Economic Implications of Psychosocial Development in Childhood: Long-Term Outcomes and the Costs of Intervention

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2005

PhD Thesis

Abstract

This thesis explores two issues: **1.** the relationship between emotional and behavioural difficulties in childhood and adult economic attainment; and **2.** the costs arising from the public service response to child and adolescent psychosocial difficulties.

After a review of the relevant literature, longitudinal data are used to examine the first of these issues. The relationship between psychosocial development and labour market outcomes are examined for a cohort of British males of predominantly working class origin. Similar longitudinal analyses are then repeated in a national and more socially representative British birth cohort born in 1970 who were most recently followed-up at age 30. Econometric estimations relating to age 30 earnings within the 1970 cohort are combined with cross-sectional earnings data from a large survey of the UK labour force to arrive at a series of lifecycle earnings projections for workers who experienced childhood psychosocial problems.

Potential justifications for public intervention are examined followed by an outline of current service arrangements in the UK and a discussion of recent policy developments towards child and adolescent psychosocial problems. Service utilisation data from a major epidemiological survey of the mental health of children and adolescents in Britain are then used to derive new empirical estimates of the costs to the National Health Service and education system arising from child and adolescent psychopathology. Individual variations in costs are then examined in more detail using multivariate statistical methods with a view to assessing the extent to which services are responsive to psychosocial problems that are more socially and academically disabling.

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Acknowledgements

The empirical investigations reported in this thesis would not have been possible without access to the following data:

The Cambridge Study in Delinquent Development (CSDD)

I am grateful to Professor David Farrington (University of Cambridge) for providing access to the CSDD. The study reported in chapter 2 is in fact a follow-up to an existing piece of work, also based on the CSDD, co-authored by myself, Martin Knapp and David Farrington (Healey et al., 2004).

The 1970 British Cohort Study (BCS70)

Data from the BCS70 were made available by the UK Data Archive (UKDA) held at the University of Essex. The BCS70 is managed by the Centre for Longitudinal Studies at the Institute of Education, London.

The British Child and Adolescent Mental Health Surveys

I would like to thank Dr Tamsin Ford (Institute of Psychiatry), Professor Robert Goodman (Institute of Psychiatry) and Howard Meltzer (Office for National Statistics) for providing full access to the baseline epidemiological data and the follow-up data on service utilisation from the British Child and Adolescent Mental Health Surveys.

All the empirical investigations reported in the thesis were conducted using various statistical software including Stata (Stata & Corporation, 2005), SPSS (SPSS & inc, 2005), NORM multiple imputations software (Schafer, 1999) and Excel (Microsoft, 2005).

All the work that I have used to complete the thesis was carried out as part of my Department of Health funded post at the LSE branch of the Personal Social Services Research Unit (PSSRU). All views and opinions expressed in the thesis are my own and not necessarily those of the Department of Health.

I would particularly like to thank my supervisor, Professor Martin Knapp (LSE), for initially encouraging me to pursue the themes addressed in the thesis, for his overall guidance, for his commentary on earlier drafts of the chapters and for allowing me the freedom and time to complete.

I am also greatly indebted to everyone who provided both encouragement and advice on the long road to completion, and particularly: Jose-Luis Fernández (LSE), Alistair McGuire (LSE), Maria Raikou (LSE), Tamisn Ford (Institute of Psychiatry), Robert Goodman (Institute of Psychiatry), Barbara Maughan (Institute of Psychiatry) and Richard Dubourg (Home Office). Finally, I thank my examiners for providing some additional references and helpful comments that have been subsequently incorporated into the thesis.

Preface

There is now an extensive body of evidence showing that children and teenagers who engage in antisocial behaviour, who have severe problems with attentiveness at school or who experience emotional distress and poor mental health are more likely to be disadvantaged later in life: low educational achievement, delinquency, aggression and violence, poor-interpersonal skills and psychiatric illness are all examples of the types of adult outcomes that have been shown to have some degree of continuity with behavioural and psychological development during earlier years. Public policy in the United Kingdom has become increasingly concerned with promoting lifetime opportunity through a more concerted response to social and economic inequalities that have their roots in childhood experience. As such, the psychosocial development of children and adolescents has received greater prominence in recent policy making and legislation concerned with promoting child and adolescent wellbeing broadly defined.

Aims of the thesis

The thesis pursues two specific lines of enquiry:

1. Psychosocial problems in childhood and future economic attainment

It seeks to make a further contribution to our understanding of the lasting consequences of psychosocial problems in earlier years. Existing sources of longitudinal data are used to explore the link between behavioural problems (including antisocial conduct and attention deficit problems/hyperactivity) and emotional wellbeing in late childhood and economic attainment during late adolescence and in adulthood. Earnings, occupational status, exposure to poverty levels of income, employment participation and job stability are all examined. All of these outcomes are of relevance to public policy for varying reasons. Both stable employment and earnings provide some indication of the productive contribution an individual makes to the macro-economy. Occupational status, levels of pay and employment patterns over the working life-cycle will also determine, to a large extent, the income and underlying welfare of individuals and their families as measured, for example, by life-time consumption opportunities. Earnings are also likely to have a part in affecting the likelihood of exposure to poverty: while comparatively low pay does not always result deprived living circumstances, it is certainly the case that most people living below pre-defined poverty thresholds also live in low wage households (Nolan & Marx, 2000). Financial strain has in itself been linked to broader indicators of personal wellbeing, including mental health (Weich & Lewis, 1998). Employment and income may also have a wider social significance. There is evidence, for example, that changes in pay at the lower end of the income distribution can affect marginal incentives to commit crime (Machin & Meghir, 2000; Witt et al., 1999). Unemployment, and stability of employment through time, is also both closely related to other important public policy objectives. Persistent unemployment, for example, is closely linked to "social exclusion", a concept which has had a prominent position in social policy discourse over recent years (Burchardt et al., 2002).

2. Costs of the public service response to psychosocial problems in childhood and adolescence.

A wide range of public services and professionals are potentially in a position to offer some response to behavioural or emotional problems experienced by children and adolescents. This thesis uses parental reported service utilisation data from a large epidemiological survey to provide estimates of the costs of public service involvement with children and adolescents experiencing behavioural and emotional problems, including contacts with teachers, special education resources, mental health professionals, primary care and children's health services.

Specific attention is paid to the measurement of the opportunity costs of targeting resources on problem children and adolescents. Knowledge of the cost consequences of behavioural problems and emotional difficulties in childhood and adolescence is of policy significance for two reasons. Firstly, it will be required when seeking to appraise the overall net contribution to societal wellbeing attributable to intervention: health and educational inputs may very well have a impact in terms of reducing behavioural problems and distress, or improving the learning capabilities of problem children, but they could also in principle be of value if allocated towards other socially productive uses. Secondly, identifying cost implications at the margin can also serve as a partial measure of the benefits of either preventing or ameliorating problem behaviour and emotional distress: effective drug treatments or behavioural interventions provided in health service settings could, for example, lower the resource demands within other sectors responding to the problems arising from behavioural and emotional difficulties, including the allocation of teacher time and special education resources toward problem children.

The thesis also examines more closely the variability in costs among children who have some level of contact with services, and the degree to which there is a responsiveness in resource terms to the severity of the social and learning impairments arising from emotional and behavioural difficulties experienced. Multivariate analysis of cost variability can offer important additional insights regarding the extent to which services currently target resources on children and adolescents identified has having more severe difficulties - i.e. those who might be considered as being in the greatest "need" of some form of intervention.

A note on terminology

In the title of this thesis, and throughout the forthcoming chapters, frequent reference is made to the concept of "psychosocial" development (or problems and difficulties). This term is potentially inclusive of a wide range of issues concerning the mental health, psychological development, cognitive development and behavioural interaction between children/adolescents and their immediate environment. From the outset the thesis largely focuses on three specific types of psychosocial problem that have received considerable attention in the relevant literature, and are generally regarded as being the most frequently occurring of problems:

Antisocial conduct - during childhood this will typically cover a range of "externalising" behaviours such as fighting and general aggressiveness, bullying, stealing and oppositionally defiant behaviour. During adolescence persistent behavioural problems may develop into delinquency and criminality including damage to property, a tendency to violence perhaps involving the use of weapons, theft, drinking and drug taking and truancy.

Attention deficit problems and hyperactivity - while distinct, both these types of problem have a tendency to co-exist and, as such, are often considered together. Attention deficit problems are characterised by an increasing tendency to be distracted and to have difficulties concentrating on basic tasks at home or within the school environment. Hyperactivity might best be described as persist restlessness or "fidgety" behaviour.

Emotional problems - including anxiety and depression. The longitudinal investigations reported in chapter 2 of this thesis also utilises a more general indicator, or risk factor, for childhood mental health problems, namely "neuroticism", a personality construct describing children who have a greater tendency to be nervous, moody, stressful, and emotionally sensitive.

It should be stressed that much of the thesis, specifically chapters 2 and 3, do not deal specifically with the identification of children who would be regarded by the psychiatric community as suffering from a specific type of mental or behavioural disorder. Each of the three general areas of concern identified above have their clinically defined equivalent requiring certain pre-specified criteria to be met before a psychiatric diagnosis can be assigned: "oppositional defiant disorder", "conduct disorder", "hyperkinetic disorder", "attention deficit-hyperactivity disorder", "anxiety disorder" and "depressive disorder" are all examples. Chapter 1, which discussed evidence relating to prevalence, and Chapter 5, which draws on data from a large-scale epidemiological survey to estimate public service costs, makes greater use of these psychiatric diagnostic classifications.

Structure of thesis

The thesis is structured as follows:

Chapter 1 *- Psychosocial problems in childhood and adolescence: prevalence, risk factors and long-term impacts*

- Reviews evidence on the prevalence and risk factors associated with the development of child and adolescence psychosocial problems and considers the existing literature concerning their relation to future labour market outcomes.

Chapter 2 *- Psychosocial development in late childhood and economic attainment: evidence from a cohort of working class British males*

- Examines the association between psychosocial problems observed in late childhood and employment outcomes within a cohort of males of mainly working class origin who attended school in an area if inner-London during the early 1960s. The outcomes studied include unemployment and number of jobs held (a measure of job stability) over specified periods of time during the post-school teenage years and prior to age 32. The chapter also considers weekly take-home pay at age 32.

Chapter 3 - Psychosocial development in late childhood and economic attainment: evidence from a British birth cohort

- Investigates the association between psychosocial problems in late childhood and future attainment, this time within a large national birth cohort of males and females born in 1970. Outcomes examined (all at age 30) include weekly earnings, occupational status, participation in employment and other human capital enhancing activities and exposure to low household income (based on a conventionally applied definition of relative poverty). Econometric estimations are used to make a series of earnings projections with a view to evaluating the potential effect on life-cycle earnings arising psychosocial difficulties observed at age 10.

Chapter 4 - Service arrangements and policy development

- Considers the possible justifications for public intervention in the psychosocial development of children and adolescents and reviews existing service arrangements and more recent policy developments in this field.

Chapter 5 - The costs of intervention

- Evaluates the costs of public service provision for children and adolescents with behavioural and emotional difficulties using data from a large-scale British epidemiological survey of child and adolescent psychiatric disorders. The emphasis is on estimating the costs to the National Health Service (mental health, child and paediatric and primary care services) and the education system (teaching and other "frontline" education inputs and special education resources).

Chapter 6 *- Concluding discussion*

- Overviews the main empirical findings and the main limitations of the empirical work reported in the thesis. The policy implications arising from the empirical investigations are discussed with some suggestions for future research.

