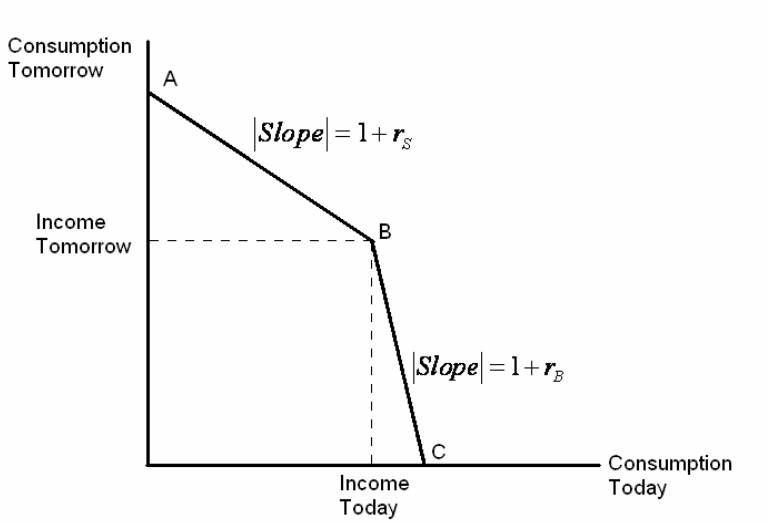
between years, determined by the prevailing interest rates on borrowing and saving. The measure of permanent income outlined by Rodgers and Rodgers (1993), used also in this thesis, is an extension of the 'smoothed' income approach. It takes into account the transaction costs associated with transferring income between years.

4.6.3. Calculating Permanent Income

Permanent income, for the purpose of this thesis, is defined as the maximum *sustainable* annual consumption level that a person could achieve with their actual income stream over *T* years, if the agent could save and borrow at prevailing interest rates. The algorithm used to calculate permanent income is taken from Rodgers and Rodgers (1993, p37) and is presented in detail in Appendix D. Since it requires that income is known in all *T* years, only those children in the balanced panel were used to calculate the chronic poverty rate.

The theory underlying the calculation of permanent income is the individual's intertemporal consumption decision. For simplicity, assume there exists only two time periods: today and tomorrow. The intertemporal budget line, representing all feasible combinations of consumption today and tomorrow, given some interest rate today on borrowing and saving, is shown in Figure 4.9 where r_S represents the interest rate today on savings and r_B represents today's interest rate on borrowing.

Figure 4.9 Intertemporal Budget Constraint



Along AB, each dollar that the individual saves today increases tomorrow's consumption by $1+r_S$ dollars and along BC, each dollar borrowed today decreases tomorrow's consumption by $1+r_B$ dollars. Given the assumption that the interest rate on borrowing exceeds the interest rate on saving there is a kink in the intertemporal budget line at the endowment point B, causing BC to be steeper than AB.

An optimising consumer can achieve any combination of intertemporal consumption on ABC, along which, all present and future income is consumed. In calculating permanent income, the consumer is assumed to begin and end the planning horizon, defined here as two periods, with nil saving and borrowing. Implicitly, it is assumed that individuals can transfer annual income between years during the period of analysis, but at a cost equal to the prevailing interest rate.

The choice of where to consume along the budget line is determined by the individual's preferences for consumption today relative to tomorrow. Intertemporal optimisation theory states that the optimal consumption point along ABC for a consumer will depend on the shape of their intertemporal indifference curves, which is determined by the

marginal utility they derive from current relative to future consumption. In other words, their optimal point depends on their preferences for consumption today relative to tomorrow.

The calculation of permanent income, however, does not take account of individuals' preferences for intertemporal consumption, and focuses on the particular case where individuals smooth their consumption intertemporally, so as to consume the same income from one period to another. In the case where the annual endowments differ between periods, the individual's permanent income will lie somewhere between the two endowments, and its specific value will depend both on the amount of annual income each year and the prevailing interest rates.

Permanent income in the two-period case can be solved using simple algebra. Generalising to the *T* period case, however, requires the use of annuities or as is done in this thesis, an iterative procedure which is taken from Rodgers and Rodgers (1993, p37) and presented in detail in Appendix D. As permanent income is based on individuals' real, household equivalised disposable income in each year, permanent income is hereafter referred to as permanent RHED income.

For the purpose of this thesis, the interest rate on savings was calculated as the average of the RBA indicator interest rates on cash management accounts of balances totalling $10,000 and $50,000, as well as the interest rate on term deposits of 6 and 12 months.[13] The rates were averaged over the financial year to arrive at an annual rate which ranged between 3.0% and 4.1%. The interest rate on borrowings was calculated as the average

[13] RBA F04 Retail Deposit and Investment Rates. Available: http://www.rba.gov.au/Statistics/Bulletin/index.html.

of the RBA indicator lending rates for fixed and variable rates on unsecured term loans as well as the standard credit card interest rate.[14] These rates were similarly averaged over the financial year and ranged between 13.5% and 14.2%. The annual interest rates on borrowing and saving are presented in Appendix D.

4.6.4. The Chronic Poverty Line

To determine which children are in chronic poverty, it is necessary to define a chronic poverty line. Two approaches were considered for the purposes of this thesis.

Firstly, one could define the poverty line as half median *permanent* RHED income. However, it is possible that this method could result in a child being categorised as chronically poor, notwithstanding that their annual RHED income was above half the median in each and every year, thus resulting in he or she never being annually poor. Whether this result occurs depends on the distribution of incomes. To avoid this incongruous result, this method was not used.

The second possibility is to define the chronic poverty line as half the permanent RHED income of a hypothetical person whose annual income was exactly equal to the median of all enumerated persons in the sample.[15] This method was preferred for setting the chronic poverty line because it utilises the longitudinal nature of permanent RHED income, rather than viewing it as simply another cross-section. Furthermore, any individual whose permanent income falls below this chronic poverty line must have been annually poor in at least one year. Note that each child will be either chronically

[14] RBA F05 Indicator Lending Rates. Available: http://www.rba.gov.au/Statistics/Bulletin/index.html.

[15] It was found that *half* permanent income of an individual whose annual income was equal to the median RHED income in each year was approximately equal to the permanent income of an individual whose annual income was half median RHED income in each year.

poor or not poor for the duration of the period, though their annual poverty status may change.

In order to take account of spatial differences in the cost of living, the chronic poverty line was also tailored to each individual's remoteness, or regional, area in each Wave. The chronic poverty line for person *i* can be expressed as:

$$Pov\ Line_i = 0.5 * Perm\ Inc_i^{median}$$

where $Perm\ Inc_i^{median}$ is the permanent income of a hypothetical person who earned the median income in the same remoteness area where person *i* resides in each Wave.[16] The median income in each regional area for each year is based on the annual RHED incomes of all individuals in the balanced sample, where longitudinal enumerated person weights are applied. Individuals, including children, are classified as chronically poor if their permanent RHED income falls below the chronic poverty line for that person.

The chronic child poverty rate over the period 2000-01 to 2005-06 is also presented based on a national chronic poverty line set at half the permanent income of a hypothetical person who earned median *national* income in each year.

The head-count ratio was used to calculate the rate of chronic poverty among the general Australian population and among children, based on their classification as chronically poor or not chronically poor.

[16] Recalling that there are three remoteness areas in each of the six Waves, there are 729 (=3^6) possible chronic poverty lines.

4.6.5. The Balanced Panel and Longitudinal Weights

The chronic poverty rates calculated in this section are based on a balanced sample of individuals. This sample includes all individuals whose reported annual RHED income is greater than zero in all six Waves. The balanced sample is used as annual income must be known in all years in order to calculate permanent income.

The balanced child sample consists only of those children aged 15 years or younger *throughout* the six Waves. Table 4.7 presents the balanced sample sizes for the general population and children:

Table 4.7 Unbalanced Panel Sample Size

Waves	All Persons	Children
1-6	12,528	2,404

To ensure that all poverty rates based on the balanced panel are representative of the Australian population generally, *longitudinal* enumerated person weights have been applied to all calculations in this section.

4.6.6. Chronic Poverty Rates

Table 4.8 presents the chronic child poverty rate for the period 2000-01 to 2005-06 as well as the annual poverty rate for the same sample of children, where longitudinal enumerated person weights are applied to all calculations. The annual poverty line is half median income of all enumerated persons in the balanced panel, after applying longitudinal enumerated person weights.

Table 4.8 Annual and Chronic Child Poverty Rates by Wave: Regional Chronic Poverty Line

Year	Annual Child Poverty Rate	Chronic Child Poverty Rate
2000-01	11.5%	6.7%
2001-02	10.2%	
2002-03	11.8%	
2003-04	8.2%	
2004-05	11.2%	
2005-06	10.4%	

Though the annual child poverty rates do not exactly match those in Table 4.2, which are based on the unbalanced sample, in both cases the child poverty rate fluctuated in a similar manner between 2000-01 and 2005-06 and ended slightly lower over the period. The annual poverty rates presented in Table 4.8 are presented only for the purpose of comparison between chronic and transitory poverty, and are not purported to accurately reflect the annual child poverty rate among Australian children over the period.

The first noteworthy difference is that the chronic child poverty rate is considerably lower than the annual child poverty rate in any year, indicating that a large number of children experience only transitory poverty. That is to say, a number of children live in households which are annually poor but which are able to escape chronic poverty by saving in non-poor years and either borrowing or living off household assets in their years of low income. Using the technique of Hill and Jenkins (1999, pp4, 25), total child poverty, or the average annual child poverty rate is 10.6%.[17] Subtracting the chronic poverty rate from the rate of total, average annual poverty rate gives a residual, transitory poverty rate of 3.9%. This measure indicates that on average, over the period 2000-01 to 2005-06, 37% of annual child poverty was transitory whilst the remaining 63% was chronic. These results are almost identical to the findings of Hill and Jenkins (1999, p25) based on British data from 1991-1996 which showed 40% of annual child poverty was transitory.

Table 4.9 presents the annual and chronic poverty rates for children in the balanced panel, based on the conventional national chronic poverty line.

[17] Total (average annual) child poverty = (0.115 + 0.102 + 0.118 + 0.082 + 0.112 + 0.104) / 6 = 0.106

Table 4.9 Annual and Chronic Child Poverty Rates by Wave: National Poverty Line

Year	Annual Poverty Rate	Chronic Poverty Rate[1]
2000-01	12.0%	7.1%
2001-02	10.1%	
2002-03	12.1%	
2003-04	9.4%	
2004-05	11.7%	
2005-06	10.2%	

[1] National chronic poverty line was $14,857 in 2005-6 dollars.

The same pattern emerges in that the chronic child poverty rate is considerably lower than the annual child poverty rate. This reinforces the conclusion that many of the children who are poor in any given year are in transitory poverty.

The following section examines whether there has been a significant difference in the chronic child poverty rate between children living in couple-parent, and children living in single-parent households, over the period 2000-01 to 2005-06. Following this is a detailed analysis of the overlap between annual and chronic child poverty, highlighting the extent of transitory poverty among Australian children.

4.6.7. Chronic Poverty Rate by Household Type

The balanced child sample was trimmed to include only those children living in couple-parent or single-parent households for at least four of the six Waves. Children were classified by household type based on their most frequent household type. Table 4.10 presents the size of the sample used for this analysis.

Table 4.10 Balanced Child Panel Sample Size by Household Type

Years	Balanced Child Panel		
	Couple-parent	Single-parent	Total
2000-01 to 2005-06	1,928	387	2,315

Due to the cumbersome nature of recalculating poverty lines for each of the 45 sub-samples based on the replicate sets of longitudinal weights, it was assumed that the chronic poverty line was the same across each replicate sub-sample. Standard errors

were generated using the jackknife procedure by re-calculating the chronic poverty rate for children of couple-parent and single-parents, using the 45 sets of replicate longitudinal enumerated person weights. For a more detailed explanation of the jackknife procedure used in this section, see Appendix B.

Table 4.11 presents the chronic poverty rates and 95% confidence intervals for children living in couple-parent and single-parent households.

Table 4.11 Chronic Child Poverty Rate by Household Type

Years	Couple-parent			Single-parent		
	Poverty Rate	95% Confidence Interval		Poverty Rate	95% Confidence Interval	
2000-01 to 2005-06	4.2%	2.3%	6.1%	16.5%	11.3%	21.7%

As the confidence intervals do not overlap, one can conclude that the chronic child poverty rate for children living in single-parent households is significantly higher than that for children living in couple-parent households. This is consistent with the result based on annual child poverty over the period 2000-01 to 2005-06, presented in Table 4.5

4.6.8. The overlap between annual and chronic poverty

After ascertaining whether each child in the balanced panel was annually and/or chronically poor, this section analyses the extent of overlap between annual and chronic poverty, in order to determine what proportion of annual child poverty is chronic and what proportion is transitory. The results for each year are shown in Figure 4.10 and Table 4.12.

Figure 4.10 Overlap between Chronic and Annual Child Poverty

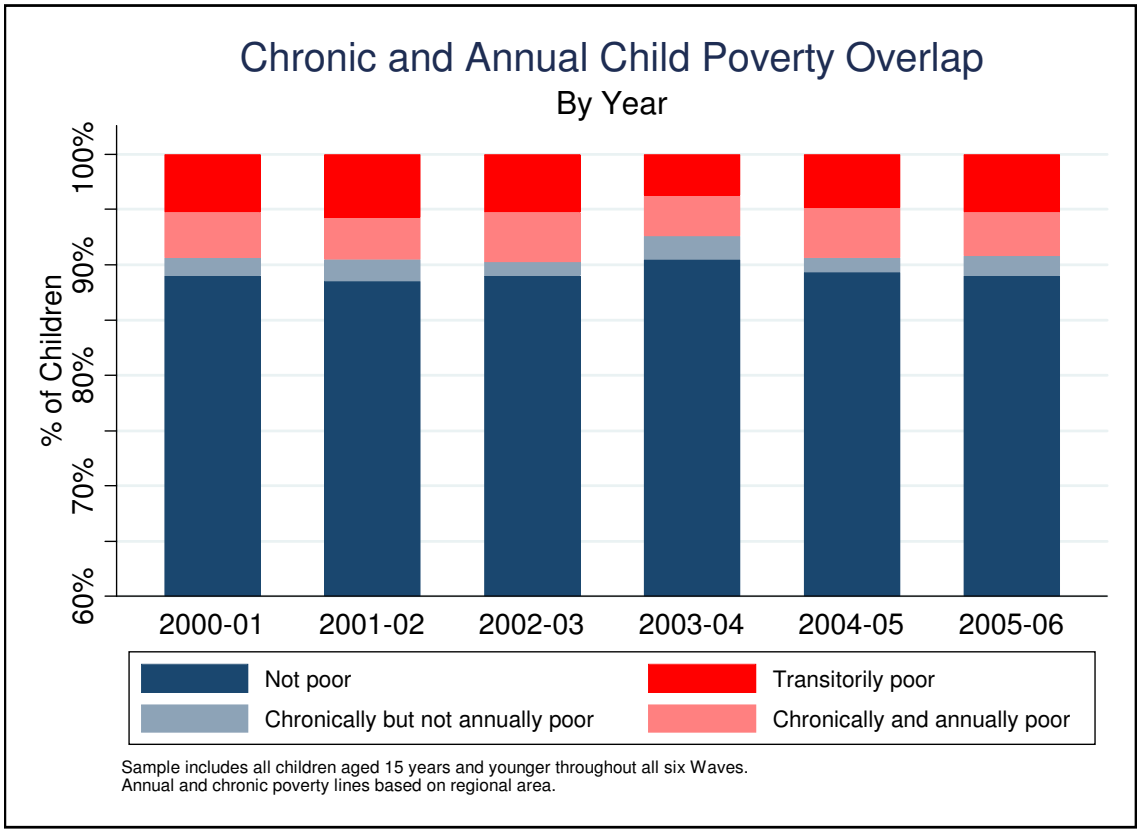


Table 4.12 Overlap between Chronic and Annual Child Poverty

Year	Transitorily Poor	Poor (Annually and Chronically)	Chronically but not Annually Poor	Not Poor
2000-01	5.2%	4.1%	1.7%	89.0%
2001-02	5.7%	3.8%	2.0%	88.5%
2002-03	5.2%	4.5%	1.3%	89.0%
2003-04	3.7%	3.6%	2.2%	90.5%
2004-05	4.9%	4.5%	1.3%	89.4%
2005-06	5.2%	4.0%	1.8%	89.0%

The blue areas represent those children that were not annually poor and the red areas represent those children that were in annual poverty. The lighter areas signify the children that were chronically poor based on their permanent RHED income.

The vast majority of children in each wave, which is typically over 90%, are not annually poor. A minority of children each year are in chronic poverty but are not

annually poor, which is due to an unusually high income in that year. This applies to approximately 2% of children in each year.

Approximately 10% of children in each year are in annual poverty, but of these children, only half are chronically poor, implying that the remaining children are only transitorily poor. The results of the overlap between annual and chronic poverty are very similar when a national poverty line is used which is not specific to individual's regional area (see Appendix C, Figure 10.2).

On average, 45% of children who were annually poor between 2000-01 and 2005-07 were also chronically poor. This implies the remaining 55% of children who are annually poor experience only transitorily poor. The proportion of children annually poor that are also chronically poor has remained relatively stable throughout the period 2000-01 to 2005-06, whether using a regional or national poverty line. If the households where transitorily poor children live were given the opportunity to transfer income between years, and borrow in those years where annual RHED income was temporarily low, these households could escape chronic poverty and thus, maintain a standard of living which was above the chronic poverty line.

The results of the overlap between annual and chronic child poverty for Australian children presented in this section are very similar to those found by Hill and Jenkins (1999, p25). These authors found that, based on a sample of British children aged 17 years and younger, approximately 36% to 46% of annual poverty was chronic during the period 1991 to 1996 which is lower than the result, presented herein for Australian children. These authors also found that approximately 2.8% of children aged 0-17 years

were chronically poor each year between 1991 and 1996, but were not annually poor. This is somewhat higher than the rate of 1.7% based on Table 4.12.