1 Psychosocial problems in childhood and adolescence: prevalence, risk factors and long-term impacts

Summary

Many children and adolescents will developmental problems of a psychosocial nature. Epidemiological evidence, for example, suggests that around 10% of British children aged 5-15 will have a behavioural or emotional difficulty severe and pervasive enough to warrant a psychiatric diagnosis, though prevalence varies significantly by gender, ethnicity and family income. It is generally accepted that most psychosocial problems of childhood and adolescence are the outcome of a complex interplay between genetic heritability and environmental factors. Lower educational achievement, a persistence of behavioural problems and antisocial lifestyles and a greater risk of future psychiatric illness are all reasons for expecting lower levels of economic attainment among children and adolescents who experience psychosocial difficulties. This chapter considers published evidence on the link between child and adolescent behavioural and emotional problems and economic attainment later in life. There is overwhelming evidence that antisocial children and adolescents face a greater risk of unemployment or poor employment stability as teenagers and adults, though evidence on their relative future earnings potential remains unclear. There is an indication in some studies that child and adolescent emotional distress and attention deficit problems/hyperactivity may increase the likelihood of experiencing poor employment outcomes later in life. Collectively, however, this evidence is not as extensive, nor as consistent in its findings, when compared to those studies primarily concerned with antisocial conduct and future employment status.

1.1 Introduction

This chapter offers something of a "curtain raiser" to chapters 2 and 3, which both detail two empirical strands of research that seek to contribute to the existing body of evidence on the association between adult economic attainment and psychosocial problems during childhood. It initially provides an overview of existing estimates of the number of children and adolescents likely to be affected by psychosocial problems, including behavioural and emotional difficulties, and looks at what factors are thought to play a significant role in their development. A framework for conceptualising the link between psychosocial characteristics and adult economic attainment is then described, followed by a discussion of some the potential transmission mechanisms governing the relationships outlined in this model. The chapter finishes with a review of what the empirical literature has to say on the relationship between psychosocial development and future labour market outcomes.

1.2 The prevalence of child and adolescent psychosocial problems

Epidemiological surveys provide and important source of evidence on the number of children affected by behavioural and emotional difficulties. The focus of these surveys is usually on psychiatrically defined "caseness" - the identification of those children who meet pre-defined diagnostic criteria for specific types of mental or behavioural disorders. The most widely adopted criteria in Europe are the World Health Organisation's ICD-10 classificatory system (World Health Organisation, 1993). North American studies - an important source of evidence of population prevalence - mainly apply the fourth Diagnostic and Statistical Manual for Mental Disorders (DSM IV) as advocated by the American Psychiatric Association (American Psychiatric Association, 1994).

It is important to recognise that epidemiological prevalence estimates, whilst useful in summarising the numbers affected by specific types of disorder, generally rely on the dichotomisation of children into those who are and who are not considered to be disordered in any specific way based on accepted psychiatric definitions. However, there is clearly scope for many more children to be functionally and socially impaired by the symptoms and behavioural features associated with recognisable disorders who would not necessarily meet the required diagnostic criteria for being identified as a clinical "case". For example, Pickles et al. (2001) found that meeting the threshold for a psychiatric disorder is not necessarily a good indicator of the degree to which a specific set of problems impact on children's day-to-day functioning. This would imply that psychosocial problems in childhood and adolescence, and the social disabilities and damage to individual functioning that they engender, may be significantly more extensive than that implied by current prevalence estimates concerning psychiatric disorder *per se*.

The most detailed survey of the mental health and behavioural problems of children and adolescents carried out in the United Kingdom was recently conducted by the Office of National Statistics (ONS; The British Child and Adolescent Mental Health Surveys; Meltzer et al., 2000). It estimates that over 1 in 10 of the British population aged between 5- and 15-years-of-age will experience a mental or behavioural disorder at any given time. Around 8% of children aged 5-10 are estimated to be affected, while the prevalence among secondary school-aged children is put slightly higher at around 11%. Prevalence estimates of a similar order of magnitude have also been observed in other non-UK epidemiological studies (Brandenburg et al., 1990; Costello, 1989; Padgett et al., 1993).

There is considerable variation in the prevalence of different types of disorder. Conduct disorder - characterised by persistent and frequently aggressive, destructive and disruptive behaviour in the home and at school (Scott, 1998) - is estimated by the ONS survey to be the most commonly occurring childhood psychiatric disorder in Britain, with an estimated prevalence of 4.6 % among 5-15-year-olds (Meltzer et al., 2000). Other non-UK studies have estimated rates of prevalence ranging from anything between 2% to 10% (Bird et al., 1988; Costello et al., 1988). Hyperkinetic disorders - characterised by severe restlessness, impulsiveness and impaired concentration levels - are estimated to be less common than conduct disorder, affecting around 1.5% of 5- to 10-year-olds and 1.4% of adolescents. These estimates are similar to those reported elsewhere by Taylor et al. (1991) who studied a sample of UK primary school boys.

Sensitivity of prevalence estimates to diagnostic criteria is reflected in international discrepancies in prevalence rates for attention deficit problems and hyperactivity (Lord & Paisley, 2000). North American studies, which use an alterative system of diagnostic classification to British epidemiological surveys, deliver much higher prevalence estimates for what the DSM IV criteria calls attention deficit-hyperactive disorder (ADHD). ADHD is based on less stringent criteria for the identification of psychiatric caseness compared to the ICD-10 definition of a hyperkinetic disorder. (Green et al., 1999) report US prevalence estimates ranging from 4% up to 26% for ADHD. (Lord & Paisley, 2000) also suggest that discrepancies in epidemiological findings with respect to hyperactivity and attention deficit-related problems may be due to important cultural-specific differences as regards the recognition of problem behaviour in children, as well as variability in levels of exposure to potentially important risk factors.

Emotional disorders in childhood are also of epidemiological significance. These cover a range of childhood mental health problems including types of anxiety disorder and child and adolescent depression. Depressive illness is of particular concern in the light of evidence showing increasing prevalence levels in recent decades and rising levels of adolescent suicide (Diekstra, 1995; Klerman & Weissman, 1989). Meltzer et al. (2000) estimate that only 0.2% of 5 to 10 year olds could be considered as being clinically depressed, though the prevalence rate increases to 1.8% among 11 to 15 year olds. In Britain most emotional problems experienced by children are in fact anxiety-related, affecting 3.1% of children aged 5 to 10 and 4.6% of 11 to 15 year olds.

There is evidence that the prevalence of psychosocial problems varies considerably according to gender, ethnicity, familial characteristics and parental income. Conduct and hyperkinetic disorders are significantly more prevalent in boys, though gender-based differences in prevalence rates for emotional disorders are generally less marked. Of particular note are the stark inequalities in prevalence by parental income. In the ONS survey referred to earlier, the prevalence rate among all children living in families with a weekly income of more than £500 per week was estimated to be 6% compared to 16% among children whose parents were located in the poorest income bracket (less than £100 per week). Differences between the top and bottom ends of the parental income distribution in the ONS survey were also found to be even more substantial for children aged 8-10 years, with a 19 percentage point difference in the estimated prevalence of all childhood psychiatric disorders between the top and bottom income groups (Meltzer et al., 2000).

Different types of childhood psychosocial difficulties are also more likely to jointly occur with one-another, or at least with other types of developmental impairment. Conduct disorder and attention deficit/hyperactivity are co-existing problems for many children and adolescents (Biederman et al., 1991; Kaplan et al., 2000; Peterson et al., 2001). The long-term prognosis is particularly poor for children experiencing both conduct disorder and hyperactivity, most notably with regard to low achievement at school and the development of persistent antisocial and delinquent tendencies (Scott, 1998). Attention deficit problems have also been shown to co-exist with emotional problems (including anxiety-and mood-rated disorders) and a range of other developmental problems including dyslexia, dysgraphia and Tourettes syndrome (this literature has been reviewed more extensively by Brassett-Grundy & Butler (2004a)).

1.3 Risk factors

The identification of factors that make an important contribution to elevated risks of experiencing emotional and behavioural problems is an important issue for social policy design, not least because they point to the types of external intervention that are likely to be most successful in preventing, or at least limiting, psychosocial difficulties experienced through childhood and adolescence. Many of the existing interventions that target mental health and behavioural problems in children have been developed from knowledge of the processes that seem to increase individual susceptibility to problems. Drug treatments for attention deficit problems and hyperactivity, for example, target biological mechanisms while social interventions promoting better parenting skills deal the quality of child and parental interactions which are known to influence the risk of a child developing and maintaining patterns of problem behaviour (Cooper, 2001; Scott, 1998; Taylor, 1994).

The debate and evidence concerning the relative contribution of nature versus nurture in psychological and behavioural development is complex. It is now generally believed that genetic heritance plays an important role, but crucially it should be seen as a *risk factor* for certain types of psychosocial problem and not in anyway deterministic (Rutter, 2002). Genetic heritability is known to be relatively important contributor to the development of hyperactivity and life-course persistent antisocial behaviour (M. Rutter, 2002; Simonoff, 2001; Tannock, 1998) - these conclusions being reached through rigorously designed "twin" and "adoption" studies. Genetic inheritance is thought to be of less importance in explaining individual susceptibility to depression and anxiety-related disorders (Rutter, 2002).

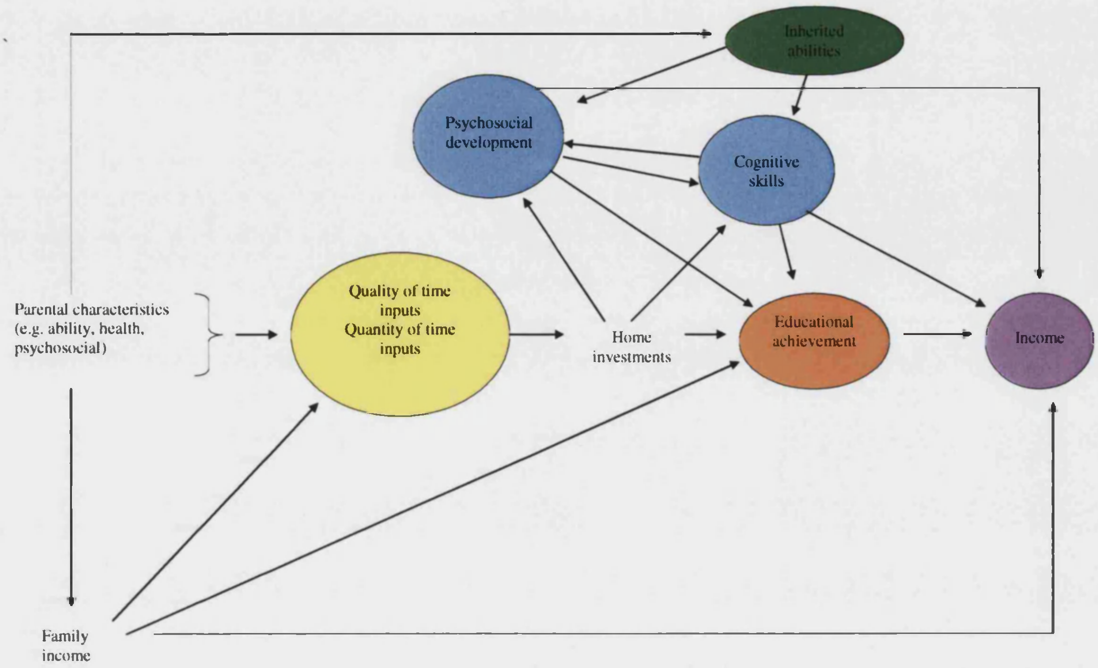
Despite scientific support for the role of genetic heritability, the effect of environmental influences both within and beyond the context of the immediate family have also been shown to be of significance. Poor parenting skills (e.g. harsh and inconsistent discipline regimes), lack of parental involvement and supervision and parental separation and marital discord are all examples of adverse environmental risk factors linked to the development of behavioural problems (Earls, 1994; Maughan, 2001; Rodgers & Pryor, 1998; Scott, 1998). Child abuse (physical and sexual) is more strongly linked to life-course persistent antisocial tendencies and adult personality disorders (Maughan, 2001). There is some evidence that children who have spent time within institutional settings are at greater risk of developing attention deficit problems and impulsive behavioural traits (Tizard & Hodges, 1978). Dietary intake and environmental exposure to lead - are both thought to adversely affect behavioural development (Earls, 1994; Taylor, 1994; Thomson et al., 1989). Family adversity and parental psychopathology have both been positively linked to depression in adolescence, while positive relationships with peers, parents and other adults are associated with a reduced risk of experiencing depressive outcomes (Fombonne, 1995). Away from the family, the school environment and the quality of teacher-pupil interactions have been shown to have a negative reinforcing influence on behavioural outcomes (Farrington, 2003; Maughan, 2001), while area-level deprivation has also been linked to behavioural problems in children, though the causal mechanisms behind this relationship remain unclear (Kalff et al., 2001).