Figure 4.10 answers one of the main questions posed by this thesis: to what extent is there an overlap between those children identified as poor in any given year, based on cross-sectional income data, and those children who are chronically poor based on their permanent RHED income? The investigation presented in this section shows that only a limited degree of overlap exists. On average, cross-sectional data identifies only *half* of those in chronic poverty and completely misses approximately 2% of children each year who are in chronic poverty but who are able to temporarily escape annual poverty by having an unusually high annual RHED income. The same result was found, based on the conventional poverty line of half median income of all Australians and a regional-specific poverty line that took account of cost of living differences across Australia.

In conclusion, this investigation has shown that cross-sectional data is a poor indicator of chronic poverty as it includes a sizeable number of persons who are only transitorily poor. Furthermore, cross-sectional data cannot identify the small proportion of children in each year who temporarily escape annual poverty but nevertheless remain in a state of chronic poverty.

4.6.9. Policy Implications

From a policy perspective, it is crucial that welfare be directed to those children who are most in need. In turn, this requires that the necessary data are accessible and accurate. This chapter has shown that the traditional cross-sectional measures of poverty are poor indicators of those children who are most in need: the chronically poor. In fact, cross-sectional data identifies approximately only half of those who are chronically poor and

fails to identify those 2% of chronically poor children who occasionally escape annual poverty due to uncharacteristically high incomes in a given year.

Children who experience transitory poverty are, at least in theory, living in households that are able to save or borrow to supplement their low incomes and therefore, maintain a basic standard of living, as measured by the chronic poverty line. It is the children who experience chronic poverty who are most in need of Government welfare assistance because, even with access to market mechanisms such as borrowing and savings, the households where these children live cannot escape chronic poverty. These households have insufficient permanent income to maintain a basic standard of living. Cross-sectional data has been shown to be a poor indicator of chronic poverty. Therefore, Government welfare policy requires panel data in order to accurately identify the characteristics of children who are in chronic poverty, and therefore, in most need. Only by identifying the factors that characterise these children can Government welfare assistance be better targeted.

4.7. Summary and Conclusions

This chapter has examined the extent of poverty amongst Australian children over the period 2000-01 to 2005-06 using a variety of approaches. Over the period, approximately 10.3% of children were relatively poor based on a poverty line set at half median RHED income in an individual's remoteness area in each year. Approximately 11.2% of children were annually poor based on the conventional measure of poverty: a poverty line which is set at half median RHED income of all Australians where individuals with zero or negative annual RHED incomes were included in the sample. These poverty rates were within the range found in similar studies by Harding and

Szukalska (2000b), Headey *et al.* (2005), Saunders and Bradbury (2006) and Rodgers *et al.* (2008).

Interestingly, the annual poverty rate for children aged 15 and younger over this period was approximately 1.5 percentage points lower than the poverty rate for the general Australian population. This is unlike the findings of other similar studies in Australia though it is consistent with the results of Headey and Warren (2008) covering the same period: 2000-01 to 2004-05.

The nature of annual poverty among Australian children was also examined (Section 4.4.4). Children in single-parent households were found to have a significantly higher annual and chronic poverty rate compared with children living in couple-parent households. The technique which was used could also be applied to determine the effect of other dimensions such as race, parental education and employment status or location on the child poverty rate. This would be a valuable area for further research.

Section 4.5 decomposed the change in the annual child poverty rate between 2000-01 and 2005-06 by isolating changes in relative poverty caused by changes in the distribution of incomes and changes in the value of median income. It was found that the observed decrease in relative child poverty from 10.7% in 2000-01 to 9.3% in 2005-06 was a result, mainly, of a large decrease in absolute poverty, implying a decrease in the concentration of children in the lower tail of the income distribution over the period.

Section 4.6 examined the extent and nature of chronic poverty among Australian children, using the permanent income approach. The chronic child poverty rate was

based on a regionally tailored chronic poverty line and resulted in a measured chronic child poverty rate of 6.7% over the period. As this rate was considerably below the annual child poverty rate in any year, it implied that a substantial degree of transitory poverty existed amongst Australian children, as has been the finding of other chronic poverty studies using the duration or permanent income approaches (Hill and Jenkins 1999; Headey *et al.* 2005). By analysing in more detail the extent of overlap between the children who were identified as annually poor and chronically poor in each year, between 2000-01 and 2005-06, it was confirmed that only a limited degree of overlap exists. Of those children who were poor in any given year, only 45% were in chronic poverty. The remaining 55% of children experienced only transitory poverty. Approximately 2% of children each year were found to be living in chronic poverty though their unusually high annual RHED income indicated they were not annually poor.

The findings of this chapter, regarding the limited degree of overlap between annual child poverty and chronic child poverty in Australia has important implications for Government social policy. In view of the child poverty literature presented in the earlier chapters, the children most in need of Government welfare assistance are those in chronic poverty who are expected to suffer the most powerful and long-lasting effects from low RHED income, in terms of educational and later life outcomes. If welfare assistance is given on the basis of annual RHED income, approximately one quarter of those children who are chronically poor will miss out on necessary assistance as they are not annually poor. Meanwhile, those children who are in only transitory poverty, and are thus likely to experience little or no change in their actual standard of living, would be in receipt of welfare assistance.

A detailed investigation into the factors associated with chronic child poverty would be a valuable area for further research as this may result in more efficient targeting of Government welfare assistance. One such dimension, household structure, was examined in this chapter and revealed that children living in single-parent households have a significantly higher rate of chronic poverty compared with those in couple-parent households (Section 4.6.7). Further research in this area could focus on identifying those factors which are uniquely associated with the incidence of chronic poverty. These factors may be unlike those associated with annual poverty, thus leading to more efficient welfare targeting. Suggested dimensions for analysis include parental education and employment status, race and geographical location.

The following chapter examines, in detail, the effect of family permanent income on a child's probability of completing secondary schooling or trade qualifications. This area is highlighted as one of the dimensions whereby chronic child poverty is transmitted to poor outcomes in later life. Education is also one of the vital mechanisms for breaking the cycle of intergenerational poverty.

5. The Effect of Family Income on Completed Schooling

5.1. Objective of the Regression Analysis

The objective of this chapter is to determine the effect of family income during adolescence on a student's probability of completing a minimal level of schooling. For the purpose of this thesis, a 'minimal' level of schooling is defined as Year 12 or a trade certificate. In modern Australian society, one may postulate that having completed a minimal level of schooling is essential to function as an adult. This is because Year 12 completion, or completion of a trade certificate, improves one's chances of securing employment in adulthood and substantially increases one's earnings (Leigh 2008), making it less likely that a person will fall into poverty. These justifications for completing a minimal level of schooling reflect the ideology of human capital as a valuable resource or commodity. However, education and a minimum level of schooling are also worthwhile from a broader, 'capability' perspective as it enables one to read, communicate, argue and make decisions in a more informed way (Sen 1997, p1959). Sen (1997, p1960) argues that education is a human capability, rather than merely human capital, which allows one to live a different 'type' of life.

In conclusion, attaining a minimal level of schooling is an important part of an individual's adulthood in Australian society, not only because it improves his or her chances of securing employment and an acceptable income, but also because it gives a person the freedom to direct his or her own life and achievements (Sen 1997, p1959). Therefore, this chapter focuses on an adolescent's achievement of a minimal level of

schooling as it represents a capability to which every member of Australian society is entitled.

Section 5.2 briefly introduces the methodology used in this chapter to model the binary response outcome. Section 5.3 develops the model of minimal schooling in detail, based on consumer optimisation theory and relates this to the latent variable commonly used in probit modelling. This section also develops the author's hypothesis, introduces the regression sample and discusses the variables which are used. Descriptive statistics are presented for the included variables in Section 5.3.4.

Section 5.4 presents the statistical results for the main sample of students and also some preliminary sensitivity analysis. The marginal effects are then examined (Section 5.5) along with more detailed sensitivity and diagnostic analysis (Section 5.6). Finally, the conclusions from the regression analysis are summarised in Section 5.7.

5.2. Methodology

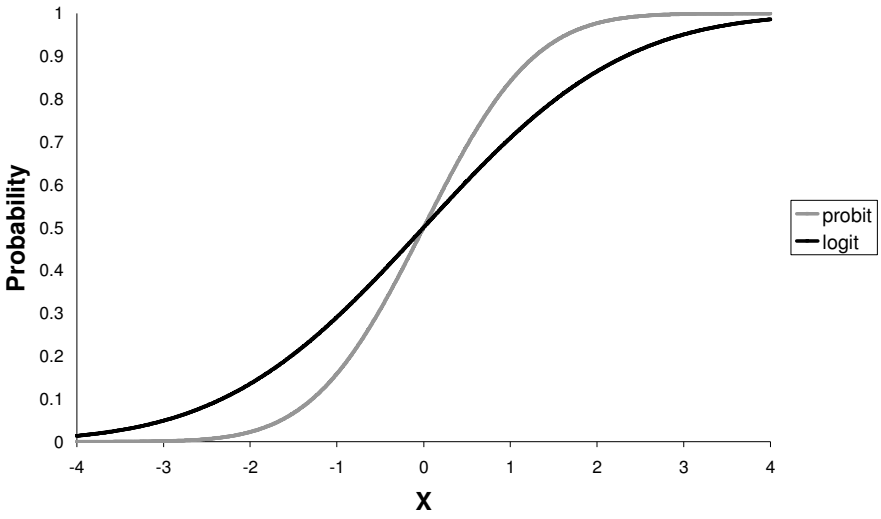
5.2.1. Modelling Binary Response Variables

The dependent variable of interest in this chapter is the decision to complete a minimal level of schooling, which has only two possible outcomes: either completed or not completed. The dependent variable is, therefore, binary or dichotomous and a probability model must be used. Three such models are commonly used in empirical literature: the linear probability model, the logit model and the probit model. For the reasons discussed herein, the probit model is used for all regression analysis in this thesis.

The linear probability model is the simplest technique, though it suffers from a number of shortcomings, most notably that the predicted values of the dependent variable are not limited between zero and one and hence may result in nonsensical probability predictions. Furthermore, the marginal effects from the linear probability model imply that regardless of the level of the independent variable, a unit change in any explanatory variable will always produce the same change in the probability of a successful outcome. In the present case, there are strong *a priori* reasons to expect that a given change in permanent RHED income will affect a child living in a poor household differently to a child living in a rich household, in terms of educational outcomes. Thus, the linear probability model is not appropriate.

The logit and probit models, however, by utilising the s-shaped cumulative distribution function, overcome the two problems. Firstly, the predicted values of the dependent variable are bounded between zero and one and secondly, the probability of a successful outcome is non-linearly related with the independent variables. The difference between the logit and probit models lies in the assumption of the error variance: the logit model assumes that the errors are logistically distributed, whereas the probit model assumes that the errors are normally distributed. Figure 5.1 presents the cumulative distribution functions for both the logistic and standard normal (probit) distributions.

Figure 5.1 Cumulative Distribution Functions



The standard normal distribution has a variance of one, whereas the logistic distribution has a variance equal to $\pi^2/3$, which is greater than one. This causes the logistic distribution to have slightly "fatter" tails.

Gujarati (2003, p614) states that in most applications, the logit and probit models are quite similar and there is generally no "compelling reason" to prefer either distribution. The only subtle difference is the shape of the cumulative distribution which causes the coefficient estimates to differ slightly between the two methods, such that the logit coefficients are approximately 1.81 $\left(\approx \pi/\sqrt{3}\right)$ times the magnitude of the probit coefficients. Long (1997, p50) draws particular attention to the fact that whilst the estimated coefficients are affected by the arbitrary assumption of the variance of the error term, the probabilities estimated from either a probit or logit model are unaffected. Consequently, he states, "the probabilities can be interpreted without concern about the arbitrary assumption that is made to identify the model," (Long 1997, p50). Typically, researchers will use the logistic distribution as the coefficient estimates are relatively

easier to interpret. However, in this thesis, the probit model is used, on the assumption that the errors follow the normal distribution.

5.2.2. Probit Specification and Diagnostics

The development of a probit model specification, based on the latent variable approach is presented in Appendix F, which also contains an outline of the econometric assumptions underlying the model. As explained in Appendix F, the probit model cannot be estimated using ordinary least squares and therefore, a detailed explanation of the maximum likelihood technique used to estimate the probit model is also presented in the Appendix. Lastly, the method of interpreting the marginal coefficients is explained in the context of a probit model and the goodness-of-fit statistics appropriate for binary choice models are presented.

5.3. The Model of Minimal Schooling

5.3.1. Hypothesis Development

This section develops the empirical model to be estimated in the context of the utility maximisation approach, focussing on the *student's* maximisation decision. This can be contrasted with the work of Becker and Tomes (1986), which views a child's educational attainment as a passive response to the human capital investments made by parents throughout childhood (Ermisch and Francesconi 2001, p138). My approach is based on the nature of the decision to complete Year 12 or a trade certificate. Unlike the decision to complete a lower level of education, the decision to complete Year 12 or a trade certificate is typically made by the student. Therefore, parents' human capital investment or neighbourhood characteristics play a secondary role by influencing the student's decision.

Assume the individual student faces a decision between completing a minimal level of schooling (option A), and dropping out of school without completing a minimal level (option B). The indirect utility derived from each decision is given by (Kennedy 2008, p247):

$$U_A = \alpha_A + \beta_{1A} x_1 + \beta_{2A} x_2 + ... + \beta_{KA} x_K + \varepsilon_A$$
$$U_B = \alpha_B + \beta_{1B} x_1 + \beta_{2B} x_2 + ... + \beta_{KB} x_K + \varepsilon_B$$

where $x_k \ \forall k = 1,2,...K$ represents K explanatory variables which affect the indirect utility derived from the education decision. These include social, familial and individual background characteristics. The i subscripts have been dropped for notational simplicity.

The student chooses to complete a minimal level of schooling only if the indirect utility derived from deciding to complete exceeds that derived from dropping out. That is, a student will maximise their utility by choosing to complete a minimal level of schooling only if:

$$U_A - U_B > 0$$
$$\alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_K x_K + \varepsilon > 0$$

where the simplified coefficients represent the difference in the parameters from both indirect utility functions. This function is the latent variable index reflecting the individual's propensity to complete a minimal level of schooling. The observed outcome depends on whether or not the individual's latent index exceeds the threshold value of zero.

The probability that student *i* chooses to complete a minimal level of schooling is given by the probability that the indirect utility derived from completing exceeds that of dropping out or, equivalently, the probability that $\alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_K x_K + \varepsilon > 0$. The importance of the error term in the latent variable specification now becomes clear. The probability that a successful outcome is observed is given by the probability that:

$$\varepsilon > -(\alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_K x_K)$$

The probit model assumes that the error term is normally distributed and therefore, the probability of a successful outcome is equivalent to the probability that:

$$\varepsilon \leq \alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_K x_K$$

The probability that person *i* chooses to complete a minimal level of schooling is thus determined by whether the individual's error term is large enough to produce an index which is greater than zero (Kennedy 2008, p243). If individual *i* has a large index value, based on the value of all other explanatory variables, virtually any error term would result in an index value greater than zero. Hence, there is a high probability that the student chooses to complete a minimal level of schooling. In contrast, if a student has a very low index value, they would require an unusually high error term in order to complete. Thus, the student would have a very low probability of completing a minimal level of schooling.

The factors which are used in the specification of the latent variable are those which, based on theoretical and empirical literature, are expected to affect the individual's indirect utility from completing a minimal level of schooling. Based on the literature discussed at 3.2, the variables chosen to be included in the model included permanent RHED income, gender, race, parent's education, neighbourhood advantage and

disadvantage and household wealth. The specification of the model, and the manner these variables are introduced into the model, is discussed below.

5.3.2. The Data

The regression model in this chapter is based on data from the HILDA Survey. However, a different sample of individuals to that used in the previous chapter is used, in order to focus the analysis on school leavers. Data is used from six waves, from 2000-01 to 2005-06.

5.3.3. The Sample

Most students in Year 12 are aged 17 or 18 years old, while the majority of those who leave school to pursue a trade qualification do so at age 15 to 16 years. With this in mind, the main sample used for the regression analysis consists of individuals aged 17, 18 and 19 years at the end of 2005-06. This ensures that the schooling level attained for most sample members is known with certainty, whilst also allowing sufficient years of household income data during adolescence to be used in the calculation of permanent RHED income.

A minority of students aged 17 and 18 years are still studying in Years 10 or 11 in Wave 6. It is not possible to determine whether these students will complete a minimal level of schooling. The students are therefore excluded from the main regression sample. However, they are included as part of a smaller sample of students, aged 17 and 18 years in 2005-06, for the purpose of sensitivity analysis.

The main sample of students is taken from the balanced panel as permanent RHED income, the focus variable, requires that annual RHED income is known in all years. Initially, this resulted in a sample of 594 students, consisting of 229 17-year olds, 191

18-year olds and 174 19-year olds. However, the sample was further reduced due to missing education data[18] and to ensure permanent income during adolescence reflected only family income.[19] The remaining sample consisted of 209 17-year olds, 182 18-year olds and 167 19-year olds: a total of 558 students. Students who were still studying in Year 11 or below in Wave 6 were then excluded[20] leaving a total sample of 503 students: 160 17-year olds, 176 18-year olds and 167 19-year olds.

Based on the literature reviewed earlier, there are reasons to expect that many of the explanatory variables chosen for this analysis will be closely related. For example, parental education and permanent RHED income are expectedly correlated, as are household income and relative advantage and disadvantage in the student's neighbourhood. This potential multicollinearity may cause the estimated coefficients to exhibit large variance. To overcome this potential problem, the approach taken in this thesis is to use a sample which is as large as possible, thereby incorporating as much variation in the data as possible. Students aged 17, 18 or 19 years in Wave 6 are combined, notwithstanding that some students, aged 17 and 18, needed to be dropped as their outcome was unknown and there was limited data available to calculate permanent RHED income during adolescence for students aged 19. For the purpose of sensitivity analysis, two smaller samples are considered: 17 and 18-year olds including students still studying and 18 and 19-year olds in 2005-06.

[18] Fourteen 17-year olds, five 18-year olds and four 19-year olds were dropped as they had not reported their education level in Waves 5 or 6.
[19] Six 17-year olds, four 18-year olds and three 19-year olds were dropped as they were living as sole persons or with a partner during their 'adolescent' years, as defined in the following section.
[20] 49 17-year olds and six 18-year olds were excluded.

5.3.4. The Variables

Completed Schooling

The dependent variable of interest was whether or not a student had completed a minimal level of schooling. As stated previously, this is defined as having completed Year 12 or a trade certificate, specifically a Certificate III or IV or Diploma. Completing a trade certification is assumed to be equivalent to completing formal secondary schooling, as Vocational Education and Training courses have been associated with greater labour market success (Curtis 2008) which is closely related with adult income.

A student who has left school having completed a minimal level of schooling, is classified as a 'success' (MINSCHOOL=1). Those who had left school but who had not completed a minimal level of schooling are classified as drop-outs (MINSCHOOL=0). Individuals who were still studying in Year 12 in Wave 6 are classified as 'successes' (MINSCHOOL=1) as the HILDA survey is generally carried out in the latter part of the year, in particular, from September to November (Watson 2008, p114), and it is highly unlikely that these students would not finish the school year.

For the purpose of sensitivity analysis, the students still studying in Year 11 or below in Wave 6 were classified as 'successes,' as it was reasonable to expect they could complete a minimal level of schooling within the following two years. This supposition was confirmed by analysing a sample of individuals aged between 19 and 22 years in Wave 6 who were still studying in Years 10 or 11 at age 17. The majority of these students went on to complete a minimal level of schooling within the next two years.

A breakdown of the completed levels of schooling is provided at Appendix E, Table 12.1.

Excluding those students still studying in Year 11 and below, 26.0% of the sample did not complete a minimal level of schooling. If one includes those students still studying in Year 11 or below, assuming they do complete a minimal level of schooling, the drop-out rate for the sample is reduced to 23.5%.

Permanent Income

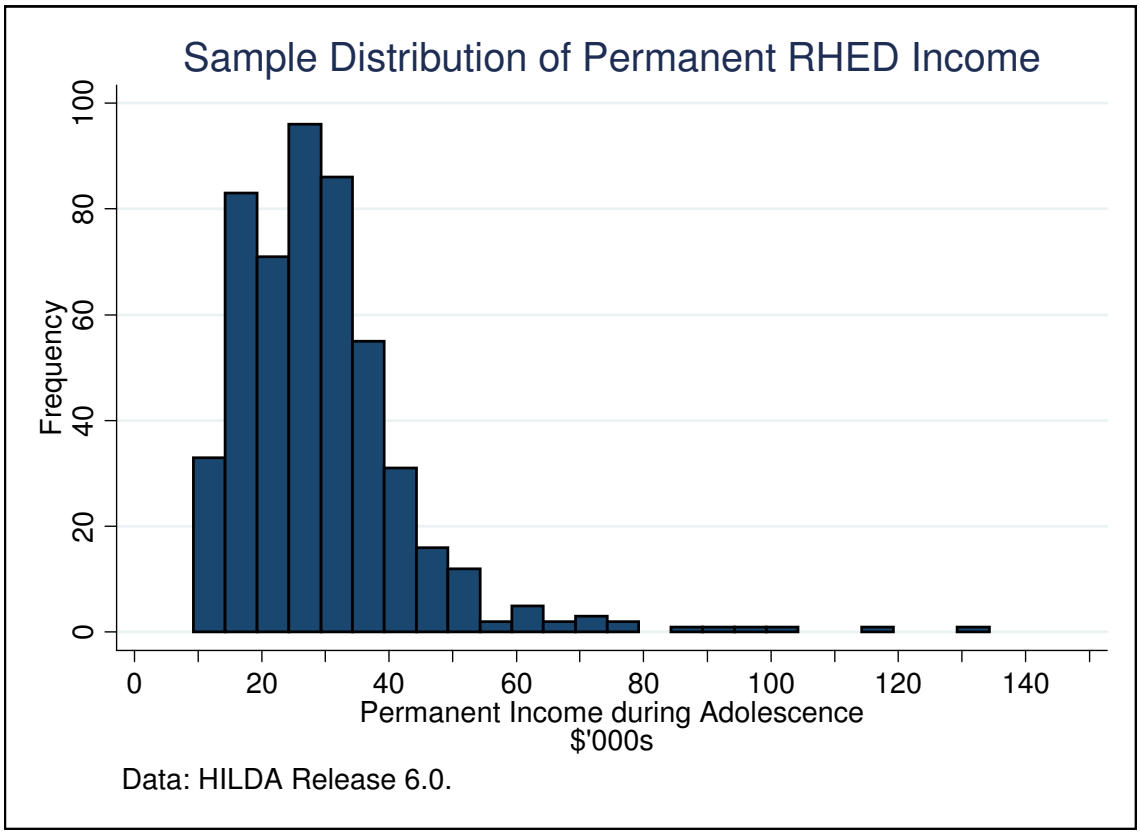
Permanent RHED income was calculated using the student's annual RHED income during their adolescence. For students aged 17 and 18 years in Wave 6, this included four years of data, from the years the student was aged 13 to 16 years. For students aged 19 years in Wave 6, only three years of income data was used covering ages 14 to 16 years. Permanent RHED income was calculated using the procedure outlined in Appendix D, Section 11.1, using the interest rates from the appropriate years.

The decision to calculate permanent RHED income based only on those adolescent years prior to age 17 years ensured that it was strictly exogenous with respect to the decision: whether to complete a minimal level of schooling. If annual RHED income were used from any year after the student had decided, they would likely be contributing to household income, causing a feedback effect from the 'dependent' variable to the regressors known as the problem of endogeneity.

Figure 5.2 presents the sample distribution of permanent RHED incomes. Most students had permanent RHED income of less than $50,000. However, two students' permanent RHED income was in excess of $110,000 and one in particular had permanent RHED

income greater than $150,000. Both students could potentially bias the regression estimates and thus, the model is re-estimated after excluding these observations for sensitivity analysis.

Figure 5.2 Permanent Income 17, 18 and 19 year-old Sample



To account for the expected non-linear relationship between permanent RHED income and the probability of completing a minimal level of schooling (Duncan *et al*. 1998, p414), the natural log of permanent RHED income is used.

Gender

Gender is expected to have a significant impact on a student's probability of completing a minimal level of schooling, with girls being more likely to complete. Thus, a dummy variable was included to control for gender, where the reference case was male. The distribution of boys and girls in the sample was relatively equal as shown in Table 5.1.

Table 5.1 Gender of Sample Members

Gender	Age in Wave 6			Total
	17 years	18 years	19 years	
Girl	72	96	83	251
Boy	88	80	84	252
Total	160	176	167	503

Race

Race is also expected to have a significant effect, and hence, a dummy variable is included which equalled one if the child was Aboriginal and/or Torres Strait Islander, based on data from Waves 5 and 6. The reference case, therefore, was a non-indigenous child. A small number of students were not asked their race and further investigation revealed they were born overseas. These 33 individuals were classified as non-indigenous.

Only 20 students in the sample were Aboriginal or Torres Strait Islander, representing 4.0% of the sample. The permanent RHED income of Aboriginal students in the sample was significantly below that of non-Aboriginal students, at the 1% significance level.

Parent's Education

Relying on the economic and socialisation theories, specifically the human capital investment model and Mayer's (1997) "good parent" and other role model theories, parent's education is expected to have a significant impact in determining a child's completed schooling. Since parent's education, like the child's, is observed at discrete intervals, it was also included using dummy variables.

The estimated models include separate variables for father and mother's education. Father's highest level of education is divided into three categories: either the father had completed or was attending university, had completed a trade certificate or diploma or his highest level of education was anything other than university or a trade certificate.

The last category represents the reference case and includes fathers whose highest level of education is high school. Regarding mother's education, a dichotomous dummy variable is used, where the mother's highest level of education is having completed at least Year 12 or not having completed at least Year 12. The mother's education was divided into only two categories to ensure sufficient variation in the data, as only a small number of students had mothers who were university educated.

Data on the parent's highest level of education was taken from a number of sources. Primarily, data were sourced from the parent's own responses to HILDA questionnaires. Parent's education data was matched with their children using the appropriate identifiers. The parent's most recently reported level of education was used. In the case that a parent had not reported their highest level of education in any of the years, the child's own report of their parent's highest qualification was used. For example, this method was used if the parent was not living with the child in any of the six years and therefore did not complete any questionnaires. It is acknowledged that using the child's own account of their parent's education may not be the most accurate method. However, the effect of parent's education on a child's probability of completing a minimal level of schooling is transmitted through the creation of a role model. Therefore, a child's perception of their parent's education is indicative of this effect.

Table 5.2 presents the distribution of parent's education among students in the sample. Approximately one-third of children in the sample have a father who has attended or completed a university course whilst 40% of children in the sample had a father whose highest level of education was a trade Certificate or Diploma. Over 60% of children in the sample had a mother who had completed at least Year 12.

Table 5.2 Parent's Highest Level of Education

Father	
University	157
Trade Certificate/Diploma	182
Other than University or Trade Certificate	164
Total	503

Mother	
Year 12 or Higher	320
Less than Year 12	183
Total	503

Neighbourhood

As discussed at 3.2, neighbourhood infrastructure or resources and neighbourhood role models play a large role in determining a child's completed schooling. These factors are included in the estimation model using the ABS Socio-Economic Index for Areas 2001 (ABS Cat. No. 2039.0, 2003). Four neighbourhood indices are available pertaining to relative socio-economic disadvantage, relative socio-economic advantage and disadvantage, neighbourhood economic resources and neighbourhood education and occupation.

In the estimation model, the Index of Relative Socio-economic Advantage and Disadvantage is used as it has the most broad coverage of all indices and best proxies the transmission of neighbourhood characteristics onto the decision to complete a minimal level of schooling. The index incorporates information on neighbourhood education such as the proportion of adults with a degree or higher qualification, the proportion of persons aged over 15 years attending university or other tertiary education institution and the proportion of adults with no qualifications (ABS Cat. No. 2039.0, 2003, p22). The index also includes information on the occupational status of those in the neighbourhood, such as the proportion of working adults classified as 'professionals,' 'associate professionals,' 'tradespersons' and 'labourers' among other categories, and the unemployment rate for both genders within the neighbourhood (ABS Cat. No. 2039.0, 2003, p22). Furthermore, it contains information on the socio-

economic demographics of the neighbourhood such as the distribution of incomes within the neighbourhood and the rate of single-parenthood.

It is expected that the degree of relative socio-economic *advantage* present in one's neighbourhood will be positively correlated with permanent RHED income. This has been well documented by Duncan and Brooks-Gunn (2000) and Jensen and Seltzer (2000). Both find that household income is a large determinant of how a society self-segregates into particular neighbourhoods. However, the index incorporates many other factors apart from household income, such as the educational and occupational attainment and income of other role models in the neighbourhood. Hence, it is more encompassing and is expected to affect a child's schooling decisions, independent of permanent RHED income.

The SEIFA 2001 Index used in this thesis was computed by the ABS based on data from the 2001 Census of Population and Housing. Households are classified into deciles, with the lowest decile representing a neighbourhood which is, relatively, most disadvantaged. For the purposes of this thesis, SEIFA was treated as a categorical variable and was represented by three dummy variables, namely low, middle and high ranked neighbourhoods. If a child lived in a suburb which was in one of the three lowest deciles of relative socio-economic advantage and disadvantage, implying that their suburb was highly disadvantaged, they were categorised as living in a 'low' neighbourhood. Children living in neighbourhoods in the highest, or most advantaged, three deciles were classified as living in a 'high' neighbourhood. Those living in deciles four to seven were treated as the reference case and categorised as living in a 'middle' index neighbourhood. To accommodate those students who moved location, each

student was assigned to a neighbourhood category based on whether they most often lived in a low, middle or high index neighbourhood during the six years. In the case that a student lived equally in two neighbourhood categories, they were classified as having lived in the higher of the two.

The sample distribution of children among low, middle and high SEIFA suburbs was approximately equal as shown below in Table 5.3.

Table 5.3 Sample Distribution of Index of Relative Socio-Economic Advantage and Disadvantage

	Frequency
Low	157
Mid	183
High	163
Total	503

In order to determine the sensitivity of neighbourhood estimated effects, the probit model was re-estimated using two other socio-economic indexes for areas: the Index of Economic Resources and the Index of Education and Occupation.

The Index of Economic Resources is calculated primarily on the proportion of high-income and low-income families of different structures in the neighbourhood (ABS Cat. No. 2039.0, 2003, p23). Again, neighbourhoods are divided into deciles, and for the purpose of this analysis, were classified into 'low', 'middle' and 'high' economic resource neighbourhoods as done for the Index of Relative Advantage and Disadvantage. The distribution of students among low, middle and high economic resource neighbourhoods is approximately equal, as shown in Table 5.4.

Table 5.4 Sample Distribution of Index of Economic Resources

	Frequency
Low	148
Mid	205
High	150
Total	503

The Index of Education and Occupation is calculated based on the proportion of adults in the neighbourhood who are employed in a variety of occupational fields, the proportion with high and low levels of educational attainment and the employment rate for either gender (ABS Cat. No. 2089.0, 2003, p24). Suburbs were again classified into 'low', 'middle' and 'high' categories based on their decile of education and occupation. The distribution of sample members among low, middle and high 'education and occupation' neighbourhoods is again relatively equal as presented in Table 5.5.

Table 5.5 Sample Distribution of Index of Eduction and Occupation

	Frequency
Low	163
Mid	183
High	157
Total	503

Wealth

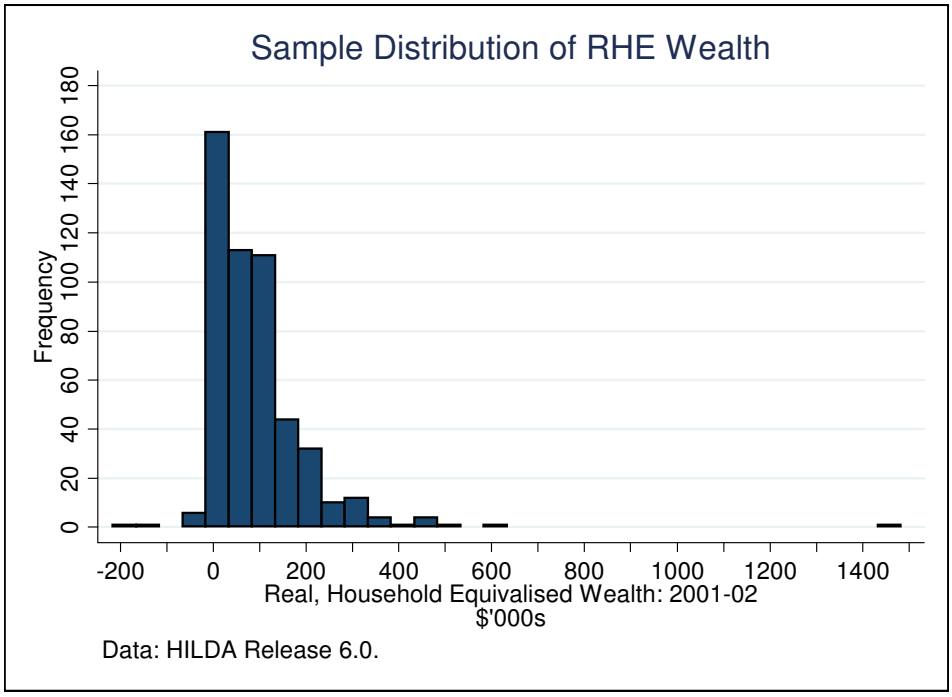
Wealth, as measured by real, own home equity in 2001-02 has been included as an explanatory variable in some of the estimated models. This variable is calculated as the current value of the main home less the value of current mortgages and other debts owed by the household (MIAESR 2008b, pD52). Real household equity was also transformed into $2005-06 real dollars, and equivalised using the OECD equivalence scale, to allow a comparison between adolescents living in households of different size and structure. It is hereafter referred to as real, household equivalised wealth, or RHE wealth.

In the sample, only ten students lived in households where RHE wealth was negative and of these, only two students lived in households with household debt in excess of $50,000 per adult equivalent. Approximately 24% of students in the sample lived in households with zero RHE wealth.

In order to take account of the expected non-linear relationship between RHE wealth and the probability of completing schooling, the natural log of RHE wealth is used. This is considered to be zero for students whose household wealth is non-positive. The correlation between log of permanent RHED income and log of RHE wealth is equal to 0.31 for the sample of 503 students.

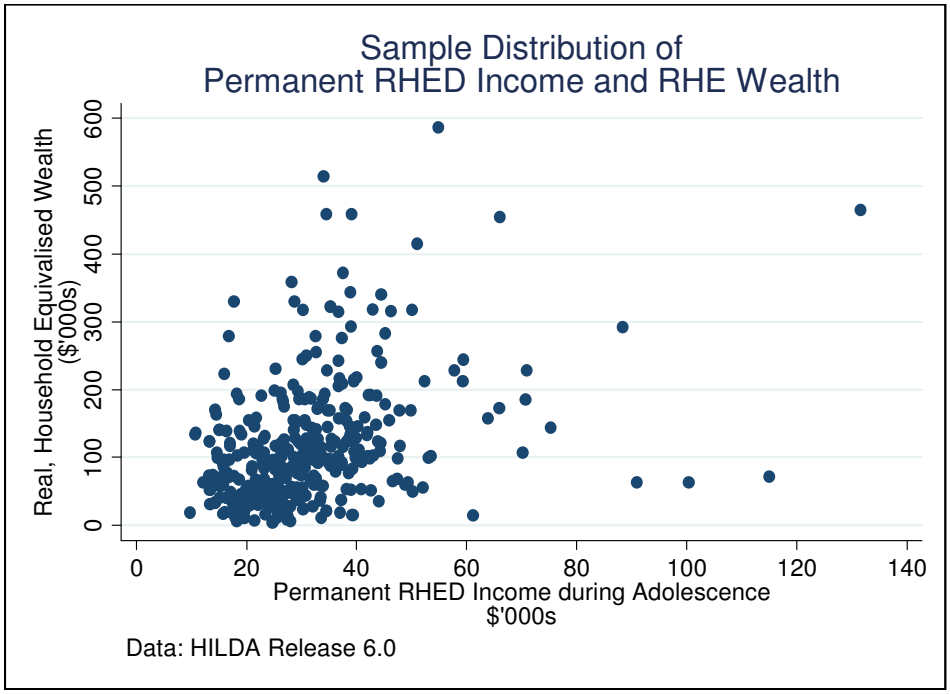
Figure 5.3 presents the distribution of RHE wealth among students in the sample. Most students live in households with RHE wealth of less than $150,000. One student in the sample is considered an outlier as his equivalised household wealth is greater than $1,400,000. To determine the sensitivity of the estimates to this observation, the regression model is re-estimated after excluding this student. Note that the student whose RHE wealth is a large negative value is not considered an outlier as log of RHE wealth is used in the regression model and is considered to be zero for all those with non-positive household wealth.