While there are clear associations between nature, nurture and the development of psychosocial difficulties, the causal processes that underpin these relationships may not yet be fully understood (Rutter, 2002). For example, studies that demonstrate a link between parenting and behaviour may not fully account for the fact that both may have an important genetic component. There are also questions regarding the degree to which psychosocial outcomes depend on more complex processes involving different mediating mechanisms. Neuro-chemical and neuro-psychological factors, which may have a strong heritable component are, for example, thought to be important causal factors behind the development of hyperactivity, conduct problems and anxiety-related disorders in childhood (Earls, 1994; Harrington, 2001; Klein, 1994; Taylor, 1994). Moreover, simply adding up the separate component effects of nature and nurture is still likely to yield unexplained variance in the psychosocial characteristics of individuals given that there are also likely to be important interaction effects between heritability and environmental factors to take into account (Rutter, 2002).

1.4 Adult economic attainment psychosocial development in childhood: analytical framework

Much of the work carried out by economists into the determinants of adult economic status has been based around the theoretical modelling of the family as a decision-making unit (Becker & Tomes, 1979; Becker, 2001; Leibowitz, 1974). Theoretical and empirical developments in this area of work have been extensively reviewed by Haveman & Wolfe (1995). The economic approach to modelling future attainment provides a useful framework within which to consider the potential long-standing effects of psychosocial development during childhood and beyond. Figure 1.1 is a version of a diagrammatic exposition of the model originally presented by Leibowitz (1974), adapted to include psychosocial development as an integral mechanism in determining adult economic status.

Figure 1
Adult economic status, psychosocial development and family background



Adapted from Leibowitz (1974) and Haveman and Wolfe (1995)

The model is a somewhat simplified version of what are likely to involve many complex inter-connections between various salient features of childhood development and economic and social outcomes later on in life. The model has two defining features. Firstly, individuals can genetically inherit natural endowments from their parents: these endowments might relate to intelligence, or specific "cultural" endowments such as a willingness to learn or a stock of highly marketable skills. It is straightforward to think of different aspects of psychosocial development as being an inclusive part of this inherited stock of personal characteristics - and as outlined in the previous section, heritability is likely to have an important role to play in this regard.

In addition to inherited endowments, parental decision-making (which in itself may have an important genetic component) also plays a central role in the economic model of future attainment. The future wellbeing of off-spring is taken to be a primary motivation behind the time allocation and expenditure decisions made by parents.[1] Parental characteristics (e.g. ability, health), prior educational investments, parental fertility (affecting the number of children in a household) and preferences are all assumed to play a role in influencing allocative decisions within the family unit. These "home investments", combined with inherited endowments, are all likely to influence educational attainment and the future earnings potential of children.

Cognitive skills development, for example, is but one type of an inherited and environmentally determined ability that is known to have a crucial impact on schooling outcomes and labour market success (Carneiro & Heckman, 2003; Heckman, 2000). This is not surprising given that cognitive development will typically encompass mathematical competence, problem solving skills and word knowledge. But parental investments and heritability are also likely to affect the psychosocial (non-cognitive aspects) of personal development from an early age. Economists are now beginning to view these additional characteristics as at least as important for future levels of attainment. Indeed, Cawley et al. (2001) suggest that the failure to account for the role of non-cognitive skills in determining future attainment has represented a major draw back of existing econometric investigations of individual labour market success. They consider various types of abilities as being of potential significance, including individual self-motivation, persistence, self-discipline and time preference, though it would be straightforward to expand this list to include the wider aspects of behavioural and emotional development. A growing body of empirical work in the economics literature is beginning to offer a growing indication of the significance of inherited and parentally determined non-cognitive endowments for educational attainment - an

[1] Becker (2001) also allows a role for public expenditures and investments in the future attainment of children. Possible justifications for public intervention in the psychosocial development of children and adolescents are outlined in chapter 4.

important contributor to how much an individual can expect to earn over their life-time (Behrman & Taubman, 1989). Hansen et al. (2004), using national longitudinal data from the US, find a significant relationship between both cognitive and non-cognitive abilities (specifically self-esteem and "locus of control") on the probability of school drop-out as well as spending time in jail, becoming a smoker and non-marital pregnancy. Increasing levels of non-cognitive performance, for example, were found to reduce the probability of being a school drop-out to almost zero for females with average cognitive skills. Elsewhere, non-cognitive performance has been found to hinder schooling with attendant implications for school achievement test scores (Hansen et al., 2004).

In principle, there are likely to be various transmission mechanisms linking the main childhood psychosocial outcomes of interest in this thesis with future economic status. Children and adolescents with more severe psychosocial problems, including conduct problems and hyperactivity/attention deficits, are less likely to do well at school (Barkley, 1990; Faraone et al., 1993; Fergusson & Horwood, 1995; Kessler et al., 1995; Lambert, 1988; Taylor, 1994). Beyond their impact on educational achievement, behavioural problems in childhood have also been shown to be an important marker for the future development of a cluster of adult behavioural characteristics indicative of an antisocial personality (Maughan, 2001; Robins, 1978; Rutter et al., 1998; Scott, 1998; Taylor, 1994). These typically include criminality, poor peer-relations and interpersonal skills, impulsiveness (i.e. acting without thinking), aggressive and violent behaviour, and heavy drinking (Moran & Hagell, 2001). There is further evidence suggesting that these behaviours and life-style characteristics are unlikely to be conducive to more favourable employment outcomes. Problem drinking and illegal drug use have been shown to inhibit employment participation (Buchmueller & Zuvekas, 1998; Mullahy & Sindelar, 1996) and to depress earnings (Mullahy & Sindelar, 1993). Receipt of a criminal conviction can also significantly reduce the chances of gaining employment (Nagin & Waldfogel, 1995), although this may depend on the reason for conviction and the extent to which factors such as trust are viewed as an important job characteristic (Waldfogel, 1994).

As noted earlier, economists have more recently begun to address in more detail the lack of explanatory power associated with empirical models of adult attainment that specify relevant outcomes, such as the wage rate, purely as a function of human capital-related factors (qualifications, skills and ability), age, gender, and family background variables (Bowles et al., 2001a; Cunha et al., 2005; Filer, 1986; Goldsmith et al., 1997). Much of this work had focused on the significance of indicators of personality type (or non-cognitive skills) as additional determinants of economic status. These newer developments have a particular resonance in the context of the current discussion because of the continuity that has been shown to exist between behavioural problems in children and adult antisocial personality development. Caspi et al. (1998), for example, characterise adult antisocial tendencies as a form of depleted "personal capital." They suggest that young adults who are more prone to antisocial behaviours may have a greater propensity to select out of stable employment for various reasons: firstly, it may be indicative of an inherent preference to avoid work which in turn reflects one element of a more general syndrome of deviant, or non-conformist, choice patterns; secondly, antisocial adults may have a tendency to select into jobs that have a higher natural rate of employee turnover; and thirdly, poor social skills and an inability to get on with peers will both increase the risk of dismissal from employment.

The relationship between childhood psychosocial development and future personal/psychological capital need not only be limited to issues concerning the antisocial behaviour. There is evidence that many children who suffer from poor attentiveness or hyperactive behaviour will continue to experience these difficulties into their adult lives (Brassett-Grundy & Butler, 2004a). A persistent inability to concentrate on work-related tasks may, for example, negatively affect employment chances as well as workplace productivity and earnings.

Emotional difficulties in childhood and adolescence - including anxiety and depression - may also persist. E. Fombonne et al. (2001b) and E. Fombonne et al. (2001a), report that in excess of 70% of a group of depressed children and adolescents referred to a child and adolescent mental health service also experienced depressive symptoms in adulthood, while over 40% had attempted suicide as adults. Capaldi & Stoolmiller (1999) also report evidence of continuity between depression in adolescence and early adulthood. Caspi et al. (1998) suggest that poor mental health may limit the desire and motivation to seek employment, it may interfere with workplace productivity and it may further destabilise job status if it interferes with the ability of individuals to interact appropriately with fellow workers. Various empirical studies have found that adult mental health problems do have a negative impact on both earnings (Bartel & Taubman, 1986; Frank & Gertler, 1991; French & Zarkin, 1998) and workforce participation (Bartel & Taubman, 1979; Hamilton et al., 1997).

1.5 *Economic status and psychosocial development: current evidence*

The review of existing evidence on adult economic status and psychosocial problems in childhood and adolescence is divided between those studies that have either looked at outcomes relating to employment participation and job stability and those that have focussed on pay. While the review is not systematic, it has attempted to pick up on the main sources of existing evidence using internet searches and citations made in the relevant literature. Interest in this field of study has been multidisciplinary, including empirical research reported in the developmental psychology, child psychiatry, sociological and economic literatures. Nearly all the papers published by non-economists have considered various measures of employment participation alongside, in some cases, other social outcomes (e.g. marital status, peer-relationships, criminal behaviour, drinking behaviour). Empirical investigations of the relationship between adult earnings and antecedent indicators of psychosocial development have, with the occasional exception, been carried out by economists.

All the evidence reviewed has utilised various types of longitudinal data when examining key relationships of interest, reflecting the methodological advantages of using prospectively generated data on the same individuals through time (Hakim, 1987). Longitudinal data, while having some important limitations (some of these are discussed in relation to the empirical analysis reported in chapters 2 and 3) enable hypotheses regarding causality to be tested that could not be done so in a reliable fashion using cross-sectional data (Rutter, 1994). They can facilitate the investigation of important relationships of interest (causal or otherwise) between variables that widely separated by time (so-called "sleeper effects"; (Hakim, 1987)). They also avoid the problem of recall bias often associated with cross-sectional survey designs that employ the retrospective measurement of individual-level events and experiences that have occurred during the past (Dex, 1991).

1.5.1 Labour market participation

The evidence relating to participation in the labour market has either been concerned with employment outcomes during adulthood - mainly over the 26-36-age range - or during the post-school period of adolescence. It is also possible to further divide the evidence on employment participation into that which has looked at labour market status in relation to childhood indicators of psychosocial development - as measured typically between the ages of 5 and 10 - and those studies that focus on psychosocial outcomes during adolescence - mainly over the 13 to 19 year age band.

Banks & Jackson (1982) conducted a 2.5-year follow-up study of 480 16-year-old school leavers who were in the bottom 50% in terms of exam performance on leaving school. Employment outcomes at follow-up were examined in relation to a standard measure of psychological distress administered at age 16, including symptoms of depression and anxiety. Statistical analysis - without standardising for other antecedent risk factors - revealed no association between uriemployment at follow-up and prior levels of psychological distress. Lynn et al. (1984) used a randomly selected sample of 701 15-16 year olds living in Northern Ireland to examine the relationship between employment status at a 1-year follow-up and a variety of antecedent variables relating to home background, intelligence, personality and educational attainment. The personality variables measured at age 15-16 included measures of neuroticism, psychoticism, and extraversion. At follow-up, subjects were classified as either being employed or in further education or unemployed or in a subsidised government-training scheme. Multivariate analysis revealed no association between most of the personality measures and employment status, though, somewhat surprisingly, *lower* psychoticism scores predicted a higher likelihood of being unemployed 1 year later.

Capaldi & Stoolmiller (1999) explored the relationship between mean adolescent conduct problems and depression scores prospectively measured over the 13-16 year age range and the likelihood of being in employment or in any educational programme between the ages of 18 and 20. Their study sample was exclusively male and drawn from a population of fourth grade boys attending schools in higher crime areas of a metropolitan region of the north-western United States. Increasing adolescent conduct problems (characterised by aggression and other forms of antisocial conduct) were associated with a lower likelihood of future employment or involvement in education. Both depression and conduct problems were found to be associated with an increased likelihood of dismissal from employment. Apart from academic skills, the authors did not control for the effects of any other antecedent factors.

Caspi et al. (1998) utilise data from the Dunedin Multidisciplinary Health and Development Study - a longitudinal investigation of the health, development and behaviour of a complete cohort of births over a 12-month period in Dunedin, New Zealand. The study was concerned with identifying the main child and adolescent predictors of unemployment between the ages of 15 and 21 years. Unemployment was measured in terms of months spent out of work (excluding time allocated to further education or home-making responsibilities). The study is of particular significance, not only because of its use of birth cohort data, but also because it considered the labour market significance of psychosocial development during childhood (3-5 years and 7-9 years) as well adolescence (at age 15).

Using a censored regression approach to control for a range of other contemporaneously measured background variables, the presence of early temperament problems (ages 3-5) were found to have the strongest association with future unemployment: their presence predicted a 14.6% increase in the probability of experiencing unemployment and an average increase in the duration of unemployment of 2.2 months for those not in work. In a separate estimation (controlling for other age 15 variables), self-reported delinquency was found to have a slightly lower effect on the number of months of unemployment and the probability of being unemployed. Behavioural problems identified at 7-9 years of age (a grouped variable including aggression and hyperactivity) had the lowest estimated effect on employment. All these relationships were reported to be statistically significant. In contrast, mental illness identified at age 15 (a combined indicator including depression, anxiety and attention deficit problems) had no significant association with later unemployment. These findings are of interest, not least because the relatively strong effect on the early temperament measure supports existing theories of adult antisocial personality development, of which non-participation in formal employment is a characteristic outcome. Moffitt (1993), for example, suggests that antisocial tendencies later in life are the outcome of a persistent pattern of behavioural problems affecting a relatively small percentage of the population. Individuals displaying these characteristics will typically have experienced significant learning deficits or behavioural problems from a very early age due to a combination of genetic, environmental and parental-related factors.

Maughan et al. (1985) examine the relationship between antisocial conduct in childhood and youth employment outcomes using follow-up data on a community sample of male 10-year-olds living in an area of inner-London. Controlling for a range of other childhood variables, conduct problems and low reading attainment at age 10 were both found to increase the risk of youth unemployment, as well as selection into unskilled work, dismissal from employment and the frequent changing of jobs. Nagin & Waldfogel (1995) consider the impact of criminality and the possession of a criminal conviction on job stability and work-participation between the ages of 17 and 19 within a cohort of British males of working class origin. Possession of a criminal record was found to be linked to an increase the length of time spent unemployed over a 1-year period, a reduction the length of job tenure and an increase the number of jobs held.[2]

Three studies utilise dichotomous employment measures that effectively consider the work-education decision during the early phase an individual's working life cycle. The decision to continue in education or to enter the labour market is an important feature of the human capital model (Polachek & Siebert, 1993), whereby individuals either choose to work or to invest in a higher future earnings potential through participation in educational or training programmes at the cost of forgoing current employment income. Using multivariate statistical methods applied to data on 3000 Australian 15-17 year olds, Tiggermann & Winefield (1989) compared three distinct groups over a 5 year follow-up period: those who continued in school, those who were working and the unemployed. Those who continued their schooling were found to possess the lowest number of antecedent risk factors including low levels self-esteem (a correlate of emotional difficulties). Sanford et al. (1994) also considered education versus work

[2] The data on the same cohort of British males examined in the Nagin and Waldfogel study are utilised in chapter 2 of this thesis.

participation for a community sample of 520 Canadian 17-20 year olds. Controlling for a range of other background variables, the presence of conduct disorder, prospectively identified when the sample were 13-16 years of age, was associated with a significantly increase likelihood of later work-force involvement at ages 17-20 as opposed to participation in further education. Hyperactivity and emotional disorders were found to be unrelated to the work-education decision.

Brook & Newcomb (1995) employed a representative sample of children aged 5-10 years living in New York State who were prospectively followed through time. A structural equation approach was used to test a model of the pathway from childhood aggression into various employment outcomes measured when the sample were aged between 15 and 20 and between 21 and 26 years of age. Childhood aggression was found to be directly and positively related to a latent construct, derived from observable indicators, defined as a tendency to "need more work" when the sample were age 21-26 and negatively related to "academic orientation" at the same age. Its was also found to be directly related to intermediate outcomes measured during adolescence which themselves were related to "need to work" and "academic orientation": thus aggression in childhood was positively associated with adolescent "unconventionality" (indicated by measures of rebelliousness and responsibleness) and negatively related with adolescent academic orientation. Taken together, the findings of Sandford et al and Brook and Newcomb may suggest, after allowing for earlier failings in school, that young adults who had significant conduct problems as children or adolescents have a greater tendency to discount the future more highly, as evidenced by their increase likelihood to choose work rather than education at the earlier stages of the working life-cycle.

A number of studies also consider employment status during adulthood, particularly within the mid-20s to mid-30s age range. Zoccolillo et al. (1992) investigate the continuity between childhood conduct disorders and social outcomes in adulthood. Their study used combined follow-up data on a group of young adults who had previously spent time in care and a quasi-random comparison sample living in economically deprived inner-city areas. The study utilised contemporaneous information from teacher rating and parental interviews (for those in care) in order to arrive at prospective and retrospectively determined diagnoses of conduct disorders prior to age 15. Both samples were re-interviewed regarding social outcomes during their mid-20s (average age of 26). Using logistic regression the authors concluded that the presence of conduct disorder during childhood or adolescence significantly increases the odds of experiencing more than one type of social dysfunction at age 26, after standardising for gender and care status in childhood. The social outcome measures included, among others: unemployment for at least 1 month or more than twice since age 18; 6 or more jobs over the 4 years prior to the follow-up interview; any job dismissal; ever walked out of a job; and experience of friction with workmates.

Three papers report studies that use Finnish longitudinal data to examine the association between child and adolescent psychosocial problems and unemployment during adulthood (Kokko & Pulkkinen, 2000; Kokko et al., 2000; Roenkae & Pulkkinen, 1995). The Jyväskylä Longitudinal Study of Personality and Social Development has traced, at various stages of their development, a random selection of 369 school children living in a medium-sized Finnish town from the age of 8 up until, most recently, age 36. The evidence, largely derived from structural equation modelling, generally points to a strong relationship between childhood aggression and lengthy periods of unemployment between the ages of 27 and 36 (> than 24 months). The pathway from childhood aggression into long-term unemployment was found to be mediated via maladjustment at school measured at age 14 (low interest in school work, truanting, low school achievement and receipt of punishment), involvement in heavy drinking at age 27 and a limited availability of occupational choices at age 27 (Kokko & Pulkkinen, 2000). Kokko et al. (2000) provide evidence that passive and anxious behaviour observed at age 8 is positively associated with exposure to long-term unemployment in the future, an effect mediated through lower educational attainment. Roenkae & Pulkkinen (1995), modelling developmental trajectories from childhood, provide evidence that that aggression in childhood is linked to an unstable career line observed at age 26, including long periods of unemployment, varied occupations, subsidised employment and time spent in other non-educational activities.

Burgess & Propper (1998) use data from the National Longitudinal Survey of Youth (NLSY) to examine, among other outcomes, the effect of adolescent self-reported violence and other health- and life style characteristics on adult labour supply. The NLYS is a US panel data set based on an ongoing follow-up study of a national sample of 12,686 youths aged 14-22 initially surveyed in 1979. Labour supply was measured according to the average number of weeks worked per year over the period 1981 to 1992. All antecedent variables included in the reported estimations were derived from interviews conducted when the study sample were aged between 16 and 22. The analyses were restricted to male high-school graduates. After conditioning on a range of health and life-style characteristics (e.g. illicit drug use, work-related health shocks) and other standard background variables, self-reported involvement in extreme violence ("times attacked with intent to injure or kill in past year") was found to be negatively associated with the number of hours worked. The same direction of effect was also observed for involvement in less extreme violence ("times seriously threatened to hit; or actually hit someone in past year"), though it was not found to be statistically significant.

Five studies uncovered by the review consider the relationship between child development (including psychosocial difficulties) and adult labour market participation using British birth cohort data. Three of these studies use data from the National Child Development Study (NCDS), a long-term follow-up of 17,000 children born during March 1958. Flouri & Buchanan (2002) use the NCDS to investigate the childhood predictors of labour market participation at age 33 within a multivariate framework. They find no relationship between a combined indicator of emotional and behavioural problems at age 7 and employment status at age 33. The lack of an association may have been down to their grouping of conduct, attention deficit and emotional problems into a single index thereby masking any independent effect associated with each of these problem areas. However, their model also includes a variety of other antecedent factors measured at later stages of individual development that may serve to mediate the effects of emotional and behavioural problems at an earlier age, thereby potentially explaining their lack of significance in this type of model specification. For example, academic attainment by age 20, low academic motivation and a measure of involvement with the police at age 16 were each included. The structural equation models developed by the Finnish studies cited earlier suggest that the pathway from childhood psychosocial problems into unemployment later in life is likely to be partly routed via these types of mediating outcomes.

Hobcraft (1998) included separate indices of aggression, anxiety and restlessness, measured when the NCDS cohort were age 7, as control variables within a more general investigation into the relationship between aspects of childhood disadvantage and adult social outcomes. There were no statistically significant associations between age 7 psychosocial characteristics and the likelihood of being unemployed at age 33, though adolescent delinquency (self-reported contact with the police at age 16) was reported to elevate the risk of future unemployment for males. In a sequentially developed model of adult economic outcomes with the NCDS cohort (including being in employment at ages 23 and 33), Gregg et al. (1999) find a negative relationship between both absence from school and contact with the police at age 16 and work participation - the effect is larger for females. However, these associations are not reported to be statistically significant.

Feinstein (2000) uses data from the 1970 British Birth Cohort (BCS70 - described in more detail in chapter 3) to examine the association between psychosocial problems at age 10 and exposure to periods of unemployment prior to age 26. Some of the key age 10 indicators of relevance included antisocial behaviour, attentiveness at school and self-esteem. For males, increasing antisocial behaviour scores were found to strongly predict a higher likelihood of extended spells of unemployment (>4 months), though they were not significantly related to spells of unemployment lasting in excess of 12 months. The study also reports an estimated 6% increase in the likelihood of experiencing more than 4 months of unemployment resulting from a movement from the 20^{th} to the 80^{th} percentile on the age 10 antisocial score distribution. For males, self-esteem was also found to be a significant predictor of extended spells unemployment.

Female unemployment was more strongly associated with lower levels of attentiveness at age 10.

Brassett-Grundy & Butler (2004b) also use the BCS70 data to examine the association between a variety of economic and social outcomes at age 30 and attention deficit and hyperactivity measured at age 10. Controlling for a range of other childhood factors, those individuals who, at age 10, had behavioural rating scores severe enough to warrant classification as an attention deficit/hyperactivity disorder, were predicted to have an elevated risk of living in a workless household at age 30. This finding applies to both males and females. While the effect is statistically significant for both genders, the estimated change in the probability of observing this outcome is not particularly substantial - a probability increase of 0.03 and 0.05 for males and females respectively.