Figure 5.3 Sample Distribution of Real, Equivalised Household Wealth



After excluding the outlying student as well as those whose RHE wealth is negative or zero, Figure 5.4 shows that a weak, positive relationship exists between permanent RHED income and RHE wealth. The correlation between log of RHE wealth and log of permanent RHED income for this sample of 378 students is equal to 0.36.

Figure 5.4 Sample Distribution of Permanent Income and Wealth



Excluded variables

Three variables which were highlighted in the literature as important determinants of a student's probability of completing schooling were not included in the regression analysis for the purpose of this thesis.

Firstly, parent's employment status, particularly father's employment during adolescence, is regarded as an important influence a student's completed schooling. However, only a small minority of fathers in the sample were unemployed during the students' adolescence causing any estimates to be unreliable. Furthermore, the employment status of both parents is expected to be closely correlated with parental education and inclusion of both variables may amplify the problems of multicollinearity, including large estimator variances.

Secondly, the welfare transmission hypothesis suggests that children living in households which are working poor are less adversely affected by low income, compared with children living in welfare-dependent poor households (Haveman, Wolfe and Spaulding 1991, p135). The HIDLA dataset does contain information on household welfare receipts, making it possible to carry out such analysis. However, this is left as an area for future research, as the focus of this thesis is the effect of permanent RHED income itself on a student's probability of completing a minimal level of schooling.

Lastly, family type or parental marital status may affect a student's completed schooling. However, Kornberger (1999, p22) states that the estimated effects have been mixed and, "the negative relationship between child development and single-parent status can largely be attributed to the lower incomes of single mothers relative to two

parent families." Household type, therefore, is not included as an independent explanatory variable.

5.3.5. Model Specification

The utility model estimated in Section 5.4 is based on the latent variable specification discussed previously, and the variables highlighted by the literature as significant transmission mechanisms between a student's background characteristics and educational attainment.

The structural specification of the estimated model is:

$$P(MINSCHOOL_i = 1) = \Phi\begin{bmatrix} \alpha + \beta_1(LOGPERMINC) + \beta_2(GIRL) + \beta_3(INDIG) \\ \quad + \beta_4(F\_UNI) + \beta_5(F\_TRADE) + \beta_6(M\_YR12) \\ \quad + \beta_7(LOW\_AD) + \beta_8(HIGH\_AD) \end{bmatrix}$$

where *LOGPERMINC* is the natural log of permanent RHED income, *GIRL* and *INDIG* are dummy variables for gender and race respectively, *F_UNI, F_TRADE* and *M_YR12* are parental education dummy variables and *LOW_AD* and *HIGH_AD* represent the neighbourhood categories of relative disadvantage and relative advantage, respectively.

The focus in estimating this model is to examine the separate and combined effects of individual, familial and neighbourhood characteristics on a child's decision to complete a minimal level of schooling.

The estimation procedure is carried out by sequentially including sets of variables in order to examine the sensitivity and robustness of the parameters. Initially, the variable of most interest in the present thesis, permanent RHED income, is used with dummy variable controls for gender and race (Model I). Secondly, parent's highest level of

education is introduced (Model II). Finally, the relative advantage and disadvantage in the child's neighbourhood is also included (Model III). Using the likelihood ratios from these estimated models allows one to determine whether the additional sets of variables significantly add to the explanatory power of the model, using the restricted log likelihood statistic.

Based on the theoretical and empirical literature discussed at 3.2, one expects the variables to have coefficients with the following signs:

Table 5.6 Expected Coefficient Signs

Variable	Expected Sign
LOGPERMINC	+
GIRL	+
INDIG	-
F_UNI	+
F_TRADE	+
M_YR12	+
LOW_AD	-
HIGH_AD	+

In order to evaluate whether parental education has differential effects on students depending on their gender, interaction effects were then included in the estimation model. In theory, interaction terms could be included for each category of parental education, such that Model IV is represented as:

$$P(MINSCHOOL_i = 1) = \Phi\begin{bmatrix} \alpha + \beta_1(LOGPERMINC) + \beta_2(GIRL) + \beta_3(INDIG) \\ + \beta_4(F\_UNI) + \beta_5(F\_TRADE) + \beta_6(M\_YR12) \\ + \beta_7(F\_UNI * GIRL) + \beta_8(F\_TRADE * GIRL) \\ + \beta_9(M\_YR12 * GIRL) + \beta_{10}(LOW\_AD) + \beta_{11}(HIGH\_AD) \end{bmatrix}$$

Interaction terms are only included, however, for those categories of parental education which are found to be significant based on the previously estimated models. If a mother's education has a stronger effect on their daughters, one would expect β_9 to be positive and significant. Furthermore, if father's education has a stronger effect on their

sons, one expects β_7 and β_8 to be negative and jointly significant. However, we have no *a priori* expectation about the sign of these coefficients.

Lastly, the natural log of household RHE wealth was introduced into the model (Model V) and it is expected to positively influence the probability of completing a minimal level of schooling:

$$P(MINSCHOOL_I = 1) = \Phi\begin{bmatrix} \alpha + \beta_1(LOGPERMINC) + \beta_2(GIRL) + \beta_3(INDIG) \\ + \beta_4(F\_UNI) + \beta_5(F\_TRADE) + \beta_6(M\_YR12) \\ + \beta_7(F\_UNI * GIRL) + \beta_8(F\_TRADE * GIRL) \\ + \beta_9(M\_YR12 * GIRL) + \beta_{10}(LOW\_AD) + \beta_{11}(HIGH\_AD) \\ + \beta_{12}(LOGWEALTH) \end{bmatrix}$$

All the models estimated have used Huber (1967) and White (1980, 1982) robust standard errors (StataCorp 2007, pp268-9).

5.4. Statistical Results

The statistical results for the probit model are presented below. Firstly, the results for the main sample of students, aged 17, 18 and 19 years in Wave 6 are discussed. Sensitivity analysis is then conducted using different SEIFA indices of neighbourhood characteristics and after excluding the outlying students in terms of permanent RHED income and RHE wealth. The marginal effects for the explanatory variables, based on these estimates, are then presented.

Secondly, sensitivity analysis is conducted on two smaller samples of students: one sample based on students aged 17 and 18 years in 2005-06 and another sample based on students aged 18 and 19 years in 2005-06. These results are discussed and compared with the results for the combined sample.

5.4.1. Primary Results

Table 5.7 Probit Results for the Combined Sample

Dependent Variable = Completed Minimal Level of Schooling					
	Model I	Model II	Model III	Model IV	Model V
Constant	-5.9248***	-3.7239**	-1.6901	-1.7637	-1.2725
LOGPERMINC	0.6312***	0.3729**	0.1798	0.1900	0.1137
GIRL	0.3898***	0.3987***	0.4159***	0.4519**	0.5132***
INDIG	-0.8349***	-0.6919**	-0.6462**	-0.6717**	-0.5448*
F_UNI		0.6496***	0.5285***	0.5948***	0.5583***
F_TRADE		0.0934	0.0705		
M_YR12		0.3613***	0.3461***	0.3247*	0.3418*
F_UNI*GIRL				-0.2373	-0.2100
M_YR12*GIRL				0.0348	-0.0421
LOW AD/DIS			-0.3191**	-0.3283**	-0.3022**
HIGH AD/DIS			0.3064*	0.3041*	0.3058*
LOGWEALTH					0.0316**
Wald χ^2	34.73	50.83	62.95	64.96	72.65
Prob > χ^2	0.00	0.00	0.00	0.00	0.00
Log Likelihood	-271.29	-257.56	-251.58	-251.43	-248.64
Pseudo R^2	0.0629	0.1104	0.1310	0.1316	0.1412
N	503	503	503	503	503

Legend: * p<0.1; ** p <0.05; *** p<0.01

Models I, II and III

Initially, when permanent RHED income is included, with only controls for gender and race, it appears to have a positive and highly significant impact on a student's probability of completing a minimal level of education (Model I). Overall, the model is highly significant, based on the Chi-square statistic. As expected, girls, and students who are not indigenous, are significantly more likely to complete a minimal level of schooling.

The effect of permanent RHED income is substantially reduced, however, as parent's education and neighbourhood characteristics are introduced. When parent's highest level of education is taken into account, the coefficient of permanent RHED income almost halves, though it continues to have a positive effect which is significant at the 5% level (Model II). The effect of gender and race remain significant and stable.

In Model III, neighbourhood characteristics are taken into account and this causes the permanent income coefficient to be reduced substantially, to less than half its value in Model II. The permanent income parameter remains positive though it is no longer significant at the 10% level. The dummy variables used to represent the relative advantage and disadvantage in the student's neighbourhood are both independently and jointly significant, and exhibit the *a priori* expected signs. In this sense, the explanatory power previously assumed by permanent RHED income has been absorbed by the neighbourhood variables. Model III, therefore, shows that the effect of permanent RHED income on a student's probability of completing a minimal level of schooling is transmitted, to a considerable degree, through its effect on segregating families and households into different neighbourhoods. Living in a high-income family positively affects a student's probability of completing schooling: firstly, because it allows for increased human capital investment, and secondly, because it encourages the family to live in relatively advantaged suburbs where resources and successful role models are more prevalent. The opposite effect occurs for students living in low-income households, as evidenced by the negative and significant effect of 'low' advantage and disadvantage in the neighbourhood. Model III shows that the latter neighbourhood effect is just as, if not more, important than permanent RHED income in influencing a student's decision to complete a minimal level of schooling.

As expected, higher levels of parental education are positively associated with a student's probability of completing a minimal level of schooling (Model II). Students whose father has attended or completed a university qualification are significantly more likely to complete a minimal level of schooling, compared with those students whose father's highest qualification is other than university or a trade Certificate. Similarly,

there is a positive effect on the student's probability of completing if their father holds a trade Certificate, though this effect is not significant. Students whose mother has completed at least Year 12 are also significantly more likely to complete, relative to students whose mother has not completed at least Year 12. This effect is significant at the 1% level. Based on a restricted log likelihood statistic, the parental education variables are jointly significant at the 1% level,[21] which is consistent with the findings in both the theoretical and empirical literature. For example, the positive estimated effect supports both the human capital investment and role model theories discussed at 3.2.1. The positive and significant effect of parental education remains as neighbourhood characteristics are included (Model III). Furthermore, the parameter estimates for father's university qualification and mother's Year 12 completion remain stable and significant at the 1% level, implying that the estimates are robust.

As stated above, the relative advantage and disadvantage present in a student's neighbourhood are also significant in predicting his or her probability of completing a minimal level of schooling (Model III). The parameters conform to their expected signs and are independently significant, at least at the 10% level, implying that neighbourhood resources and role models have a significant effect even after controlling for permanent RHED income. The neighbourhood variables are also jointly significant at the 1% level.[22]

The inclusion of parental education and neighbourhood characteristics also substantially improved the overall performance of the model. Firstly, the pseudo R^2 statistic increased by approximately 75% when parental education was introduced (Model II)

[21] $\lambda = -2(-271.29 - (-257.56)) = 27.46 \sim \chi_{(df=3,\ \alpha)}$

[22] $\lambda = -2(-254.56 - (-251.58)) = 11.96 \sim \chi_{(df=2,\ \alpha)}$

and a further 19% when neighbourhood variables were included (Model III). Note that the pseudo R^2 is not adjusted for the number of included variables. Secondly, the overall count R^2 of the model improved from approximately 74.8% for Model I to 75.6% for Model II and further increased to 76.3% for Model III. The model performance, as determined by the proportion of correct predictions, improved most considerably for non-completers,[23] whilst the rate of correct prediction for completers remained relatively similar.[24] The count R^2 for all three models was greater than the naïve prediction (=73.8%). Lastly, both the parental education and neighbourhood sets of variables were jointly significant based on the restricted log likelihood statistic, as mentioned previously. These factors indicate that the models, particularly those which include parental education and neighbourhood characteristics, are performing relatively well.

Model IV

Based on the results from Models II and III, interaction terms were introduced for father's university education and mother's Year 12 completion, interacted with student's gender. An interaction term was not used for father's whose highest qualification was a Trade Certificate as this resulted in no significant difference relative to father's who were in the reference case, based on the results from Models II and III.

Introducing the interaction terms between parent's education and student's gender (Model IV), suggests that father's university education has a stronger effect on a son's probability of completing a minimal level of schooling than daughters, whilst mother's Year 12 completion has the opposite effect. However, these parameters were neither

[23] Model I correctly predicted 10.6% of non-completers, compared with 18.2% for Model II and 21.2% for Model III.
[24] Model I correctly predicted 97.6% of completers, compared with 96.0% for Models II and III.

independently nor jointly significant at the 10% level implying that there was no significant difference in the effect of parental education based on the student's gender. The estimated effects for father's university qualification and mother's Year 12 completion remain relatively stable as the interaction terms are introduced, and at the same time, the estimated parameters and significance levels for all other variables remained stable.

The log likelihood and pseudo R^2 for Model IV improved only marginally with the inclusion of the interaction terms. Furthermore, there was only a slight change in the model's overall count R^2 and prediction rates for completers and non-completers. Combined, these factors indicate that including the interactions terms does not significantly improve the model's performance. However, the variables are kept as they provide some additional and useful information of the relationship between parent's education and adolescent's completed schooling and, importantly, do not interfere with the estimates of other variables.

Model V

In Model V, RHE wealth is introduced, which indicates that a positive and significant effect exists between household wealth and a student's probability of completing a minimal level of schooling. The inclusion of RHE wealth again reduces the size of the permanent RHED income coefficient implying, as expected, that the variables are positively correlated. The inclusion of RHE wealth, like neighbourhood, absorbs some of the explanatory power of household income during adolescence. However, permanent RHED income continues to have a positive effect on the probability of completing schooling, though this effect is not significant at the 10% level.

Other estimates, including gender, race, parental education and neighbourhood, remain relatively stable as wealth is introduced, and remain independently significant. This indicates that the variables other than permanent RHED income are robust to the specification of the model and therefore, are reliable estimates. It is worth noting that the coefficient of the interaction term between mother's Year 12 completion and gender has changed sign and become negative, indicating that mother's Year 12 completion, like father's university qualification, more strongly impacts on a boy's probability of completing schooling. As there was no a priori expectation for the sign of the interaction terms, and the interaction terms continue not to be significant, little weight is put on this result. The models do not evidence any significant differential effect of parental education on student's probability of completing a minimal level of schooling.

Model V is chosen as the superior model, relative to the other models presented in Table 5.7, for the purpose of examining the marginal effects, for the following reasons. Firstly, Model V has the maximum log likelihood and exhibits the expected coefficient signs for those variables which had an *a priori* expected sign, based on the empirical literature. Although no adjusted R^2 statistic is available, the pseudo R^2 for Model V is substantially larger than that of any of the other four models. The count R^2 for Model V is also relatively high (=75.8%) and compared with the other models, it correctly predicts a much larger proportion of outcomes for those students who did not complete a minimal level of schooling. As presented in Table 5.8, Model V correctly predicts the outcome for 93.3% of the observed successes and 26.5% of the observed failures: giving an overall count R^2 of 75.8% which is greater than the result for the naïve prediction.

Table 5.8 Observed v. Predicted Outcomes for Combined Sample

Predicted	Observed		Total
	MINSCHOOL=1	MINSCHOOL=0	
Pr(MINSCHOOL=1)≥0.5	355	102	457
Pr(MINSCHOOL=1)<0.5	16	30	46
Total	371	132	503

For the reasons stated above, the marginal effects in Section 5.5 are based on the estimation results for Model V.

5.4.2. Alternative neighbourhood indices

The probit model was re-estimated using two alternative indicators of neighbourhood characteristics produced by the ABS (Cat. No. 2089.0, 2003): the Index of Economic Resources and the Index of Education and Occupation. The results are presented in Table 5.9.

Table 5.9 Probit Results using Alternative Neighbourhood Indices

Dependent Variable = Completed Minimal Level of Schooling				
	Index of Economic Resources		Index of Education and Occupation	
	Model IV	Model V	Model IV	Model V
Constant	-1.8470	-1.2786	-2.3186	-1.7171
LOGPERMINC	0.1912	0.1063	0.2544	0.1667
GIRL	0.4589**	0.5271***	0.4425**	0.5138***
INDIG	-0.6635**	-0.5264*	-0.6377**	-0.4982
F_UNI	0.6289***	0.5873***	0.6292***	0.5937***
M_YR12	0.3320*	0.3524**	0.3094*	0.3319*
F_UNI*GIRL	-0.2148	-0.1901	-0.2395	-0.2211
M_YR12*GIRL	0.0354	-0.0519	0.0350	-0.0546
LOW ECO. RESOURCES	-0.2214	-0.2166		
HIGH ECO. REOURCES	0.3629**	0.3599**		
LOW ED/OCC			-0.4186***	-0.4253***
HIGH ED/OCC			0.0836	0.0600
LOGWEALTH		0.0337***		0.0340***
Wald χ^2	62.55	70.35	61.25	68.23
Prob > χ^2	0.00	0.00	0.00	0.00
Log Likelihood	-252.84	-249.64	-252.25	-249.03
Pseudo R^2	0.1267	0.1377	0.1287	0.1398
N	503	503	503	503

Legend: * p<0.1; ** p <0.05; *** p<0.01

Using the Index of Economic Resources produces no sizeable change in the estimated coefficient for any of the variables apart from those used for neighbourhood characteristics. In fact, the estimated effects of permanent RHED income are identical

as using the Index of Relative Socio-Economic Advantage and Disadvantage. Not only are the estimated parameters stable, but their variance, and thereby significance, are almost identical. It is noteworthy that the estimated parameters for 'low' and 'high' economic resource neighbourhoods maintain their expected signs, though only the coefficient for 'high economic resource' suburbs is significant.

Using the Index of Education and Occupation also produces no sizeable change in the estimated coefficients. The coefficient of permanent RHED income is somewhat larger, in both Model IV and Model V, and it continues to have a positive though not significant impact on the probability of completing a minimal level of schooling. The estimates for gender, race and parental education exhibit the same signs and are stable when the alternative neighbourhood indicator is used. In contrast to the Index of Education and Occupation, only the 'low' or relatively disadvantaged suburbs with regards to education and occupation, cause a significant difference in the student's probability of completing schooling. Both 'low' and 'high' neighbourhood categories exhibit the expected signs.