1.5.2 Earnings

Nagin & Waldfogel (1995), Burgess & Propper (1998), Gregg et al. (1999), Murnane et al. (2001), Heckman and Rubinstein (2001) and Cawley et al. (2001) all consider the relationship between adolescent psychosocial characteristics and adult wages/earnings. The Nagin and Waldfogel study (reported in the paper by the same authors referred to in the previous section) examined the effect of criminality and conviction between the age of 17 and 19 on weekly take home pay over the same period for a cohort of British working class males. Criminality *per se* was found to have no effect on pay though, somewhat surprisingly, the receipt of a conviction was predicted to increase weekly earnings. This finding is reported to be consistent with an earlier study carried out for young US offenders (Nagin & Waldfogel, 1993). The authors argue that these results can, in principle, be explained by the relative wage dynamics associated with what they refer to as "career" and "spot market" jobs. The former may typically involve the forfeiting of a higher wage at the earlier stages of the working life-cycle to cover initial job-specific training costs: individuals will trade-off these initial costs against a higher future earnings profile as skills and human capital are accumulated. "Spot market" jobs are typically unskilled with no specific career structure or long-term prospects in terms of future earnings growth. They will, however, offer relatively higher labour market returns at the earlier stages of the working life cycle. Nagin and Waldfogel suggest career jobs are more likely to demand trust as an important worker characteristic, with the possession of a conviction acting as an adverse signal in this regard. As such, convicted youths are more likely to select into "spot market" employment. These conclusions highlight the importance of examining earnings at more advanced stages of the working cycle, when the wage differentials associated with job selection are likely to be more established.

Burgess & Propper (1998) examine the impact of adolescent behaviours on later earnings for male high-school graduates participating in the NLSY: they specifically consider log of earnings at age 28, mean log of earnings over an 11-year period (1981-1992) and earnings growth among male high school graduates. Their estimations included a variety of health and life style characteristics, including self-reported violence between the ages of 16 and 22. Descriptive analysis revealed that both black and white youths who reported being involved in violent/aggressive behaviour earned, on average, less than their peers. Their conditional estimations suggested that both extreme and less extreme self-reported violence were associated with depressed mean earnings over the 1981 to 1992 period, though the estimated effect is much larger for the former. Surprisingly, the authors also report a statistically significant and *positive* association between extreme violence and earnings *growth* - the corresponding effect on less extreme violence is negative and statistically insignificant. Moreover, while less extreme adolescent violence predicted lower earnings at age 28, the corresponding effect estimated for extreme aggression and violence, while negative, is much weaker and statistically insignificant.

Gregg et al (1999), based on their sequential modelling of the NCSD data, found a negative association between the hourly wage at ages 23 and 33 and school absence and contact with the police at age 16. However, none of the estimated effects on these variables are reported to be of statistically significance. Point estimates for the effects of truancy and police contacts at age 16 on future wages are considerably larger for females.

Murnane et al. (2001) use the NLSY data to estimate the impact of male adolescent self-esteem - a correlate of behavioural and emotional difficulties - on wages at age 27-28. Conditioning on academic skills, cognitive skills, and ethnicity, the authors find a statistically significant association between a self-assessed measure of global adolescent self-esteem ("person of worth"; "able to do things as well as other people") and log of wages. The authors estimate that an adolescent whose reported self-esteem score is 1 standard deviation above the average will earn, on average, 3.8% more than their peers at age 27-28. Drawing upon evidence from the psychology literature, they suggest that self-esteem is likely to impact on earnings via a number mediating mechanisms: the ability to work productively in groups and perseverance in the face of adversity, as well as a lower risk of depression, lower resentment, tension and irritability all which may harm the ability to work productively alongside others.

Heckman & Rubinstein (2001) compare the earnings of US high school drop-outs who self-selected into the United States General Educational Development (GED) testing programme with non-GED drop-outs. The comparisons serve as a non-randomised natural experiment for testing the importance of non-cognitive skills in determining earnings. Those who select into GED are known to have similar levels of cognitive skills attainment to high school graduates - based on a standard test of performance - and a significantly higher level of cognitive ability to other high school drop-outs. At a descriptive level this is borne out by the higher levels of attainment among the GED participants compared to other drop-outs. However, after controlling for measured cognitive ability, the GED drop-outs are predicted to earn *less* and to have lower hourly wages compared to their non-GED counterparts. The authors argue that deficits in unmeasured non-cognitive (psychosocial) skills among the GED participants accounts for this disparity in attainment. While the experiment does not unpack which specific non-cognitive skills are of greatest significance, the authors suggest that the GED test inadvertently separates out bright but undisciplined and non-persistent drop-outs from other high school drop-outs.

Cawley et al (2001) use the NLSY to examine the impact of personality traits measured during early adolescence (10^{th} grade high school) on adult earnings (mid 20s) after controlling for measured cognitive ability (the inclusion of the latter in fact makes little difference to their key findings). The empirical estimations are restricted to white male high school pupils followed up over time. The authors consider a range of early adolescent behavioural indicators broadly indicative of antisocial tendencies and poor socialisation skills. These were based on whether participants indicated whether they sometimes or often engaged in: school absence; being late for school; do not attend school; cut classes; talk back to teachers; do not obey instructions; fight with one another, attack teachers; and engage in alcohol/drug use. Separate regressions on the log of earnings are carried out using each measure. All estimated coefficients on each behavioural measure were negative, with four out of the 10 reaching statistical significance. For example, a 10^{th} grade pupil reporting cutting their class attendance sometimes or often is estimated to receive 10% lower earnings 11 years hence. When the authors condition earnings upon educational attainment the estimated impact of each behavioural measure on earnings is diminished, suggesting that the effect of poor socialisation skills on labour market attainment operates via poor schooling outcomes.

The preceding studies all consider psychosocial characteristics during adolescence. Some studies have also looked at childhood indicators of emotional and behavioural wellbeing in relation to future earnings. Hobcraft (1998) finds that male workers in the NCDS data who were in the lowest earnings quartile at age 33 were more likely to have been restless children at age 7. Neither anxiety nor aggression at age 7 were found to be significantly related to exposure to low earnings status. Feinstein (2000) found that higher self-esteem was associated with higher male wages at age 26 within the BCS70, though it was found to be unrelated female pay, while increasing attentiveness was associated with significantly higher female wages. Antisocial behaviour was found to be *positively* related to the female wage, though negatively and comparatively weakly related to male earnings.

Using the NCDS, Bowles et al. (2001b) estimate a model of adult earnings allowing for the effect of personality. A measure of childhood aggression and social withdrawal, both rated when the cohort were aged 11, are used as instrumental variables for adult personality with a view to overcoming potential endogeneity. For males employed in high status jobs, a 1 standard deviation increase in aggression was estimated to increase earnings at age 33 by 14.5%. The corresponding effect is negative and less marked for male workers in low status occupations. The model also suggests that female workers employed in higher status jobs who were more aggressive at age 11 are penalised - a 1 standard deviation increase in measured aggressiveness is associated with a near 17% reduction in earnings. Men who were more socially withdrawn at age 11 were predicted to earn significantly less, irrespective of job status. Females in higher status jobs who were more socially withdrawn at age 11 were predicted to earn *more* than their occupational peers though the effect is negative for females employed in low status employment. Brassett-Grundy & Butler (2004b) find a positive, though statistically insignificant relationship between the likelihood of low wage status among males in the BCS70 and childhood attention deficit/hyperactivity disorder. For females, the estimated increase in the probability of being a low earner at age 30 is substantially higher for those who experienced attention deficit/hyperactivity disorder at age 10: the estimated increase in probability is around 0.12.

1.6 Concluding summary of the evidence

In all, 22 papers were identified in a review of the evidence concerning the link between adult economic employment and earnings and psychosocial problems in childhood and adolescence. The majority of papers that were examined considered teenage or adult employment participation or job stability, with seven papers also looking either at wages/earnings or low pay. With the exception of child and adolescent antisocial behaviour and its relation to future employment participation, the evidence concerning specific types of psychosocial problem does not generally offer any definitive guidance on the long-term significance of these problems for future attainment in the labour market. There is clearly scope for adding to the existing body of research with a view gaining additional insight into these issues.

The following paragraphs summarise the state of the evidence on employment outcomes with respect to those aspects of childhood and adolescent psychosocial development that are of central concern in the current thesis:

Antisocial behaviour - The most consistent body of evidence concerns the relationship between teenage and adult unemployment/job stability and antisocial behaviour observed at earlier ages. The findings from the various papers reviewed offer the unequivocal conclusion that children and adolescents who are observed to be aggressive and more generally antisocial in their behaviour at school and elsewhere face a higher risk of future unemployment or poor and unstable employment records. Six studies looked at employment outcomes in late adolescence and the early twenties, and all find a statistically significant association between poor employment outcomes and antisocial conduct during earlier years. Four of these studies considered antisocial conduct during adolescence, though three papers also considered antisocial behaviour in childhood. Of the nine papers that look at adult employment outcomes (early-mid twenties up to age 36), six find a significant relationship between childhood aggression/antisocial conduct and the risk of future periods of unemployment or having a poor employment record. One study found no significant association using data from a large British birth cohort born in 1958. Two of the three studies that looked at adolescent conduct problems found that delinquency and violent behaviour were associated with an increased risk of unemployment and a reduction in the time spent in active employment in later years. The evidence concerning child and adolescent antisocial behaviour and future earnings is somewhat less certain. One paper reports no statistically significant link between adolescent delinquent behaviour and adult earnings in a British birth cohort. The other paper that considered adolescent antisocial conduct found that adult earnings were lower among US adult males who had been observed to be prone to violent conduct during adolescence. However, this same study also reports a positive association between earlier violent conduct and earnings *growth* over time. Using the same source of US longitudinal data another paper reports a consistently negative association between 10 indicators of poor adolescent socialisation skills and adult earnings (for white male only). There was evidence that this effect is mediated via lower educational attainment among school pupils reported to be less socially well-adjusted.

Three papers explicitly considered childhood antisocial conduct and future earnings - all using British birth cohort data. One study reported no significant link with low income status in adulthood. Another found that female wages were *positively* associated with childhood antisocial conduct, with no statistically significant association observed for males. A third study that considered adult pay found that men and women who were more aggressive in childhood were paid less, though male wages within higher status jobs were found to be positively associated with a measure of childhood aggression.

Emotional difficulties - The evidence concerning the long-standing effects of emotional difficulties in childhood and adolescence is far from conclusive. Five papers considered teenage employment outcomes in relation to emotional distress or related issues (i.e. neuroticism and self-esteem) in adolescence. Only two of these studies found as significant association with less favourable outcomes (not continuing with further education and the likelihood of being sacked in late adolescence). Two of these papers did not control for a range of other antecedent risk factors, thus making interpretation of the findings more difficult.

Three papers examined the association between childhood emotional difficulties (including one that considered childhood self-esteem) and adult employment outcomes. Lower childhood self-esteem was associated with longer spells of adult male unemployment in a British birth cohort. The evidence on the long-standing effect of more direct measures of childhood emotional distress is less certain: one study reported a significant and positive link between childhood anxiety and extended periods of adult unemployment while the remaining paper that considered emotional distress in childhood found no significant association with the probability of being unemployed at age 33. The findings from the latter might be considered as more reliable - the results were based on data drawn from a large national birth cohort while the author also controlled for a much wider range of childhood antecedent factors. However, both studies do consider different adult unemployment measures - the former using a measure of unemployment duration - making more direct comparisons of the findings more difficult. Two papers report lower earnings for workers who had lower self-esteem in childhood or adolescence. No studies included in the review looked specifically at earnings in relation to more direct measures of emotional wellbeing (e.g. childhood anxiety or depression).

Attention deficit problems/hyperactivity - As with emotional distress, the evidence relating to the long-term employment effects of child and adolescent inattentiveness/hyperactivity is (comparatively) uncertain. In three papers that examined British birth cohort data, one reported no link between childhood inattentiveness an adult unemployment, another reported a statistically significant association between increasing inattentiveness and longer spells of female employment, with the third study reporting a statistically significant link between childhood attention deficit/ hyperactivity disorder and the likelihood of living in a workless household as an adult. The same three papers also considered attention deficit problems/hyperactivity in relation to adult pay. Two report a significant association between lower female pay and inattentiveness/hyperactivity in childhood (one looked at wages the other at exposure to low pay). The other paper also reported a significant association between inattentiveness in childhood and a higher likelihood of exposure to a low adult wage - this time for males.

The empirical studies described in chapters 2 and 3 will seek to add to this literature. Both describe studies that use existing longitudinal data to explore the association between psychosocial problems in late childhood and economic attainment at age 30 (or thereabouts). Chapter 2 also considers post-school teenage employment outcomes. Both chapters seek to make the following contributions:

1. To expand the existing body of evidence given the uncertainties that still exist in relation to many of the key relationships of interest - most notably concerning childhood antisocial conduct and future earnings, and whether emotional distress and attention deficit problems/hyperactivity in late childhood have any long-

standing effects on earnings and other employment outcomes. All the empirical investigations seek to condition these effects on a wide array of other childhood variables.

2. To examine in more detail the relationship between adult earnings and psychosocial problems in late childhood (many of the exiting studies look at employment participation). As well as considering adult earnings, chapter 3 also investigates the relationship between psychosocial problems and occupational status at age 30. Earnings are also examined for specific levels of occupational status. Together, this exploratory work will seek to provide additional insight into the extent to which the effects of behavioural and emotional problems are mediated through factors that are more likely to govern access to higher skilled and better paid work. It also seeks to contribute to our understanding of the extent to which the relationship between psychosocial problems and earnings various according to the level of occupational status achieved. The study reported by Bowles and colleagues, for example, provided some initial indication that these effects may be important in relation to childhood aggression.

3. The analysis reported in chapter 3 also aims at providing a better indication of the potential impact of psychosocial problems in late childhood on earnings over the working life cycle. A series of forward projections are made that combine coefficient estimates from the relevant multivariate estimations (from chapter 3) with cross-sectional UK earnings data. These projections are carried out with a view to comparing, in present value terms, average earnings across different

ages with the future income streams associated with more severe psychosocial difficulties identified in late childhood.

2 Psychosocial development in late childhood and economic attainment: evidence from a cohort of working class British males

Summary

The association between economic attainment and childhood psychosocial development is examined within a cohort of British males of working class origin. Those who were more hyperactive and inattentive at age 8-9 were estimated to earn significantly less than their peers at age 32. Confirming findings reported in the literature, antisocial conduct at age 8-9 was associated with a relatively high rate of teenage job turnover and lengthy spells of teenage and adult unemployment.

2.1 Introduction

This chapter describes the first of two empirical explorations into the relationship between psychosocial problems observed in childhood and economic attainment later in life. The study reported in this chapter specifically examines the relationship between hyperactivity and poor attentiveness, antisocial conduct and neuroticic tendencies (a risk factor for emotional distress) in childhood and various measures of adult economic status. It utilises data from the Cambridge Study in Delinquent Development (Farrington, 2001; West & Farrington, 1977), a long-term exploration of delinquent development in a cohort of males who attended primary school in an area of inner London during the 1960s. The longitudinal nature of the CSDD, and its rich array of prospectively generated information on the socio-economic circumstances and psychosocial characteristics of cohort subjects, provides an opportunity for assessing the extent to which some key aspects of childhood psychological and behavioural development contributed to future labour market attainment. A series of empirical models are estimated with a view to examining the association between childhood characteristics and three measures of future attainment: **1.** earnings at age 32; **2.**

exposure to extended spells of teenage and adult unemployment; and **3.** relatively high levels of teenage and adult job turnover.

The chapter is structured as follows. The design of the CSDD is initially described followed by a description of some of the main characteristics of the cohort. After providing details of the methods of analysis that were employed, the main findings are presented followed by a discussion of the results.

2.2 The data: the Cambridge Study in Delinquent Development

The Cambridge Study in Delinquent Development (CSDD) is a prospective longitudinal study of delinquent development within a cohort of males of mainly working class origin boys who have been studied at various intervals during their childhood, adolescence and adult years. The original aim of the study was to:

"...describe the development of delinquent and criminal behaviour in inner-city males, to investigate how far it could be predicted in advance, and to explain why juvenile delinquency began, why it did or did not continue into adult crime, and why adult crime usually ended as men reached their twenties" (Farrington, 1995).

The study - despite the reference to Cambridge in its title - initially recruited a sample of 411 boys who attended primary school in an area of inner London during the early 1960s. However, since its beginning, the CSDD (sometimes referred to as the "Cambridge cohort") has been managed from the Institute of Criminology at the University of Cambridge, initially by Professor Donald West and then latterly by Professor David Farrington.

Over a number of years the CSDD has delivered a range of key findings of both academic and policy significance (Farrington, 1995, 2001, 2003). The demonstrated link between low intelligence, poor parenting skills, impulsive behaviour and poverty observed in childhood and delinquency in later years are of particular note. The longitudinal nature of the CSDD makes it ideal for studying the importance of childhood factors, albeit within an exclusively male and working class cohort, as determinants of economic attainment later in life. The criminological focus of the data generated by the CSDD does not preclude its application to studies of economic relevance. Nagin & Waldfogel (1995), for example, have already applied data from the CSDD to an analysis of the effects of criminality and criminal convictions received between the ages of 17 and 19 on employment stability and pay over this period. The focus of the CSDD on developmental processes from an early age, and the wide range of hypotheses and associations it originally set out to test, has meant that a rich array of data on the individual characteristics of cohort members and the economic and social circumstances they were exposed to over an extended period of time has been accumulated. Information on a range of social outcomes observed during adolescence and adulthood has also been collected, many of which are of obvious economic relevance - earnings, occupational status and employment participation are all examples. The study presented in this chapter follows on from an existing piece of work, based on the Cambridge cohort, that has looked into the future employment impact of different developmental trajectories from late childhood up to age 16 (Healey et al., 2004). The emphasis in that study was exclusively focussed on the long-term effects of persistent antisocial tendencies from late childhood. This chapter is restricted to a consideration of the effects of problems observed in late childhood alone, and is also somewhat broader in its more detailed consideration of a wider set of childhood psychosocial characteristics, including hyperactivity/poor attentiveness and neuroticism.

2.3 Design of the CSDD [1]

The CSDD began in 1961. All 399 boys registered with six state primary schools located in an inner-city area of south London were recruited. The schools were located within a one mile radius of a locally based research office. While there were other schools located within the study catchment area, the schools included were those that agreed to participate. A further group of boys (N=12) were recruited from a school for children with learning disabilities in order to make the sample representative of the population of 8-9-year-old males living in the area at the time. Therefore, the initial sample consisted of 411 subjects in total.

The children were subsequently interviewed and tested at school by psychologists at various ages during their childhood and adolescence and parents were also interviewed at home by psychiatric social workers. Further interviewing also took place after the boys had left secondary school, and a sub-group were also studied in more detail when they were in their early twenties. The latest completed adult follow-up was carried out in the mid 1980s, when the cohort was aged 32. The economic study reported in this chapter concentrates on psychosocial data collected on each boy between the ages of 8 and 10 years. Variables identified at this age are examined in relation to a series of employment outcomes prospectively observed at ages 18/19 and at age 32. Of the 410

[1] A full description of the study design, and the characteristics of the boys who were recruited, can be found in Farrington (2003).

boys who still alive at age 18-19, 389 (95%) were successfully traced and interviewed. Of the 403 who were still living at age 32, 378 (94%) were followed-up successfully.

2.4 *Characteristics of the Cambridge cohort*

Using the Registrar General's occupational classification system, close to 95% of the 411 boys recruited could be generally described as coming from a working class background. Most fathers were employed in skilled, semi-skilled or unskilled manual occupations. Compared to the general population in the early 1960s, the CSDD over-represented boys from this type of background - a reflection of the area in which they lived and went to school: at that time, nationally only around 78% of males of that age were from working class families (Farrington, 1995). In terms of ethnicity, 357 of the participants were white and brought up by parents of British origin, 12 had at least one parent of West Indian or African origin, 14 had at least one parent of Irish origin, 12 boys had Cypriot parentage and the remaining 16 boys had at least one parent from another European country or Australia. The vast majority of the parents of the 411 boys originally recruited had not been educated beyond the age of 14 years. At the study intake, most boys had fathers who were in stable employment (80%) though nearly 10% had fathers who had previously experienced either periods of unemployment or frequent changes of employment. Around 40% had non-working mothers. Nearly a half were cohabiting with at least one brother or sister.

The social environment to which the cohort were exposed during their childhood could not be viewed as typical for the population as a whole. Ratings of living conditions made by psychiatric social workers on initial recruitment to the study were variable, with a third living in housing conditions that were considered as "unsatisfactory". This included over-crowded conditions and residence in a property selected for slum-clearance - a common occurrence in British inner cities during the early 1960s. A significant minority (20%) of the study intake were living in families who had received support from social welfare agencies in specific response to financial and social difficulties. Just over 13% of the boys were rated as being exposed to a severe "social handicap" - a combination of various sources of adversity including physical neglect, large family size, low income, poor housing and contact with social agencies.

By the time they were aged 16-17 three-quarters of those successfully traced had left full-time education. At 18-19 years of age 84 % were still living with their parents. Nearly 80% were working while 6% were still at school or in full-time education. Close to half had managed to obtain formal qualifications by the time they were 18-19, including 'O' Levels, 'A' Levels or vocational qualifications. Thirty-two-percent had been employed in the same job for two years. Only 8 subjects had left school and never had a job (excluding those who continued their schooling). Thirty-five percent were employed in semi-skilled employment while 41% were in either a skilled, clerical, or professional/managerial position (or at least training for these types of position). The remainder were either in unskilled work (around 15%) or had never had a job.

Of the 378 who were successfully traced and interviewed at age 32, 70% were married, 54% were married with children, 15% were married with no children, while 18 men (4%) were neither married or had any children. Forty-eight percent owned the house or flat where they lived, with over a third renting from a local authority or living in housing association accommodation. In terms of occupational classification, 43% were employed in a skilled job (manual or non-manual) while nearly a third had reached either managerial or professional status in their line of work. A relatively small number - just 7% - were working in manual, unskilled occupations in their early thirties.

2.5 Methods

2.5.1 Childhood psychosocial indicators

The CSDD contains multiple indicators of childhood behavioural, psychological and social status derived from prospectively administered tests and parental interviews carried out when the cohort were aged between 8 and 10 years. They include a large number of dichotomous measures indicating the presence or otherwise of specific characteristics relating to the children, their parents or their general living environment. All these variables have been already been used to examine the major childhood risk factors for life-course delinquent development in the main body of work relating to the CSDD (Farrington, 2001).