The diagnostic statistics for these alternative models, including the pseudo R^2, count R^2 and log likelihood ratio are all very similar to the results based on the Index of Relative Advantage and Disadvantage. Based on these diagnostics, as well as the size and robustness of the estimated coefficients, the conclusion is that the effect of neighbourhood characteristics on a student's probability of completing a minimal level of schooling is robust. Students living in suburbs which are relatively more advantaged, in terms of economic resources, educational attainment or occupation status of adults are significantly more likely to complete a minimal level of schooling. In contrast,

students living in relatively disadvantaged suburbs are significantly less likely to complete. These effects are significant, even after taking account of students' permanent RHED income and RHE wealth and also parental education.

5.4.3. Exclude permanent income and wealth outliers

As discussed in Section 5.3.4, two students were identified as outliers on the basis of their permanent RHED income and one student was distinguished as an outlier based on his RHE wealth. After excluding these three students, the probit model was re-estimated and the results are presented in Table 5.10.

Table 5.10 Probit Results after Excluding Outliers

Dependent Variable = Completed Minimal Level of Schooling					
	Model I	Model II	Model III	Model IV	Model V
Constant	-6.4474***	-4.3253**	-2.3017	-2.3821	-1.8988
LOGPERMINC	0.6838***	0.4334**	0.2405	0.2502	0.1740
GIRL	0.3790***	0.3874***	0.4048***	0.4597**	0.5228**
INDIG	-0.8265***	-0.6803**	-0.6350**	-0.6642**	-0.5340*
F_UNI		0.6687***	0.5468***	0.6547***	0.6189***
F_TRADE		0.0849	0.0626		
M_YR12		0.3612***	0.3453***	0.3278*	0.3458*
F_UNI*GIRL			-0.3068**	-0.3149	-0.2889
M_YR12*GIRL			0.3229*	0.0269	-0.0523
LOW AD/DIS				-0.3180**	-0.2908*
HIGH AD/DIS				0.3190*	0.3212*
LOGWEALTH					0.0323**
Wald χ^2	36.12	52.15	63.90	66.47	74.22
Prob > χ^2	0.00	0.00	0.00	0.00	0.00
Log Likelihood	-268.80	-254.58	-248.62	-248.24	-245.35
Pseudo R^2	0.0653	0.1147	0.1355	0.1368	0.1468
N	500	500	500	500	500

Legend: * p<0.1; ** p <0.05; *** p<0.01

After excluding the three outliers, the coefficient of permanent RHED income is approximately 0.06 larger across all models estimated, causing the coefficient to be considerably different in Models III, IV and V. The general trend remains, however, in that the permanent RHED income coefficient becomes smaller as additional variables are introduced, implying that the effect is not being driven by the outliers. The coefficient to RHE wealth is virtually unchanged after excluding the outlying students and continues to be significant at the 5% level. The parameter estimates and

significance of the other variables in the model remain relatively unchanged, again supporting the conclusion that these variables are robust to the specification of the model. Based on this analysis, it is concluded that the results from the main sample are not being driven by the outlying observations.

5.5. Marginal Effects

5.5.1. Marginal Effect of Permanent Income

The marginal effects presented in this section are based on the results of Model V based on the combined sample.

The procedure for calculating the marginal effect of permanent RHED income, when it is included in logarithmic form, is outlined in Appendix F, Section 13.1.4.

Figure 5.5 presents the marginal effect of permanent RHED income on a student's probability of completing a minimal level of schooling when permanent RHED income is measured in thousands of dollars. The calculations are based on a typical student who is non-Indigenous, living in a mid SEIFA neighbourhood, with median RHE wealth equal to $66,071 and whose father's highest level of education is a trade certificate and whose mother has completed Year 12.

Figure 5.5 Marginal Effect of $1000 Increase in Permanent Income

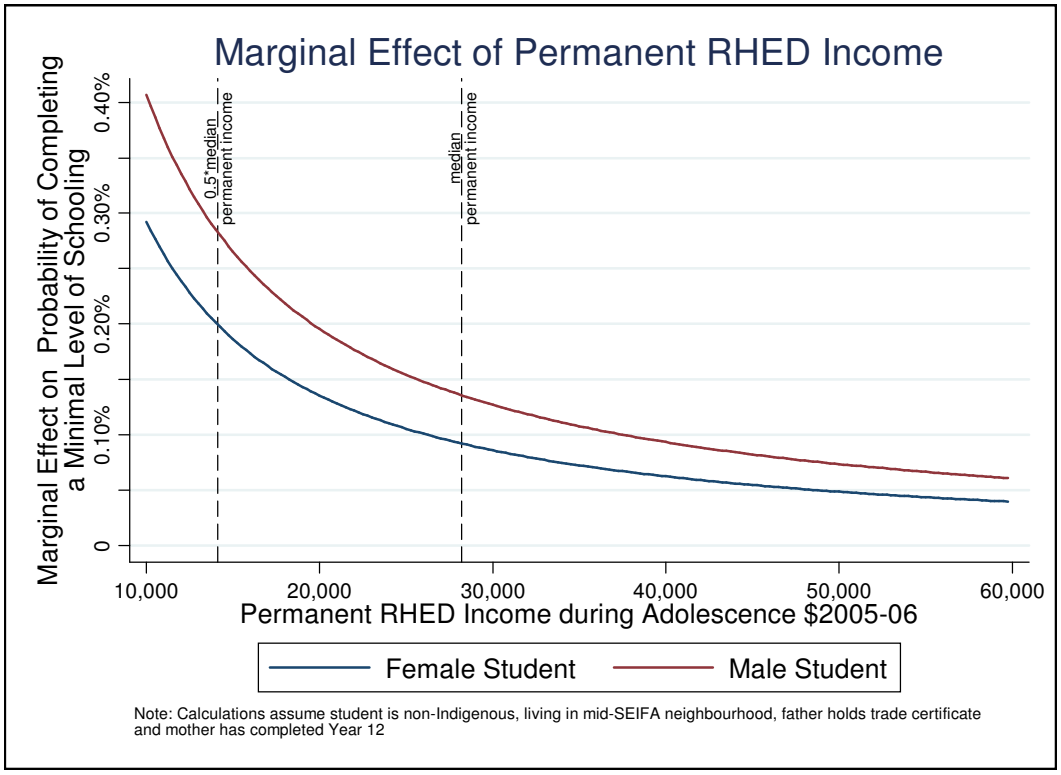


Figure 5.5 illustrates that, for a student whose permanent RHED income during adolescence is equal to the median (=$28,222), a $1,000 increase in permanent RHED income increases the probability of completing a minimal level of schooling by approximately 0.13%. However, for a student whose permanent RHED income is equal to only half median, the same change in permanent RHED income has a much larger effect, increasing the student's probability of completing a minimal level of schooling by approximately 0.25%. The impact is even greater for students whose permanent RHED income is less than half median and for male students.

Though the marginal effect of permanent RHED income may appear small, the effect is obviously much larger when considering larger changes in permanent income. For example, if the permanent RHED income of a student whose permanent RHED income is currently half the median was increased by approximately $7,000, thereby halving the student's gap from median permanent RHED income, the probability of completing a

minimal level of schooling would increase by 1.8% (=0.25*7). Furthermore, if the same student's permanent RHED income was increased to the value of the median, an increase of approximately $14,000 in permanent RHED income, the probability of completing increases by 3.5% (=0.25*14). Note that the marginal effect would be even greater for male students.

5.5.2. Marginal effect of parents' education and neighbourhood

Table 5.11 and Figure 5.6 present the effect of parental education and neighbourhood on the estimated probability of completing a minimal level of schooling. All probabilities were estimated based on a student who was non-Indigenous with half median permanent RHED income of $14,111[25]. Parents' education is considered only at the university level for fathers, and Year 12 level for mothers. Thus, an 'educated' father refers to a father who has completed or is attending University whilst an 'educated' mother refers to a mother who has completed at least Year 12. The counterfactual for either case, referred to as an 'uneducated' mother or father represents that the parent has not completed at least this level of education. Four categories of parents' education are considered: neither parent is educated, only the student's father is educated, only the student's mother is educated and lastly, both parents are educated.

[25] Median real, permanent HED income for the sample of 17, 18 and 19 year-olds was $28,222 (when enumerated person longitudinal weights were applied).

Table 5.11 Effect of Parents' Education and Neighbourhood by Gender

(Assuming half median income)

Parent's Education	Boy			Girl		
	SEIFA: Ad/Dis			SEIFA: Ad/Dis		
	Low	Mid	High	Low	Mid	High
Neither parent educated	44.5%	56.5%	68.1%	64.6%	75.1%	83.7%
Mother only educated	58.1%	69.4%	79.2%	75.0%	83.6%	90.0%
Father only educated	66.3%	76.5%	84.8%	76.5%	84.8%	90.9%
Both parents educated	77.7%	85.6%	91.5%	84.7%	90.8%	94.9%

Note: Estimated probabilities based on non-Indigenous student with half median permanent RHED income (=$14,111) and median RHE wealth (=$66,071)

Figure 5.6 Effect of Parents' Education and Neighbourhood by Gender

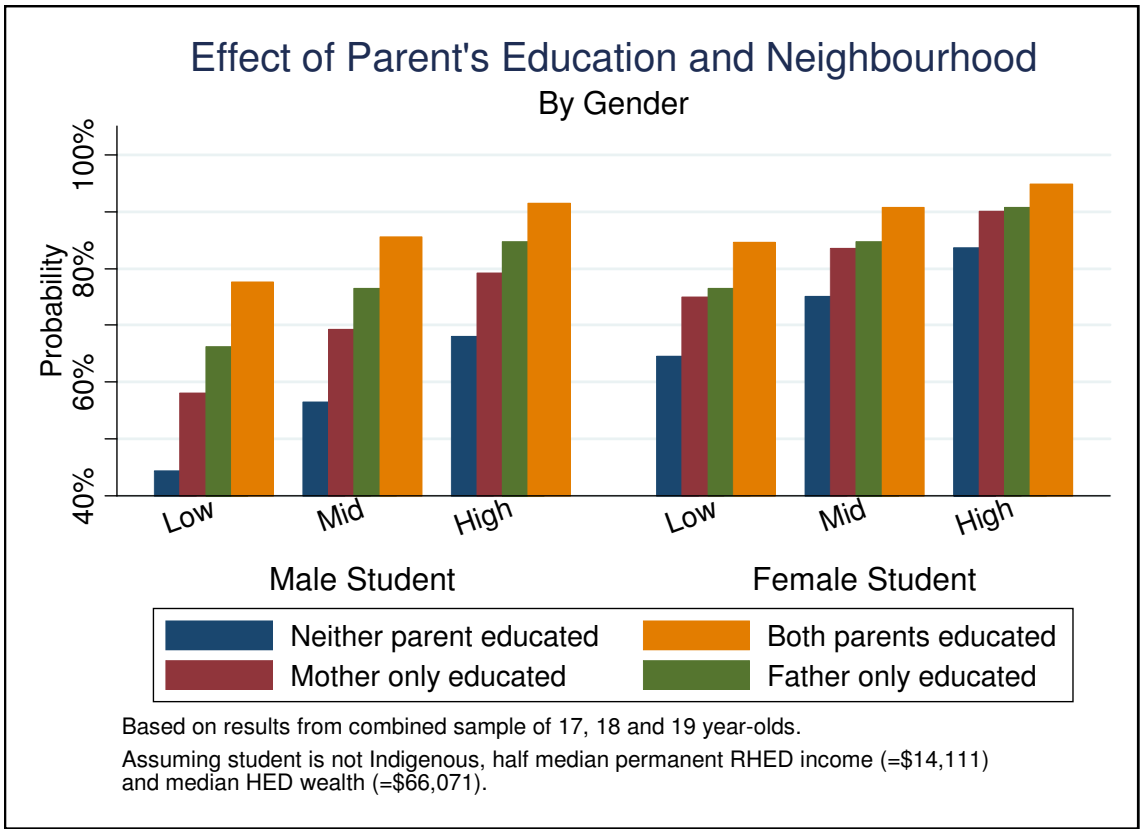


Figure 5.6 illustrates that all three variables: parental education, neighbourhood and gender have a sizeable impact on a student's probability of completing a minimal level of schooling.

Firstly, parental education is observed to have a large impact on completed schooling, regardless of the student's gender or neighbourhood. Compared with a base case student

whose father has not attended university and whose mother has not completed Year 12, female students are approximately 9 percentage points more likely to complete a minimal level of schooling if either their father or mother is educated, with the biggest impact occurring for female students living in relatively disadvantaged neighbourhoods. The effect of parents' education is even stronger for male students, who are approximately 20 percentage points more likely to complete a minimal level of schooling if their father is educated and 13 percentage points more likely if their mother is educated. Male students living in relatively disadvantaged suburbs again reap the greatest benefit from having parents who are educated. Male students are 22 percentage points more likely to complete a minimal level of schooling if their father has completed university and a further 20 percentage points more likely to complete if their mother has also completed Year 12. For both male and female students, father's education has a stronger effect on the probability of completed schooling.

Relative to the reference student whose father has not attended university and whose mother has not completed Year 12, a student whose parents are both educated is substantially more likely to complete a minimal level of schooling. For male students, for example, having parents who are both educated increases the probability of completing by approximately 29 percentage points, with the biggest impact for boys living in disadvantaged suburbs. For female students, the effect is to increase the probability of completion by approximately 16 percentage points. Having well educated parents is therefore an important factor in determining a student's probability of completing a minimal level of schooling, regardless of the characteristics of the surrounding neighbourhood.

It is noteworthy that the probabilities estimated in Table 5.11 show that, even for a student who is very poor, as their permanent RHED income is equal to only half the median, having well educated parents does give students a good chance of completing a minimal level of schooling. For example, male students living in low or middle SEIFA neighbourhoods whose fathers have a university qualification have, on average, a 71.4% chance of completing a minimal level of schooling, whilst a comparable male student whose parents are both educated is approximately 81.7% likely to complete. For comparable female students, having a father who is university educated makes a female student 80.7% likely to complete and 87.8% likely to complete if both parents are educated. For both genders, and particularly for girls, having a father who has completed university and a mother who has completed at least Year 12 makes it highly likely that the student will complete a minimal level of schooling. In conclusion, even taking account of the low permanent RHED income of these students, and the fact that they live in relatively disadvantaged neighbourhoods, they have a high likelihood of completing a minimal level of schooling if their parents are well educated.

The estimated marginal effects for parental education strongly support the theoretical role model and home environment theories. Consistent with the findings of Haveman, Wolfe and Spaulding (1991) and Buddelmeyer and Verick (2007), parental education has a strong influence on a student's decision regarding whether or not to complete a minimal level of schooling. It is plausible that the parent's level of education affects the indirect utility that a student gains from deciding to complete schooling and therefore, students whose parents are more highly educated are themselves likely to prefer to complete schooling.

The estimated probabilities in Table 5.11 and Figure 5.6 also illustrate the strong impact on a student's probability of completing a minimal level of schooling, associated with the relative advantage and disadvantage in a student's neighbourhood. Controlling for the student's permanent RHED income, the probability of completing a minimal level of schooling is approximately 10.4 percentage points higher for male students living in mid-SEIFA neighbourhoods, compared with male students living in disadvantaged neighbourhoods. The effect for girls is somewhat smaller: those living in mid-SEIFA neighbourhoods are, on average, 8.4 percentage points more likely to complete. The effect of neighbourhood characteristics is strongest for students whose parents are not well educated. Male students living in relatively advantaged neighbourhoods are approximately 8.9 percentage points more likely to complete relative to those living in suburbs of middle advantage and disadvantage. For female students, the effect is slightly smaller with girls living in advantaged areas 6.3 percentage points more likely to complete relative to girls in mid-SEIFA neighbourhoods.

Comparing the probabilities of completing for students living in relatively disadvantage and relatively advantaged areas highlights how important neighbourhood resources and role models are, even after controlling for household income. Female students living in advantaged neighbourhoods are approximately 15 percentage points more likely to complete a minimal level of schooling compared with girls in relatively disadvantaged areas. For males, the effect of living in an advantaged area is even greater, making them 19 percentage points more likely to complete relative to boys living in disadvantaged areas. Again, students whose parents are not well educated obtain the greatest benefit from living in a more relatively more advantaged suburb.

The strong and positive effect of relative advantage in a student's neighbourhood on his or her decision to complete a minimal level of schooling yields further support for the theoretical 'neighbourhood' models proposed in the literature. The findings are consistent with those of Jensen and Seltzer (2000), Duncan and Brooks-Gunn (2000) and Jencks and Mayer (1990) who all find that the resources and role models in a student's neighbourhood are important influences on their schooling decisions. Similar to the effect of parental education, one could suppose that the indirect utility a child derives from choosing to complete a minimal level of schooling is, to some extent, influenced by the education and work decisions of those in their neighbourhood. To the extent that the Index of Relative Socio-economic Advantage and Disadvantage is able to reflect these attitudes, by using information on educational and occupational attainment in the neighbourhood, the results show that students living in more advantaged neighbourhoods are substantially more likely to complete a minimal level of schooling.

Table 14.1 and Figure 14.1 (See Appendix G) present the effect of parental education and neighbourhood for a student with *median* permanent RHED income. The estimated probabilities, as expected, are somewhat larger, though the effects of parental education and neighbourhood are approximately the same as those presented above.

5.6. Sensitivity Analysis

5.6.1. 17 and 18 year-old sample

Table 5.12, below, presents the probit results based on a sample of students aged 17 and 18 years in Wave 6, after including those who are still studying in Year 11 or below as 'successes.' That is to say, students still studying in Year 11 and below are assumed to complete a minimal level of schooling. Permanent RHED income during adolescence

for the sample of students used to estimate this model is calculated on the basis of annual RHED income from ages 13 to 16 years.

Table 5.12 Probit Results for alterantive sampel of 17 and 18 year-olds

Dependent Variable = Completed Minimal Level of Schooling					
	Model I	Model II	Model III	Model IV	Model V
Constant	-4.4059**	-1.6668	0.0908	0.0219	1.0476
LOGPERMINC	0.4934***	0.1793	0.0022	0.0148	**-0.1293**
GIRL	0.3760***	0.3881***	0.4111***	0.3830*	0.4791**
INDIG	-0.8348***	-0.7598**	-0.7207**	-0.7374**	-0.5990*
F_UNI		0.7270***	0.5990***	0.5932**	0.5332**
F_TRADE		0.0872	0.0730		
M_YR12		0.4030***	0.4010***	0.3547*	0.3699*
F_UNI*GIRL				-0.0855	-0.0571
M_YR12*GIRL				0.0943	0.0124
LOW AD/DIS			-0.1179	-0.1181	-0.0499
HIGH AD/DIS			0.4357**	0.4375**	0.4914**
LOGWEALTH					0.0467***
Wald χ^2	20.84	37.48	43.46	44.71	52.63
Prob > χ^2	0.0001	0.00	0.00	0.00	0.00
Log Likelihood	-197.49	-185.69	-182.36	-182.39	-178.11
Pseudo R^2	0.0528	0.1094	0.1254	0.1252	0.1458
N	391	391	391	391	391

Legend: * p<0.1; ** p <0.05; *** p<0.01

The results in Model I are very similar to those for the main sample, though the coefficient of permanent RHED income is somewhat smaller. As parents' education and neighbourhood are introduced, the same pattern emerges whereby the coefficient of permanent RHED income is substantially reduced and it remains positive though not significant.

Based on the results for the sample of 17 and 18 year-olds, the explanatory power of permanent RHED income is reduced more severely by parents' education and neighbourhood. This is evidenced by the larger decrease in the coefficient as variables are added, with the parameter becoming almost zero in Model III. These results add further support to the argument that the effect of permanent RHED income on a student's probability of completing a minimal level of schooling is transmitted largely through its effect on segregating or channelling families into different neighbourhoods.

Thereafter, the characteristics of the student's neighbourhood explain much of the variation in schooling outcomes.

In Model III, all variables exhibit their expected signs and gender, race, parental education and neighbourhood variables are all independently significant. Based on the restricted log likelihood statistic, the three parental education variables[26] and the two neighbourhood variables[27] are also jointly significant at the 5% level.

Only interaction terms for father's university education and mother's Year 12 completion are again used as there was no significant effect for father's trade qualification. The estimated coefficients for both Model IV and Model V indicate that father's education more strongly affects their son's probability of completing a minimal level of schooling, relative to their daughters whilst mother's Year 12 completion has the opposite effect. These results are neither independently nor jointly significant at the 10% level and furthermore, cause the log likelihood ratio to worsen for Model IV. Thus, little weight is put on its interpretation, especially given that there are is no *a priori* expected sign.

The relative advantage and disadvantage within the student's neighbourhood continues to have a strong influence on student's schooling decisions, though only the 'high' advantage and disadvantage variable is significant (at the 5% level). Furthermore, parental education continues to have a strong positive effect on completed schooling. This stability of these parameters as additional variables are introduced, and also based

[26] $\lambda = -2(-197.49 - (-185.69)) = 23.6 \sim \chi_{(df=3,\ \alpha)}$

[27] $\lambda = -2(185.69 - (-182.36)) = 6.7 \sim \chi_{(df=2,\ \alpha)}$

on a different sample of students, indicates that the estimates for both parental education and neighbourhood are robust to the model specification.

In Model V, the inclusion of RHE wealth causes the estimated coefficient of permanent RHED income to become negative, which is contrary to *a priori* expectations. This represents a substantial shortcoming for the model, as one of the main diagnostic tools in judging the performance of a binary response model is whether or not the coefficient estimates conform to their expected signs. The results of Model V reflect the multicollinearity present in the data, between permanent RHED income and RHE wealth. Potentially, it could also reflect a misclassification of the outcome for those students who were still studying in Year 11 or below in 2005-06. As stated earlier, this problem has been addressed by expanding the sample to include students aged 19 years in 2005-06 and excluding those students still studying in Year 11 or below, thus giving the more robust estimates presented in Table 5.7.

5.6.2. 18 and 19 year-old sample

Table 5.13 presents the results based on the alternative sample of students aged 18 and 19 years in 2005-06, after excluding six students who were still studying in Year 11 and below. Permanent RHED income, for the purpose of this model, was calculated using three years of annual RHED income data, from the age of 14 to 16 years for all students in the sample.

Table 5.13 Probit Results for alternative sample of 18 and 19 year-olds

Dependent Variable = Completed Minimal Level of Schooling					
	Model I	Model II	Model III	Model IV	Model V
Constant	-4.6660***	-3.0835*	-0.6541	-0.7267	-0.2650
LOGPERMINC	0.5161***	0.3184*	0.0915	0.1052	0.0380
GIRL	0.2429	0.2503	0.2781*	0.2157	0.2473
INDIG	-0.9407**	-0.7999**	-0.8082**	-0.8313**	-0.6792
F_UNI		0.5807***	0.4332**	0.4874*	0.4765*
F_TRADE		0.1101	0.0657		
M_YR12		0.3866***	0.3507**	0.2531	0.2466
F_UNI*GIRL				-0.2018	-0.1986
M_YR12*GIRL				0.2022	0.1674
LOW AD/DIS			-0.4538***	-0.4592***	-0.4398**
HIGH AD/DIS			0.3492*	0.3578*	0.3511*
LOGWEALTH					0.0254
Wald χ^2	18.31	30.65	43.19	44.78	48.49
Prob > χ^2	0.0004	0.00	0.00	0.00	0.00
Log Likelihood	-185.82	-176.61	-169.70	-169.50	-168.38
Pseudo R^2	0.0486	0.0958	0.1311	0.1321	0.1379
N	343	343	343	343	343

Legend: * p<0.1; ** p <0.05; *** p<0.01

The results for Models I, II and III are very similar to those presented earlier. All variables have their expected signs and race, parental education and neighbourhood advantage and disadvantage are independently significant in determining a student's probability of completing schooling. Again, as parental education and neighbourhood are introduced, the coefficient of permanent RHED income becomes much smaller and less independently significant. Interestingly, girls continue to be more likely to complete a minimal level of schooling, though the effect is not significant. Based on the interaction terms, father's education more strongly affects male students' probability of completing and mother's Year 12 completion has the opposite effect. These effects continue to be not significant. Based on the results in Models III, IV and V, neighbourhood advantage and disadvantage has a significant effect on student's likelihood of completing schooling: students in relatively disadvantaged suburbs are significantly less likely to complete whilst those in relatively advantaged suburbs are significantly more likely to complete, when compared with students living in mid-SEIFA neighbourhoods. These effects are significant and stable even when controlling

for students' permanent RHED income and RHE wealth. Real, household equivalised wealth continues to have a positive and significant effect on completed schooling, though it reduces the effect of permanent RHED income substantially, confirming the presence of a strong correlation.

Based on the regression results for Model V, Table 5.14 presents a tabulation of the predicted and actual outcomes.

Table 5.14 Observed v. Predicted Outcomes for Alternative Sample

Predicted	Observed		Total
	MINSCHOOL=1	MINSCHOOL=0	
Pr(MINSCHOOL=1)≥0.5	236	63	299
Pr(MINSCHOOL=1)<0.5	19	25	44
Total	255	88	343

Overall, the model performs relatively well for the sample, compared with the results from the comparable model based on the combined sample of 17, 18 and 19 year-olds. Overall, Model V correctly predicts 76.09% of the actual outcomes for this sample, though it continues to over-predict that students complete a minimal level of schooling. The model correctly predicts 92.55% of successes compared with 28.41% for students who are observed not to complete a minimal level of schooling. The prediction rate for students who do not complete is approximately 2 percentage points higher than that based on the model for the combined sample, causing the overall count R^2 to be slightly higher for this sample. Relative to the naïve prediction that all students in the sample complete, the model correctly predicts the observed outcome for an additional six students.

Comparing the results for the sample of 17 and 18 year-olds and the sample of 18 and 19 year-olds, it appears that inclusion of those students aged 19 years in 2005-06

improves the performance of the model. The greater certainty in regards to classification of the outcome variable outweighs the loss of accuracy in the calculation of permanent RHED income when based on fewer years of data. In respect to the sample available for this analysis, combining the data from students aged 17 to 19 years has helped to address the problem of multicollinearity expected to be present in the data and also provides a viable compromise between the certainty of the outcome and available years of family income data during adolescence.

5.7. Summary and Conclusions

Based on the results for the combined sample of students and the sensitivity analysis conducted, there is evidence that permanent RHED income has a positive effect on a student's likelihood of completing a minimal level of schooling. This is consistent with the human capital investment model and other economic models of efficient resource allocation. However, the effect of permanent RHED income is generally not significant. The coefficient of permanent RHED income is not robust to the specification of the model and becomes unstable and substantially smaller when the model takes account of parental education and neighbourhood characteristics. Based on a variety of samples, it is concluded that the positive effect of household income is transmitted largely through its effect on restricting a family's access to living in particular neighbourhoods. Thereafter, the variation in the amount of neighbourhood resources, as well as the quality of role models, explains much of the variation in adolescent's completed schooling, though permanent RHED income continues to have some positively influence.

The marginal effect of permanent RHED income during adolescence, on a student's decision to complete a minimal level of schooling, was found to be relatively small after

taking account of other familial and neighbourhood factors. For example, a student whose permanent RHED income during adolescence was half the median for the combined sample of 17, 18 and 19 year-olds, experiences a 0.13 percentage point increase in their probability of completing for a $1,000 increase in permanent RHED income. The effect was much larger, though, for students on low permanent RHED income. For example, for students whose permanent RHED income was equal to half median, a $1,000 increase in permanent RHED income resulted in a 0.25 percentage point increase in his or her probability of completing schooling. If this student's permanent RHED income was increased to the value of the median, the student's probability of completing increased by 3.5%. These results show that permanent income, independent of other background, familial and neighbourhood characteristics, has only a small positive impact on a student's probability of completing a minimal level of schooling. A large increase in permanent RHED income is necessary to substantially increase a student's chances of completing. This is consistent with the results of Levy and Duncan (2000, p16) for example, who find that a child's income must be increased by 2.7 times for the first 15 years of the child's life in order to increase completed schooling by 0.5-1 year. Duncan *et al.* (1998) also considers the marginal effect of average household income during childhood in terms of a $10,000 change.

The sensitivity analysis confirms that parental education and neighbourhood characteristics significantly affect a student's decision whether or not to complete a minimal level of schooling. This effect is substantial and robust to the model specification. As expected, students whose parents have completed a high level of education are significantly more likely to complete a minimal level of schooling, even

after controlling for household income. This is consistent with the human capital investment model and role model theories generally. The marginal effects of parental education indicates that relative to a student whose father has not completed a university qualification and whose mother has not completed at least Year 12, having either parent who has completed such education makes a female student approximately 9 percentage points more likely to complete and a male student 13 to 20 percentage points more likely. If both parents had completed such educational qualifications, students were, on average, 29 percentage points more likely to complete relative to the reference student. The effect of parental education was greatest for students living in relatively disadvantaged neighbourhoods. It was also noteworthy that, even considering that a student had a low permanent RHED income, equal to half median, and was living in a relatively disadvantaged area, he or she were still moderately likely to complete a minimal level of schooling if his or her parents were well educated.

The relative advantage and disadvantage in a student's neighbourhood also significantly affect a student's likelihood of completed schooling. Students living in suburbs in the three most disadvantaged deciles are significantly less likely to complete a minimal level of schooling when compared with students living in the middle SEIFA neighbourhoods. Furthermore, students living in relatively advantaged neighbourhoods are significantly more likely to complete. These estimated coefficients continue to have their expected signs and are stable across a range of samples. The estimates are also stable when household wealth is taken into account. The marginal effects calculated for neighbourhood advantage and disadvantage indicated that students living in mid-SEIFA neighbourhoods were approximately 9 percentage points more likely to complete a minimal level of schooling compared with those students living in very disadvantaged

suburbs. The probability of completing a minimal level of schooling was, on average, an additional 9 percentage points higher for boys living in relatively advantaged neighbourhoods and 6 percentage points higher for girls. The strongest positive impact was felt by those students whose parents were not well educated. Comparing students whose permanent RHED income was half median, girls living in relatively advantaged suburbs were 15 percentage points more likely to complete a minimal level of education relative to those in very disadvantaged suburbs. The effect was even larger for boys who were 19 percentage points were likely to complete.

The following chapter presents the major findings and conclusions for this thesis and suggested areas of further research.

6. Summary and Conclusions

6.1. The Objectives of the Thesis

This thesis was motivated to determine the extent and nature of child poverty in Australia since 2000, focussing in particular on the incidence of chronic poverty among Australian children. Child poverty is regarded by the Australian society as a significant problem, not only due to innate feelings of protection, but also because it limits a child's educational and employment outcomes in later life, thereby creating a poverty cycle between generations and slowing a country's future economic growth. Evidence also suggests that whilst transitory fluctuations in income are common, even to levels below the poverty line in some years, it is long-term or persistent low income during childhood which results in severe and long-lasting consequences later in life. Static measures of child poverty are indicative only of the proportion of children with low household, equivalised income in any given year and cannot discern between those children who are only temporarily poor and those trapped in a childhood of sustained low income. As mentioned, this distinction is crucial as the effects and necessary policy response are likely to be very different.

This thesis, therefore, has used the HILDA longitudinal data to study the incidence of chronic poverty, using the permanent income approach. The main objective was to determine the extent of poverty among Australian children and in particular, whether child poverty was largely transitory or chronic.

The second main objective of this thesis was to determine the effect of permanent RHED income during adolescence on a child's probability of completing a minimal level of schooling. This research was motivated by evidence in the empirical literature

suggesting that education is one of the key links, or pathways, through which poverty during childhood is transmitted to adulthood. Thus, it represents one potential method of breaking the intergenerational cycle of poverty. This research objective was addressed by estimating a probit model of completed schooling.

6.2. Major Findings and Conclusions

This section presents the major findings and conclusions from this thesis in two parts. The findings in respect of the extent and nature of child poverty in Australia since 2000 are firstly presented, followed by the results of the probit model of minimal schooling.

The annual child poverty rate in Australia, based on a relative, annual poverty line tailored by regional area, was approximately 10.3% over the period 2000-01 to 2005-06, which was below the average annual poverty rate for the Australian population as a whole (11.9%). Generally, the trend was for the child poverty rate to decrease over the period, with the exception of 2004-05, when there was a sharp rise in child poverty. The annual child poverty rates were similar, though somewhat higher, based on a conventional relative poverty line. The child poverty rate was found to be significantly higher among children living in single-parent households, compared with children in couple-parent families. The average annual poverty rate was approximately 24.2% among children in single-parent families, which was more than three times higher than the average annual poverty rate for children in couple-parent families (7.8%).

The change in the annual, relative child poverty rate over the period was also examined, and showed that the 1.4 percentage point fall in relative child poverty over the period was the result of a large decrease in the concentration of children in the bottom end of the income distribution and not due to a change in the real value of median income. In

fact, the real value of the poverty line increased over the period, causing a slight increase in relative poverty.

Based on the permanent income approach, and a sample of approximately 2,400 children, the chronic child poverty rate in Australia over the period 2000-01 to 2005-06 was approximately 6.7%. This was substantially below the annual child poverty rate in any of the years, implying *a priori,* that a substantial degree of annual poverty was transitory in nature. Comparing those children who were classified as poor in any given year, and those classified as chronically poor, confirmed that only approximately half of the children who are poor in any given year were in a state of chronic poverty. The remaining children who were annually poor experienced only transitory poverty. This was consistent with the findings of Hill and Jenkins (1999) in regards to the proportion of child poverty which was chronic in Britain between 1991 and 1996. In addition, approximately 2% of children in each year were in chronic poverty, though their annual RHED income was unusually high, pushing them above the annual poverty line.

Given the evidence of the limited degree of overlap between those children classified as poor in any given year and those children with sustained low income, it was concluded that static measures of poverty are poor indicators of those children who are in most need: the chronically poor. These findings have important implications for Government welfare policy. If welfare is to be targeted at chronically poor children who are most in need, it should not be targeted merely on the basis of annual household income. Approximately half of those children whose RHED incomes are low in any given year are experiencing only transitory poverty. Assuming that households can borrow or draw on past savings, the living standards of these children are likely to change very little, if

at all. These households, by using the available market mechanisms, can avoid chronic poverty and its consequences. The households of the remaining half of children who are annually poor, however, cannot. Furthermore, 2% of children who are chronically poor each year would be overlooked if welfare were targeted at households based on annual RHED income alone. Further research is necessary to identify factors which characterise chronically poor children, thereby allowing welfare to be better targeted.

The second, major area of analysis for the purpose of this thesis is the model of completed schooling. The probit model, based on a sample of approximately 500 adolescents, revealed that permanent RHED income had a positive effect on the probability of completing a minimal level of schooling, though this effect was not significant when parental education and neighbourhood advantage and disadvantage are taken into account. As explanatory variables were successively added, the results implied that the effect of permanent RHED income on completed schooling is transmitted largely through its effect on segregating households into particular neighbourhoods. For example, richer families are able to live in suburbs which are relatively more advantaged, in terms of the educational and occupational attainment of adults, as well as household incomes. These positive role models in the student's neighbourhood, as well as the higher quality of resources available, thereafter, explain a large amount of the variation in the probability of completing a minimal level of schooling. Furthermore, it was the effect of parental education, rather than the resulting higher household income, which strongly influences a student's decision to complete.

The marginal effect of permanent RHED income was low to moderate. A $1,000 increase in permanent RHED income for a student whose permanent income is half

median, increases the probability of completing a minimal level of schooling by approximately 0.2% for girls and 0.3% for boys. If this student's permanent income were increased to median, an increase in permanent income of approximately $14,000, it would increase the student's probability of completing by approximately 3.5%.

The other explanatory variables, particularly parental education and neighbourhood advantage and disadvantage, have a substantial influence on completed schooling. For a student whose permanent RHED income is half median, having either a father who has attended university or a mother who has completed at least Year 12 increases the probability of completing a minimal level of schooling by approximately 9 percentage points for female students and 17 percentage points for male. If both parents have these educational qualifications, the probability of completing increases considerably, with students being approximately 29 percentage points more likely to complete. The effects were largest for students living in relatively disadvantaged neighbourhoods, particularly male students. The estimated effects from parental education strongly support the role model theories and the human capital investment model.