Three of these measures are of particular relevance to the current chapter. The first concerns antisocial conduct in childhood. It identifies those children who, at age 8-9 years, were regarded as being the most troublesome and aggressive at school as determined by ratings made by teachers and peers. A boy was subsequently defined as being "troublesome" if they were located within the highest quartile on ratings of bad behaviour. The second indicator relates to hyperactivity and poor attentiveness. Again, it identifies children in the highest quartile on teacher ratings of restlessness and poor concentration levels in the classroom at age 8-9. Both these indicators have already been shown to be significantly correlated with future delinquent and antisocial personality development within the Cambridge cohort (Farrington, 2001). The third indicator of relevance identifies those children who were regarded as having a "neurotic" temperament at ages 8-10 based on ratings made by social workers. This type of temperamental feature is indicated by emotional sensitivity and a pre-disposition to stress, anxiety and moodiness. Moreover, there is evidence to suggest that any genetic influence on the occurrence of depressive - and anxiety-related psychiatric disorders are mediated via the presence of neuroticism (Rutter, 2002). Again, children were defined as exhibiting this specific temperamental characteristic if they were located within the highest quartile on social worker ratings of neuroticism. Each of these three measures are used to analyse the relationship between psychosocial problems in late childhood and labour market attainment at age 32 within the cohort.

2.5.2 Economic attainment

Two prospectively determined indicators of economic attainment post-school leaving are explored followed by three measures of economic status utilising interview data collected at age 32:

- ***Extended periods of unemployment at ages 18-19*** – a dichotomous variable identifying subjects who reported experiencing more than 18 weeks of unemployment over the previous 12 months.

- ***Unstable employment record at ages 18-19*** - a dichotomous variable identifying teenage subjects who reported having three or more jobs since leaving school.

- ***Weekly earnings at age 32*** - self-reported weekly take-home pay. The analysis is restricted to earnings at age 32 in order to avoid the complications of interpreting earnings differentials at a younger age: active investments in human capital during the post-school years could serve to depress earnings differentials between those individuals whose longer-term wage prospects are generally more favourable compared to those who have relatively poor employment outcomes on leaving school (i.e. those entering unskilled jobs).

- ***Extended periods of unemployment at age 32*** - a dichotomous variable identifying subjects who reported experiencing more than one year of unemployment over the 5-year period prior to age 32.

- ***Unstable employment record at age 32*** - a dichotomous variable identifying those subjects who reported having 3 or more jobs over the 5-year period prior to age 32.

2.5.3 Other explanatory variables

The previous chapter presented a simple diagrammatic account of those childhood factors that are likely to play some role in determining future economic success (figure 1.1). These will potentially include family-related and parental characteristics (e.g. income, time investments, quality of parenting) as well as other child-specific endowments (e.g. ability/cognitive attainment). Many of these factors are also likely to have some independent impact on the psychosocial development of individuals from an early age: for example, low intelligence, limited parental supervision and the size of the family economic resource base have all been linked to the development of conduct problems in childhood and long-term antisocial personality development. Levels of parental supervision (and the quality of parenting delivered) and family income will be good indicators of the extent of parental investment in a child's emotional and behavioural development.

Given that these factors are likely to have a joint influence on adult economic status and earlier behavioural and emotional development, it is important to try and control for these relationships when examining the extent to which childhood behavioural and emotional outcomes predict future attainment. In essence, the objective of the current chapter (and the analyses presented in chapter 3) is to quantify intertemporal associations between adult employment outcomes and childhood behavioural and emotional problems while ensuring that these associations are not contaminated by the effect that other correlated variables which are also likely to have an independent influence on adult outcomes. Multivariate estimation methods used to achieve this by conditioning the main economic outcomes of interest both on indicators of maladjusted behaviour and emotional distress and on an additional set of prospectively measured childhood explanatory variables. The CSDD contains a comprehensive range of dichotomous indicators of family circumstance and child-specific characteristics derived from parent and teacher interviews and psychosocial ratings administered when the cohort were aged between 8 and 10 years. The general model of adult attainment outlined in the previous chapter, and reference to both intuition and the relevant literature concerning the kinds of variables that would need to be controlled for when looking at the key long-term associations of interest, served as the basis for choosing variables for inclusion in the multivariate estimations. These are outlined in more detail below:

- ***Low non-verbal IQ*** - a dichotomous measure of low non-verbal IQ based on tests conducted at school when the cohort was aged 8-10. As a component of inherited ability and ability determined through environmental factors, IQ is seen as being a significant input in the development of cognitive skills (Cunha et al., 2005) which, in turn, are known to have an important impact on future educational and labour market success (see evidence cited in the previous chapter). As evidenced elsewhere, low intelligence and cognitive skills are also a correlate of poor psychosocial outcomes. Low IQ is therefore included as a control variable within the empirical specifications.

- ***Low parental income*** - a measure of resource availability in the family - using psychiatric social worker impressionistic ratings of the economic circumstances of parents when the cohort was aged 8-10. This serves to indicate the presence of limited economic resources within the family unit with subsequent implications for material investments in psychosocial development (previous work on the Cambridge cohort suggests that exposure to more serious material deprivation was a risk factor of less favourable long-term psychosocial outcomes; (Farrington, 2001)). Economic and social disadvantage within the family unit may also influence future levels of attainment via other transmission mechanisms not otherwise controlled for within the empirical specifications adopted here, with the implication that this variable should be included as an extra explanatory variable.

- ***Poor parental supervision*** - a more direct measure of the quality and quantity of time allocated to child development and upbringing - based on a dichotomous variable derived from social worker ratings of parental rule making and vigilance when the cohort were aged 8-9.

- ***Harsh parenting*** – a dichotomous variable based on social worker ratings of the quality of parenting, identifying exposure to harsh and inconsistent discipline at ages 8-10.

- ***Disrupted family environment*** - a dichotomous measure based on data collected from interviews when the cohort were aged 8-10 on family events including parental separation.

- ***Parental conflict*** - a dichotomous measure identifying exposure to poor parental relations, based on social worker ratings of parental conflict made when the cohort were aged 8-10. It seems plausible that both a disrupted family environment and unstable parental relationships could disrupt emotional and behavioural development while at the same time impacting on variables of potential significance for future attainment (e.g. the productivity of schooling inputs).

- ***Large family size*** - a dichotomous indicator of time allocated to child development and upbringing based on the number of siblings living with a child at ages 8-10, with 4 or more siblings signifying a "large family". Other things equal, exposure to a larger family size would imply the receipt of a lower level of parental input (including time and other economic resources of significance for developmental outcomes).

2.6 Estimation methods

The association between childhood psychosocial outcomes and earnings at age 32 are examined using ordinary least squares regression (OLS) with the natural log of weekly earnings as the dependent variable. This is a widely adopted specification in econometric studies of wages and earnings variability. OLS assumes that explained variance in earnings is normally distributed. The appropriateness of using an OLS specification with a logged dependent variable was therefore tested using a procedure recently advocated by Manning & Mullahy (2001) based on the Park test (Park, 1966). They recommend generating log-scaled residual earnings using one of the generalised linear model (GLM) estimators (McCullagh & Nelder, 1989). If, as was found to be the case here, the log-scale residuals are heavy tailed (a coefficient of kurtosis of >3) then the use of OLS with a logged transformed dependent variable is recommended as an appropriate estimator.

The model of log of weekly earnings (y_i) can therefore be generally represented as:

$$\log y_i = \alpha_i + \sum_{j=2}^{K} \beta_J X_{Ji} + u_i \qquad [2.1]$$

Where α_i is a constant, X_{ji} is a vector of childhood variables including psychosocial characteristics, β_j are the model parameters requiring estimation and u_i is assumed to be an independently and normally distributed random error term. All the explanatory variables in the earnings equation are dichotomous (dummy) variables. Following (Halvorsen & Palmquist, 1980), the coefficient β is in fact equal to:

$$\beta = \log(1+g) \quad [2.2]$$

with g representing the corresponding true (proportional) effect on y_i associated with the presence of the specific childhood characteristic defined by each dummy in the earnings equation, where g itself is defined as:

$$g = \{\exp(\beta) - 1\} * 100 \quad [2.3]$$

The relationship between childhood psychosocial problems and the four dichotomous measures of economic attainment are examined using probit estimation (Amemiya, 1981; Dougherty, 2002). Within the probit framework the probability, P_i, of observing either of these outcomes is expressed as:

$$P_i = f(\omega_i) \quad [2.4]$$

where $f(.)$ is the standardised cumulative normal distribution and ω_i is an index of the unobservable propensity towards observing a given outcome:

$$\omega_i = \alpha_1 + \sum_{j=2}^{k} \beta_j X_{ij} + \varepsilon_i \quad [2.5]$$

where X_{ij} are the childhood explanatory variables, β_j are parameters requiring estimation and ε_i is a random independently distributed error term with a normal distribution. Equation [2.5] is empirically derived using maximum likelihood estimation.[2]

2.7 Dealing with missing data on explanatory variables

As noted earlier, the rate of successful follow-up was high in the Cambridge cohort, with a relatively small percentage of the initially recruited sample lost to follow-up either because of death or because they could not be traced. Of those cases who were successfully included in the 18-19 and age 32 follow-ups, a high percentage have complete data on each of the employment measures of interest. The largest percentage of cases with missing data of this type is 8% (for the teenage job stability measure). Loss of information is, however, compounded by incomplete information on some of the childhood explanatory variables included in the multivariate estimations (the main culprits are evident in table 2.1 presented in the results section: i.e. those with recorded observations of less than 411 - the full childhood sample at intake).

Most statistical software packages carry out complete sample estimations: multivariate equations are determined only for those observations for whom there are complete data on both the explanatory variable and each of the dependent variables of interest. However, this can lead to a significant loss of information. For example, while weekly earnings are observable for n=326 of the cohort in full-or part-time work at age 32,

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[2] The logit model can also be used to model dichotomous outcomes. It assumes a slightly different (logistic) distributional relationship between the probability of observing a given outcome and ω_i, though in practice it has been shown to generally yield similar results to the probit (Amemiya, 1981).

missing data on each childhood variable would lead to a complete case OLS regression carried out on only 285 observations: 41 cases are excluded representing around 12% of the 326 cases with complete earnings data.

Rubin (1987) describes three types of missing information: that which is missing completely at random (MCAR); data missing at random (MAR) - a process of incompleteness that is at least conditional on *observable* factors within the data; and data not missing at random (NMAR) - a systematic (non-ignorable) process whereby the probability of observing missing information is dependent on the specific variable of interest. Where data are assumed either to be MCAR or MAR then imputational methods can be used to generate values where data are absent on given variables. This may be important if there is a risk that missing data are conditional on other sample characteristics (i.e. MAR), as this could significantly change the nature of the sample upon which any estimations are carried out (Rubin, 1987).

Unconditional and conditional mean imputations are examples of commonly employed techniques for imputing values where data are missing: the later uses the sample mean for a variable based on the observed data while the latter employs regression techniques to predict means that are conditional on a set of observable characteristics. Both, however, assume that the imputations themselves are non-stochastic and therefore run the risk of underestimating variances which can lead to bias standard error estimation and inappropriate statistical inferences.

As an alterative Rubin (1987) recommends the adoption of a technique known as multiple imputation (MI), which attempts to explicitly account for the true stochastic nature of imputed data when estimating parameters of interest. Rather than using a single mean for each missing value, the MI method generates values drawn from a predictive distribution of missing values. Different imputations for missing data are generated m times thereby leading to the generation of m complete data sets containing both observed and imputed data: m is normally set at between 5 and 10, though minimal statistical information is added by carrying out more than 5 sets of imputations. Five imputed data sets were therefore used to model adult economic attainment using the NORM Statistical software (Schafer, 1999).