Neighbourhood characteristics also had a sizeable effect on completed schooling, with students in middle-index suburbs approximately 9 percentage points more likely to complete than children in relatively disadvantaged neighbourhoods. Students living in advantaged areas are a further 8 percentage points more likely to complete. The effect is strongest for students whose parents have low educational attainment. Overall, these results strongly support the neighbourhood effects model and are consistent with the findings of Jensen and Seltzer (2000).

In conclusion, the results of the model of minimal schooling completion suggest that whilst permanent RHED income does have a positive effect, it is transmitted largely by segregating families into different neighbourhoods. In regards to Government policy, these results indicate that in order to increase educational attainment and thereby break the poverty cycle, funds should be invested in ensuring the available resources between neighbourhoods are more equally distributed and that relatively disadvantaged suburbs are made more attractive to individuals with high education and occupational attainment. As school completion and educational attainment increase over time, this will have flow on effects for future generations, further improving children's chances of attaining a minimal level of schooling.

6.3. Areas of further research

Firstly, it has been found that only a limited degree of overlap exists between children identified as annually poor and those who are chronically poor. Therefore, in the hope of better targeting Government welfare assistance, research should be directed at identifying the factors which characterise these chronically poor children. Household type has been examined in this thesis, though other areas such as race, geographical region or parent's occupational status may also be informative and are worthy of further research. Secondly, as more Waves of HILDA become available, research could be conducted into the effects of chronic poverty during different stages of childhood, such as during early childhood and adolescence on achievement later in life. Thirdly, as more data relating to social exclusion and deprivation become available, further research could help to determine whether children in chronic poverty have a lower standard of living than those in transitory poverty. For example, do children in chronic and transitory poverty have different access to health care and nutritious food or different access to learning resources, either in the home or locally?

The model of completed schooling could also be updated as more waves of HILDA become available, allowing permanent income to be calculated over a longer period. This may improve its explanatory power in the model. Other variables could also be included based on the literature, such as parental employment during the student's childhood, household welfare dependency and the effect of stressful or traumatic events, such as separation or location moves, on the decision to complete a minimal level of schooling.

Lastly, research contained in this thesis could be further extended by analysing the effect of childhood poverty and schooling completion on employment, earnings and poverty in adulthood. Such research would enhance the understanding of the dynamics of poverty throughout an individual's lifetime and this could be used to help break the cycle of intergenerational poverty.

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8. Appendix A

8.1. Regional Poverty Line and Sample Breakdown

Table 8.1 Regional, Annual Poverty Line ($2005-06)

Wave	Unbalanced Panel[1]				Balanced Panel[2]			
	Regional Poverty Lines			National Poverty Line	Regional Poverty Lines			National Poverty Line
	Major City	Inner Regional	Outer Regional & Remote		Major City	Inner Regional	Outer Regional & Remote	
1	15,064	12,653	11,637	14,065	15,529	12,812	11,704	14,461
2	15,383	12,822	12,474	14,197	15,548	12,931	12,929	14,361
3	15,546	12,908	12,649	14,547	15,662	13,156	12,496	14,619
4	15,823	13,341	12,667	14,946	15,968	13,266	12,939	14,980
5	16,413	13,513	12,787	15,477	16,353	13,626	12,811	15,360
6	17,002	14,167	13,746	16,120	17,190	14,196	13,746	16,066

[1] Enumerated person cross-sectional weights applied.
[2] Enumerated person longitudinal weights applied.

Table 8.2 Regional Sample Size (Unbalanced Panel)

Wave	General Population				Children <16 years			
	Major City	Inner Regional	Outer Regional & Remote	Total	Major City	Inner Regional	Outer Regional & Remote	Total
1	12,386	4,552	2,871	19,809	3,018	1,249	791	5,058
2	11,235	4,420	2,582	18,237	2,673	1,191	699	4,563
3	10,772	4,333	2,474	17,579	2,504	1,171	659	4,334
4	10,453	4,311	2,370	17,134	2,393	1,167	606	4,166
5	10,656	4,361	2,390	17,407*	2,392	1,162	613	4,167
6	10,623	4,357	2,407	17,387	2,322	1,153	594	4,069

* One person was excluded as their regional area was ‘Migratory’

9. Appendix B

9.1. Poverty by Household Type: The Jackknife Procedure

Firstly, the regional poverty line of half median income in one's remoteness area was recalculated based on each of the 45 sets of replicate cross-sectional weights provided in HILDA. Individuals were classified as poor or not poor based on the poverty line in their regional area in each Wave. This created a total of 45 replicate classifications of individuals as poor or non-poor for each of the six Waves.

Secondly, the annual poverty rate for children living in single-parent and couple-parent households was calculated separately, applying the appropriate replicate weight corresponding with the replicate poverty line.

Standard errors for the child poverty rate, for both couple-parent and single-parent households, were calculated using the jackknife procedure as follows (ABS Cat. No. 6541.0, 2005, pp.10-11):

$$SE(\hat{p}) = \sqrt{\frac{J-1}{J}\sum_{j=1}^{J}(\hat{p}_j - \hat{p})^2}$$

where $\hat{p}$ is the poverty rate based on the 'full' child sample computed using the 'main' weight and $\hat{p}_j$ is the poverty rate computed from the sub-sample of children that is obtained when the j^{th} set of replicate weights are used (Rodgers *et al.* 2008, p8).

Thus, using the main weight and 45 sets of replicate cross-sectional weights, the standard error is calculated as:

$$SE(\hat{p}) = \sqrt{\frac{44}{45}\sum_{j=1}^{45}(\hat{p}_j - \hat{p})^2}$$

for both couple-parent and single-parent households in each of the six Waves.

The 95% confidence interval for the child poverty rate is calculated as:

$$\hat{p} - 1.96 * SE(\hat{p}) < p < \hat{p} + 1.96 * SE(\hat{p})$$

for both couple-parent and single-parent children, where *p* is the poverty rate for the population.

Where standard errors are calculated for the chronic child poverty rate, the replicate sets of weighs are only used to recalculate the chronic poverty rate. Unlike the procedure used for generating the standard error of the annual poverty rates, the chronic poverty line was not recalculated each time using the replicate weights. This was due to the cumbersome nature of recalculating a regionally tailored chronic poverty line. Instead, the single chronic poverty line, based on the main weight, was used to calculate the chronic poverty line and this was used, with the replicate weights, to calculate all replicate chronic poverty *rates*.

10. Appendix C

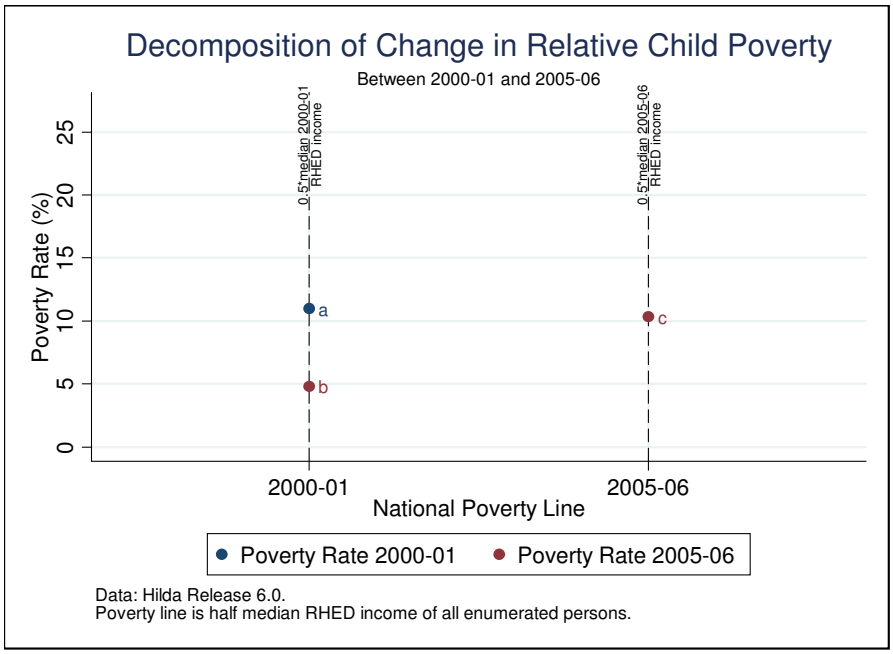
10.1. Decomposition based on national poverty line

Table 10.1 Child Poverty Rate Decomposition: National Poverty Line

	Poverty Rates	
Poverty Line	2000-01	2005-06
Half median income, 2000-01 ($14,065)	11.0%	4.8%
Half median income, 2005-06 ($16,120)		10.3%

Data: HILDA Release 6.0
Poverty line is half median income of all enumerated persons in the unbalanced panel.

Figure 10.1 Child Poverty Rate Decomposition: National Poverty Line



Based on the relative poverty lines in 2000-01 and 2005-06, the relative child poverty rate decreased over the period by 0.7 percentage points from 11% in 2000-01 to 10.3% in 2005-06. Based on the anchored, national poverty line of $14,065, there was a decrease in absolute poverty of 6.2 percentage points: a movement from point a (11.0%) to point b (4.8%). In 2005-06, the real value of the relative poverty line was greater than the anchored, implying that median income increased over the period. This caused a residual increase in child poverty of 5.5 percentage points: a movement from point b to c in Figure 10.1. Combined, the absolute decrease in child poverty of 6.2 percentage

points outweighed the residual increase in child poverty of 5.5 percentage points, causing relative poverty to decrease overall by 0.7 percentage points. Essentially, the isolated changes in absolute and residual poverty were the same as those based on regional poverty lines, presented in Table 4.6.

10.2. Child Poverty Overlap

Figure 10.2 Overlap between Chronic and Annual Child Poverty: National Poverty Line

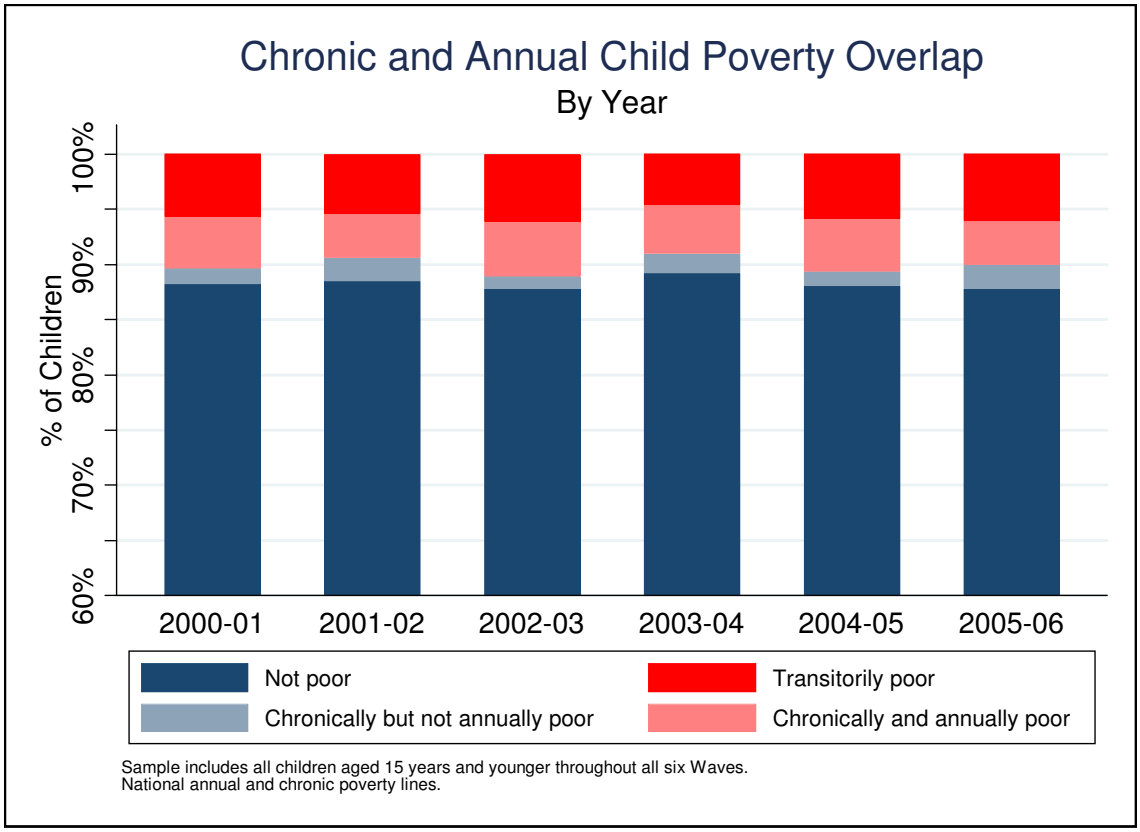


Table 10.2 Overlap between Chronic and Annual Child Poverty: National Poverty Line

Year	Transitorily Poor	Poor (Annually and Chronically)	Chronically but not Annually Poor	Not Poor
2000-01	5.7%	4.7%	1.4%	88.2%
2001-02	5.4%	4.0%	2.1%	88.5%
2002-03	6.1%	5.0%	1.1%	87.8%
2003-04	4.7%	4.4%	1.7%	89.2%
2004-05	5.9%	4.8%	1.3%	88.0%
2005-06	6.1%	4.0%	2.2%	87.8%

11. Appendix D

11.1. Calculating Permanent Income

This procedure is taken from Rodgers and Rodgers (1993, p37).

Given:

The interest rate on savings in each year, $rs_t \quad \forall\, t = 1, 2, ...T$

The interest rate on borrowings in each year, $rb_t \quad \forall\, t = 1, 2, ...T$

And annual income, $y_t \quad \forall\, t = 1, 2, ...T$

Permanent income, for T years, can be calculated for any individual using the procedure set out below.

Step 1: Compute average income as the first approximation of one's permanent income.

$$\overline{y} = \frac{\sum_{1}^{T} y_t}{T}$$

Step 2: Compute savings and borrowings in each year.

$$s_t = y_t - \overline{y} \quad \forall\, t = 1, 2, ...T$$

Where $s_t > 0$ implies positive savings in year t

$s_t < 0$ implies borrowings in year t

Step 3: Compute the balance remaining at the end of each year if the individual consumes their average income in each year.

$$b_t = s_t + d * (1 + rs_{t-1}) * b_{t-1} + (1 - d) * (1 + rb_{t-1}) * b_{t-1} \quad \forall\, t = 1, 2, ...T$$

Where $b_0 = 0$ (initially there is nil savings, consistent with the assumption of no inter-period transfers);

$d = 1$ if $b_{t-1} > 0$; $d = 0$ otherwise.

The dummy variable *d* determines if the individual had a savings or borrowing *balance* rolling over from the previous year and ensures the appropriate interest rate is applied.

For example, consider an individual who earned more than their average income in the first and second years. At the end of year one, the savings accumulated would roll over with interest to increase period two's potential consumption. The person's end of year balance after the second year would equal the savings from that year as well as their savings and interest from the first year.

Step 4: Determine whether the end of year balance in year *T* (the end of period balance) is sufficiently close to zero.

$$b_T \approx 0?$$

This is consistent with the assumption that the individual begins and ends the planning horizon with nil borrowing and saving, and can only transfer income between and within years. It is a judgment call for the author how small a balance will be tolerated. For the purpose of this thesis, an end of period balance of less than $0.10 was accepted to be sufficiently close to zero.

Step 5: Where the individual's end of year balance in year *T* is not sufficiently close to zero, one must adjust the savings and borrowings in each year according to the following formula:

$$s_t = s_t - b_T / T$$

and repeat steps 3 and 4. The iterative procedure in Steps 3, 4 and 5 is repeated until the end of period balance is sufficiently close to zero.

Step 6: Permanent income is finally calculated as:

$$Y_t^* = y_t - s_t \quad \forall\, t = 1, 2, ...T$$

Step 7: To ensure that the permanent income is exactly the same in each year, permanent income is averaged over all *T* years:

$$Y^* = \frac{\sum_{1}^{T} Y_t^*}{T}$$

11.2. Annual Interest Rates

Figure 11.1 Indicator Savings Rates

Month/Year	Cash management accounts at banks		Banks' term deposits ($10 000)		Average of Indicator Saving Rates
	$10 000	$50 000	6 mths	1 year	
2000-01 Annual Average	3.50		4.76		**4.13**
2001-02 Annual Average	2.39		3.65		**3.02**
2002-03 Annual Average	2.54		3.86		**3.20**
2003-04 Annual Average	2.81		4.14		**3.48**
2004-05 Annual Average	3.17		4.33		**3.75**
2005-06 Annual Average	3.26		4.27		**3.76**

Source: RBA F04 Retail Deposit and Investment Rates

Figure 11.2 Indicator Lending Rates

Month/Year	Personal loans			Average of Indicator Saving Rates
	Term loans (Unsecured)		Revolving credit	
	Fixed	Variable	Credit cards Standard	
2000-01 Annual Average	11.82		16.44	**14.13**
2001-02 Annual Average	11.29		15.72	**13.50**
2002-03 Annual Average	11.75		16.00	**13.87**
2003-04 Annual Average	11.67		16.31	**13.99**
2004-05 Annual Average	11.90		16.58	**14.24**
2005-06 Annual Average	12.13		16.80	**14.47**

Source: RBA F05 Indicator Lending Rates

12. Appendix E

12.1. Completed Years of Schooling

Table 12.1 Highest Level of Education Achieved

	Highest Level of Education Achieved	Age in Wave 6			Total
		17 years	18 years	19 years	
'Failures'	Year 8	0	0	1	1
	Year 9	1	7	6	14
	Year 10^	16	13	16	45
	Year 11^	22	23	19	64
	Certificate I or II	4	1	2	7
	Total	43	44	44	131
'Successes'	Year 10*	6	0	0	6
	Year 11*	43	6	0	49
	Year 12	112	121	105	338
	Certificate III or IV	4	10	11	25
	Diploma, Advanced Diploma	1	1	7	9
	Total	166	138	123	427
	Total (including students still studying in Year 11 and below)				558
	Total (excluding students still studying in Year 11 and below)				503

^ These students have left school, but have not commenced any further qualification.
* These students are only included for the purpose of sensitivity analysis

13. Appendix F

13.1. Methodology

13.1.1. Probit Model Specification

The probit model is developed herein using the utility or rational consumer choice theory, as developed by McFadden (1973).

One may assume that an individual's decision to complete a minimal level of schooling is dependent on their unobservable *preference* for higher education as determined by a range of socio-economic, familial and individual characteristics. This underlying and unobservable preference or propensity to complete a minimal level of schooling can be represented by an index variable as:

$$I_i = \alpha + \sum_{k=1}^{K} \beta_k X_{ki} + \varepsilon_i$$

where X_{ki} is a vector of K explanatory variables and ε_i is the random error term. This index variable representing one's propensity to complete education may be considered the difference in indirect utility gained from either completing a minimal level of school or not completing a minimal level of school, as presented at 5.3.1.

In practice, one's propensity to consume education is unobserved. Instead, one observes the actual outcome as either completing a minimal level of schooling $(MINSCHOOL_i = 1)$ or not completing $(MINSCHOOL_i = 0)$.

If the latent variable is assumed to represent the difference in utility from deciding to complete a minimal level of schooling and deciding *not* to complete, the binary outcome is observed as:

$$MINSCHOOL_i = 1 \quad if \quad I_i > 0$$
$$MINSCHOOL_i = 0 \quad if \quad I_i \leq 0$$

If a student gains greater utility from deciding to complete a minimal level of schooling, relative to not completing, $I_i > 0$ and we observe the student as completing. In contrast, if a student gains equal or greater utility from dropping out of school, $I_i \leq 0$ and we observe the student as having dropped out. The outcome observed thus depends on the value of the latent variable relative to some threshold value (Stokes 1997, pp70-1). This has been described as a "threshold-crossing" model.

The conditional probability of observing a successful outcome, or in this case observing a student complete the minimal level of schooling, is given by the probability that the latent variable exceeds the threshold level of zero:

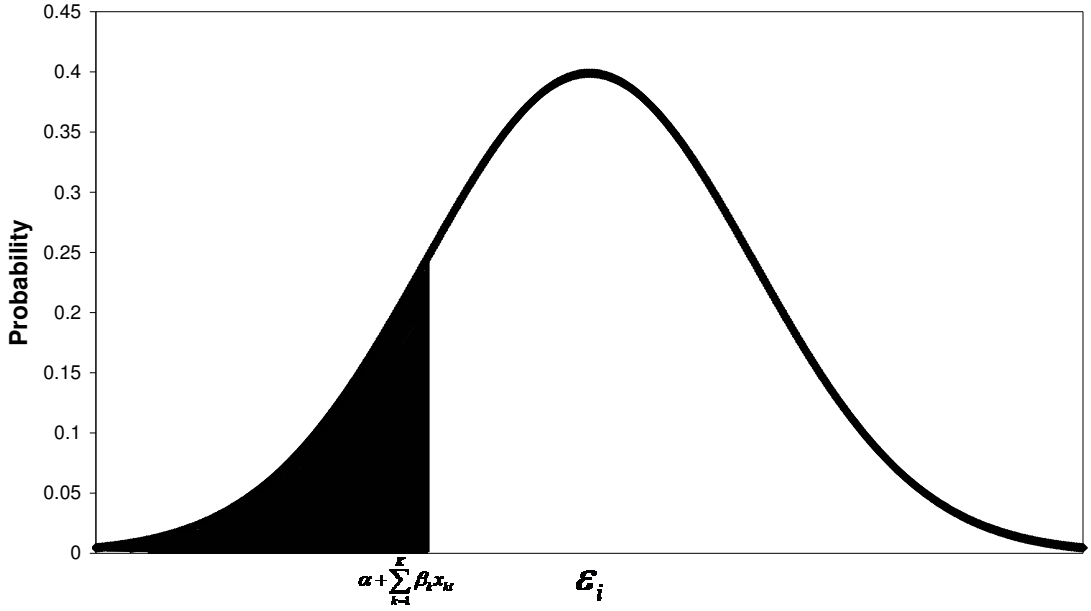
$$\begin{aligned} P\left(MINSCHOOL_i = 1 \middle| X_{ki}\right) &= P\left(I_i > 0\right) \\ &= P\left(\alpha + \sum_{k=1}^{K} \beta_k x_{ki} + \varepsilon_i > 0\right) \\ &= P\left(\varepsilon_i > -\left(\alpha + \sum_{k=1}^{K} \beta_k x_{ki}\right)\right) \\ &= P\left(\varepsilon_i \leq \alpha + \sum_{k=1}^{K} \beta_k x_{ki}\right) \end{aligned}$$

The latent variable has been replaced with its underlying specification. This shows that the probability of observing a successful outcome, conditional upon the values of all explanatory variables, is the same as the probability that the error term is greater than the negative value of the latent index. Since the probit model assumes the error is

normally distributed and therefore, symmetric, this is equivalent to evaluating the probability that the error term is less than or equal to the latent variable.

The probability that the normally distributed error term is less than the value of the index variable is given by evaluating the area under the standard normal probability distribution function to the left of the value of the index variable as shown in Figure 13.1.

Figure 13.1 Standard Normal PDF



This is equivalent to evaluating the value of the standard normal cumulative distribution function at the value of the latent variable. Thus, the conditional probability of a successful outcome is given by:

$$P(MINSCHOOL_i = 1 | X_{ki}) = P\left(\varepsilon_i \leq \alpha + \sum_{k=1}^{K} \beta_k x_{ki}\right)$$
$$= \Phi\left(\alpha + \sum_{k=1}^{K} \beta_k x_{ki}\right)$$

where Φ is the standard normal cumulative distribution function.

The conditional probability of a successful outcome is expressed as:

$$P(MINSCHOOL = 1 | X_{ki}) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{I_i} e^{-z^2/2} dz$$

13.1.2. Underlying Assumptions

The first assumption of the probit model, which is implicit in its specification, is that the dependent variable, Y_i, is binary, taking only the values of 0 or 1. Furthermore, the outcomes of Y_i are mutually exclusive and exhaustive (Aldrich and Nelson 1984, p48). The value of Y_i is assumed to be a function of the exogenous variables and the error term which account for the variation in the probability of a successful outcome (Aldrich and Nelson 1984, p48).

As discussed previously, one of the central assumptions of the probit model is that the conditional distribution of the error term, in the structural specification of the latent index, has a mean of zero and a variance of one. Since I_i is unobserved, we cannot estimate the variance of the error term ε_i. One must make some assumption regarding the mean and variance of the error term in order to identify the model (Long 1997, p47). In the case of the probit model, we impose the assumption that the error term is normally distributed. The probit model also assumes that the error term is distributed independently of the explanatory variables.

Probit models can suffer the same problems of multicollinearity as does ordinary least squares regression if any pair of the explanatory variables are highly linearly correlated. Multicollinearity may lead to imprecise and unstable coefficient estimates as well as large standard errors (Aldrich and Nelson 1984, p49). In this thesis, as is common in the econometric literature, the problem of multicollinearity is addressed by using the largest

possible sample for the regression analysis, thereby ensuring sufficient variation in the data.

13.1.3. Maximum Likelihood Estimation

As the latent variable is unobserved, the probit model cannot be estimated with ordinary least squares regression and is most commonly estimated using maximum likelihood (Long 1997, p42). This estimation technique chooses the parameters which maximise the value of an objective likelihood function which is derived with reference to the probability distribution of the dependent variable (Aldrich and Nelson 1984, p50). This procedure is detailed below.

Let p_i be the probability of observing the actual outcome of the dependent variable, be it a success (Y_i=1) or a failure (Y_i=0):

$$p_i = \begin{cases} \mathrm{P}\left(Y_i = 1 \middle| X_{ki}\right) & \text{if } Y_i = 1 \text{ is observed} \\ 1 - \mathrm{P}\left(Y_i = 1 \middle| X_{ki}\right) & \text{if } Y_i = 0 \text{ is observed} \end{cases}$$

where $\mathrm{P}\left(Y_i = 1 \middle| X_{ki}\right)$ is defined by:

$$P\left(MINSCHOOL = 1 \middle| X_{ki}\right) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{I_i} e^{-z^2/2}\, dz$$

Supposing there is a random sample of N observations, the joint probability of observing n number of Y values is given by:

$$\begin{aligned} p_i\left(Y_1, Y_2, ..., Y_N\right) &= \prod_{i=1}^{N} p_i\left(Y_i\right) \\ &= \prod_{i=1}^{N} \left[P\left(Y_i = 1 \middle| X_{ki}\right) \right]^{Y_i} \left[1 - P\left(Y_i = 1 \middle| X_{ki}\right) \right]^{(1-Y_i)} \end{aligned}$$

If the observations are independent, the likelihood function is given by:

$$\mathrm{L}\left(\alpha, \beta \middle| Y, X_K\right) = \prod_{i=1}^{N} p_i$$

Expanding the likelihood function using the binomial probability distribution yields:

$$\mathrm{L}\left(\alpha,\beta\middle|Y,X_K\right)=\prod_{y=1}P\left(Y_i=1\middle|X_{ki}\right)\prod_{y=0}\left[1-P\left(Y_i=1\middle|X_{ki}\right)\right]$$

where the index of multiplication indicates that the product is only taken over those cases where $Y_i = 1$ and $Y_i = 0$ respectively (Long 1997, p53).

The α and β coefficients to be estimated are then incorporated into the likelihood function using the specification of the probit model:

$$L\left(\alpha,\beta\middle|Y,X_K\right)=\prod_{y=1}\left[\Phi\left(\alpha+\beta_k X_{ki}\right)\right]\prod_{y=0}\left[1-\Phi\left(\alpha+\beta_k X_{ki}\right)\right]$$

where Φ is the standard normal cumulative distribution function.

Taking logs of both sides, we obtain the log likelihood function:

$$\log\mathrm{L}\left(\alpha,\beta\middle|Y,X_K\right)=\sum_{y=1}\ln\Phi\left(\alpha+\beta_k X_{ki}\right)+\sum_{y=0}\ln\left[1-\Phi\left(\alpha+\beta_k X_{ki}\right)\right]$$

For the general case, Aldrich and Nelson (1984, p53) state that the exact properties of the maximum likelihood estimators (unbiasedness, efficiency and normality) cannot be established in small samples. However, Amemiya (1985, p273-4) proves that under conditions likely to prevail in practice, the likelihood function is globally concave, ensuring unique maximum likelihood estimates. The quality of the approximation improves as the sample size increases (Aldrich and Nelson 1984, p53). Maximum likelihood estimates are consistent, asymptotically normal and asymptotically efficient (Long 1997, p53).

13.1.4. Interpreting the Marginal Coefficients

The interpretation of marginal coefficients in the context of a probit model is complicated as the estimated coefficients, $\beta_k \quad \forall k = 1,2,...K$, represent the marginal change in the value of the latent variable for a given change in the explanatory variable. This must be transformed to arrive at the marginal effect on the *probability of a success* for a given change in the same explanatory variable.

Recalling that the conditional probability of a success is equal to the cumulative density function evaluated at the value of the latent variable, the marginal effect on the probability of a success for a unit change in the independent variable x_{ki} is given by, differentiating as shown below:

$$\frac{\partial P_i}{\partial X_i} = \frac{\partial \Phi(I_i)}{\partial (I_i)} \cdot \frac{\partial (I_i)}{\partial X_i}$$
$$= \phi(I_i) \cdot \beta_k$$

where $I_i = \left(\alpha + \sum_{k=1}^{K} \beta_k X_{ki} \right)$ and ϕ is the standard normal probability density function.

Therefore, the marginal effect on the probability of success of a unit change in the explanatory variable X_k, is given by weighting the relevant coefficient by the value of the standard normal PDF evaluated at I_i. The marginal effect, therefore, differs as the value of the index variable changes. That is to say, the marginal effect of a change in any of the explanatory variables depends on the assumed values of all explanatory variables, as these are used in evaluating the value of the standard normal PDF.

However, the marginal effects for permanent income in the context of the present model is somewhat complicated by the fact that it is introduced in logarithmic form. Thus, the marginal effect for permanent income is given by:

$$\frac{\partial P_i}{\partial Y_i} = \frac{\partial \Phi(I_i)}{\partial I_i} \cdot \frac{\partial I_i}{\partial \ln(Y_i)} \cdot \frac{\partial \ln(Y_i)_i}{\partial Y_i}$$
$$= \frac{\partial \Phi(I_i)}{\partial I_i} \cdot \beta \cdot \frac{1}{Y_i}$$

where Y_i is permanent income and β is the coefficient of log permanent income. Hence, the marginal effect of permanent income must also be weighted by the inverse of the permanent income at which it is evaluated.

Evaluating the marginal effect of a dichotomous, dummy variable, however, is typically done by evaluating the probability of success for the hypothetical cases where the dummy variable is equal to zero and one, holding all other variables constant at appropriate, assumed values. The difference in the calculated probabilities represents the 'marginal' effect of the dummy variable.

13.1.5. Goodness-of-Fit

Authors have highlighted that the conventionally computed R^2 statistic is, "of limited value in the dichotomous response models," (Gujarati 2003, p586; Aldrich and Nelson 1984, p29). Aldrich and Nelson (1984, p15) contend that, "use of the coefficient of determination as a summary statistic should be avoided in models with [a] qualitative dependent variable." This was based on two factors which the authors saw as significant shortcomings to the use of summary, goodness-of-fit statistics in the binary response case. Firstly, the dependent variable is inherently heteroscedastic meaning sample variance can be neither aggregated nor apportioned easily between explained and residual variance (Aldrich and Nelson 1984, p15). Secondly, the maximum R^2 value is

generally much lower than one as a "perfect fit is essentially impossible," when the dependent variable can take on only two values (Aldrich and Nelson 1984, p29). Gujarati (2003, p586) states that in practical applications, R^2 for binary response variables ranges between 0.2 and 0.6.

Given these shortcomings, however, using some augmented measure of goodness-of-fit can be informative nonetheless for judging the quality of a particular binary response model. A number of these alternative measures are presented below. It is important to remember, however, that these statistics should always be treated as secondary conditions in judging the performance of a model. Of primary importance is whether the coefficient estimates conform to their *a priori* expected sign, as well as the significance of individual coefficient estimates and the sensitivity of the estimated coefficients to the specification of the model (Gujarati 2003, p606). In addition, it is important that the included variables, and the manner in which they are introduced, is based on strong theoretical and empirical evidence.

One of the most useful measures of goodness of fit for a model based on maximum likelihood estimation is the Likelihood Ratio statistic. The null and alternative hypotheses are:

$$H_0: \beta_1 = \beta_2 = \beta_3 = ... = \beta_K = 0$$

H_1: At least one of the slope coefficients is non-zero.

Thus, it is a test of the overall significance of the model.

The test statistic is calculated as:

$$\lambda = -2(\log L_0 - \log L_C) \quad \sim \chi^2_{(df=K,\alpha)}$$

where L_o is the likelihood ratio for the null model when all slope coefficients are assumed to equal zero and L_C is the likelihood ratio for the 'competing' model (Powers and Xie 2000, p70; Aldrich and Nelson 1984, p55). This statistic follows the Chi square distribution where the degrees of freedom is equal to the number of restrictions *(K),* or in other words, the number of slope coefficients assumed to be equal to zero. If the test statistic is significant, this implies that the null hypothesis is rejected and the model is significant overall.

Another popular measure of a model's overall goodness-of-fit is the pseudo R^2 which also utilises the log likelihood. It is calculated as:

$$Pseudo\ R^2 = \frac{\log L_C - \log L_0}{\log L_f - \log L_0}$$

where L_0 is the likelihood from the null model where all slope coefficients are assumed to be zero, L_C is the likelihood from the competing model and L_f is the maximum attainable likelihood for the data. Given that $L_0 \le L_C \le L_f \le 0$, the *pseudo* R^2 statistic lies between zero and one where zero implies that the competing model offers no improvement over the null, whereas one implies that the model provides perfect fit for the data (Powers and Xie 2000, p71).

Finally, the count R^2 statistic can be used as a measure of a model's overall performance. Generally, it is calculated by forecasting the probability of success for all sample members and then determining what proportion of these predictions were correct, based on the observed data and a probability cut-off of 0.5 (Aldrich and Nelson

1984, p57). However, there are a number of shortcomings of using this procedure, as highlighted by Weisberg (1978). For example, there is no well-defined baseline or null expectation as to an acceptable count R^2. An erroneous prediction at a cut-off of 0.51 should also be treated as less 'bad' than an incorrect prediction which prevails at a cut-off of 0.99 (Aldrich and Nelson 1984, p57).

Two alternative methods of calculating a count R^2 have been suggested which address these shortcomings. Firstly, Long (1997, p108) suggests using:

$$R^2_{AdjCount} = \frac{\sum_j n_{jj} - \max_r (n_{r+})}{N - \max_r (n_{r+})}$$

where $\sum_j n_{jj}$ is the number of correct predictions for the outcome, $\max_r (n_{r+})$ is the maximum row marginal (the number of observations in the observed outcome with the most observations) and N is the sample size. This statistic is based on the idea that any model could correctly predict at least 50% of the observations by merely predicting, for all observations, that outcome which most frequently occurs in the sample. The $R^2_{AdjCount}$ statistic, therefore, measures the proportion of incorrect predictions from the naïve model which can be corrected by using the additional explanatory variables included in the model. Kennedy (2008, p249) suggests calculating a count R^2 equal to, "the sum of the fractions of zeros correctly predicted plus the fraction of ones correctly predicted." This number should exceed unity if the prediction method, "is of value," (Kennedy 2008, p249).

14. Appendix G

14.1. Marginal Effects

14.1.1. Effect of Parents' Education and Neighbourhood

Note that the marginal effects presented in this Section are based on a student with permanent RHED income equal to the median (=$28,222).

Table 14.1 Effect of Parents' Education and Neighbourhood by Gender

Parent's Education	Boy			Girl		
	SEIFA: Ad/Dis			SEIFA: Ad/Dis		
	Low	Mid	High	Low	Mid	High
Neither parent educated	47.7%	59.6%	70.9%	67.5%	77.5%	85.6%
Father only educated	69.1%	78.9%	86.6%	78.9%	86.5%	92.1%
Mother only educated	61.1%	72.1%	81.4%	77.5%	85.5%	91.3%
Both parents educated	80.0%	87.4%	92.6%	86.5%	92.0%	95.6%

Note: Estimated probabilities based on non-Indigenous student with median permanent RHED income (=$28,222) and median RHE wealth (=$66,071)

Figure 14.1 Effect of Parents' Education and Neighbourhood by Gender