Standard methods of econometric estimation can then be routinely carried out on each of the complete data sets. Single estimates of the parameters of interest in the estimated model (e.g. the proportional change in earnings associated with a given indicator) and its associated variance are derived using a method proposed by Rubin (1987) (the variances are used by the NORM soft ware to compute appropriate standard errors, t-statistics and 95% confidence intervals). The parameter of interest $\hat{\vartheta}$ is calculated as:

$$\hat{\vartheta} = \frac{1}{m}\sum_{l=1}^{m}\hat{\vartheta} \qquad [2.6]$$

Equation [2.6] is simply the average of each estimated model parameter across the m inputted data sets. The total variance is estimated as:

$$\mathrm{var}\left(\hat{\vartheta}\right) = \frac{1}{m}\sum_{l=1}^{m}\mathrm{var}\left(\hat{\vartheta}\right) + \left[\frac{m+1}{m}\right]\left[\frac{1}{m-1}\right]\sum_{l-1}^{m}\left(\hat{\vartheta}_l - \hat{\vartheta}\right)^2 \qquad [2.7]$$

The first term in this expression - $\frac{1}{m}\sum_{l=1}^{m}\hat{\text{var}}\left(\hat{\vartheta}\right)$ - measures the "average of within-imputation variances" - the variance in the mean costs within each imputed data set. The second term - $\left[\frac{1}{m-1}\right]\sum_{l=1}^{m}\left(\hat{\vartheta}_l-\hat{\vartheta}\right)^2$ - identifies the "between imputation variance" - or the variance in mean costs across the *m* data sets. This essentially builds in the stochastic component associated with the data imputations upon which the estimated are partially based. The term $\left[\frac{m+1}{m}\right]$ is a bias correction factor.

As there was no a-priori reason for suspecting any of the data on each of the explanatory variables derived from the childhood BCS70 data to be NMAR, multiple imputation methods were used to impute values where data were incomplete.

2.8 Results

Table 2.1 provides descriptive statistics for each of the childhood variables used in the multivariate estimations and each economic attainment.

Table 2.1
Childhood variables (8-10 years of age) and measures of economic attainment at age 32: descriptive statistics

	Mean	Std. Dev	N
Economic attainment			
Weekly take home earnings (1985 prices)	171.50	99.09	326
Log of weekly take home earnings	5.03	0.45	326
Unemployed for > 18 weeks (age32) (1= yes;0=no)	0.11	0.31	368
Unemployed for > 1 year (age32) (1= yes;0=no)	0.16	0.37	376
Unstable employment record (ages 18/19) (1= yes;0=no)	0.50	0.50	361
Unstable employment record (ages 32) (1= yes;0=no)	0.21	0.41	369
Childhood variables			
Troublesome/antisocial (1= yes;0=no)	0.22	0.42	411
Restless/Poor concentration (1=yes; 0=no)	0.20	0.40	410
Neurotic (1=yes;0=no)	0.29	0.46	395
Low non-verbal IQ (1=yes;0=no)	0.25	0.43	408
Low family income (1=yes;0=no)	0.23	0.42	411
Poor parental supervision (1=yes;0=no)	0.18	0.38	383
Harsh discipline by parents (1=yes;0=no)	0.28	0.45	391
Large family (1=yes;0=no)	0.24	0.43	411
Parental conflict (1=yes;0=no)	0.22	0.41	373
Disrupted family (1=yes;0=no)	0.22	0.41	411

Note
Mean of dummy (0-1) variables identify proportion of the sample with specified characteristic.

As a prelude to the multivariate estimations, Tables 2.2 and 2.3 provide some descriptive comparisons. While not as reliable as the multivariate estimations in terms of identifying whether there are any important relationships between childhood psychosocial outcomes and later employment outcomes, they do offer an initial insight into some interesting longitudinal patterns of association within the data. Table 2.2 considers average (mean) earnings at age 32 and the presence of each of the three main childhood characteristics of interest. At a purely descriptive level (and without testing the statistical significance of any differences) there is some evidence that those subjects who were identified as either antisocial, prone to restless/poor concentration or neurotic at ages 8-10 had a lower weekly take-home pay at age 32, though the difference in average earnings compared to the rest of the cohort is not particularly substantial. The largest difference relates to poor concentration/restless behaviour.

Table 2.2
Average weekly earnings at age 32 and childhood psychosocial indicators

	MEAN WEEKLY EARNINGS (£)
Troublesome/antisocial	166.27
Rest of cohort	172.72
Restless/poor concentration	150.53
Rest of cohort	176.13
Neurotic	165.02
Rest of cohort	174.42

Note
Earnings in 1985 prices.

By contrast, the strength of association is much more noticeable when comparing childhood psychosocial characteristics with future job stability and unemployment - particularly during the late teenage years (table 2.3).

Table 2.3
Employment outcomes at ages 18-19 and 32 and presence of psychosocial problems in childhood

	TROUBLESOME/ ANTISOCIAL	RESTLESS/POOR CONCENTRATION	NEUROTIC
Unemployed for > 18 weeks (ages 18-19)			
Yes	52.8	27.5	32.4
No	19.5	20.1	29.3
Unemployed for > 1 year (age 32)			
Yes	36.7	28.3	37.0
No	18.4	17.7	29.0
Unstable employment (ages 18-19)			
Yes	32.0	27.1	32.0
No	13.3	15.6	26.7
Unstable employment record (age 32)			
Yes	21.3	22.5	32.0
No	21.1	19.2	24.4

Note
All figures are percentages.

Over 2.5 times as many subjects who had experienced lengthy spells of unemployment after leaving school had been previously rated as antisocial at ages 8-9. At age 32 twice as many subjects who had experienced in excess of 12 months of unemployment over a 5 year period had been classified as antisocial at age 8-9 compared to the rest of the cohort. Similarly, there is a strong association between post-school job instability (3 or more jobs since leaving school) and childhood antisocial conduct, though the association does not appear to be sustained when considering job instability at age 32. Childhood neuroticism and poor concentration/restlessness were also more prevalent among those with less favourable teenage and adult employment outcomes, though the associations are generally less marked when compared to childhood antisocial conduct.

2.8.1 Multivariate estimations

Weekly earnings at age 32

The OLS regression on log of weekly earnings is reported in table 2.4. A link test (Pregibon, 1981) was used to assess the appropriateness of functional form. There was no evidence of mis-specification. Heteroskedasticity (unequal error variances) can lead to bias standard error estimation when using OLS. A Breuch-Pagan test was used to assess whether this was likely to be a major problem in this instance (Breusch & Pagan, 1979). The test fails to the reject the null hypothesis of homoskedastic (constant) error variances across all the multiply imputed data sets (all test results are presented in the appendix to the chapter).

Table 2.4
OLS regression: dependent variable - log of weekly earnings (age 32)

	B	t-ratio
Antisocial	0.064	0.90
Restless/Poor concentration	-0.131	-1.88
Neurotic	-0.034	-0.60
Low non-verbal IQ	-0.074	-1.20
Low family income	-0.164	-2.21
Poor parental supervision	0.020	0.26
Harsh discipline by parents	-0.004	-0.07
Large family	-0.056	-0.84
Parental conflict	0.005	0.08
Disrupted family	0.035	0.54
Constant	5.108	133.750
N	326	

Note
significant at 1% level significant at 5% level significant at 10% level.

The multiple imputations procedure does not produce summary statistics relating to the estimated model (F-tests of joint significance of explanatory variables or R-Squared statistics). Within each of the 5 multiply imputed data sets that were used to estimate the parameters reported in table 2.4, explanatory power with respect to log of earnings at age 32 was generally low - around 0.05 in each case (the five models based on each multiply imputed data set with associated statistics are presented in the appendix to the chapter).

Poor concentration/restlessness at age 8-9 was found to be associated with lower earnings at age 32 - the average effect on this variable is statistically significant at the 10% level. The estimated coefficient corresponding to a 12% disparity in average take-home pay between workers who were more restless and had greater difficulty concentrating on school work in their late childhood and the rest of the cohort (applying equation [2.3] to the relevant coefficient from table 2.4). In contrast, earnings at age 32 were unrelated to the presence of antisocial conduct and neuroticism in late childhood at that age. Of the other childhood variables, low parental income identified at age 8-9 was the only variable to reach statistical significance (at the 5 % level).

Unemployment and job stability

A link test carried out on each of the probit models did not deliver any evidence of functional form mis-specification. As with OLS, heteroskedasticity is also a potential problem for probit estimation, in terms of the consistency of parameter estimates and variances (Greene, 2003). There is no formal test for heteroskedasticity of unknown form within a probit framework, though a procedure for detecting and correcting for the presence of unequal variances that follow a specific type of functional relationship has been recommended in the literature (referred to as the heteroskedastic probit model (Greene, 2003). However, Keele & Park (2004) have recently shown this approach to be unreliable with model parameters particularly sensitive to the assumptions made regarding the precise nature of the error variance function. Without any strong a-priori grounds for assuming any specific functional form with respect to the error variances the heteroskedastic probit model was not used in this instance. However, given that micro-level data is always likely to be prone to heteroskedasticity (Greene, 2003) a "robust" sandwich estimator is used to estimate test statistics for the coefficients in each of the probit estimations, with a view to correcting for any bias associated with the estimated variances and standard errors (White, 1980).

Teenage outcomes (age 18-19)

Tables 2.5 and 2.6 present the probit estimations for the teenage employment outcomes. In general, across the multiply imputed data sets, pseudo R-squared statistics are in the region of 0.11 and 0.16 for the unemployment and job stability models respectively, with all explanatory variables jointly statistically significant at the 1% level in both cases based a χ^2 distributed likelihood ratio test (see appendix).

Table 2.5
Probit: Unemployed for > 18 weeks (ages 18/19)

	β	Z
Troublesome/antisocial	0.695	3.05
Restless/Poor concentration	-0.281	-1.18
Neurotic	-0.022	-0.10
Low non-verbal IQ	0.433	2.10
Low family income	0.595	2.62
Poor parental supervision	-0.407	-1.70
Harsh discipline by parents	0.199	1.01
Large family	-0.196	-0.89
Parental conflict	0.269	0.95
Disrupted family	0.468	2.32
Constant	-1.870	10.53
N	368	

Notes
1.significant at 1% level significant at 5% level significant at 10% level.
2.Robust standard errors used for z- values

Table 2.6
Probit: Unstable employment record (ages 18/19)

	β	Z
Troublesome/antisocial	0.400	2.16
Restless/Poor concentration	0.050	-0.27
Neurotic	0.017	0.07
Low non-verbal IQ	0.403	2.41
Low family income	0.127	0.65
Poor parental supervision	0.040	0.20
Harsh discipline by parents	0.222	1.34
Large family	0.592	3.22
Parental conflict	0.224	1.12
Disrupted family	0.211	1.18
Constant	-0.537	-4.79
N	361	

Notes
1.significant at 1% level significant at 5% level significant at 10% level.
2.Robust standard errors used for z-values

Antisocial conduct at ages 8-9 is associated with a significantly higher propensity towards extended periods of unemployment and job instability post-school leaving: the effect is statistically significant at the 1% and 5% levels respectively. Linear predictions from both sets of estimations are used to arrive at a predicted probability of observing teenage unemployment or unstable employment for those subjects who were classified as troublesome compared to the remainder of the cohort. The predictions indicate a sizeable differential in the risk of experiencing either outcome. In percentage terms, the risk of exposure to an extended period of unemployment at 18-19 years of age is estimated be around 12% for the antisocial group and only 3% for the rest of the cohort. The probability of having an unstable employment record after leaving school was 45% for those who were relatively badly behaved at age 10 compared to an average of 30% for other cohort members.

Neither restlessness/poor concentration or neuroticism in late childhood were linked to either teenage employment outcomes. Low IQ measured at age 8 is associated with a greater chance of unemployment and an unstable employment record after leaving school - in both cases the effect is statically significant at the 5% level. Low parental income and exposure to a disrupted family life are both associated with a higher likelihood of an extended periods out of work post-school leaving (both significant at the 1% and 5% levels respectively). Poor parental supervision identified at age 10 is associated with a *lower* likelihood of unemployment at ages 18-19 - the effect is significant at the 10% level. Large family size is associated with an increased likelihood of an unstable employment record after leaving school (significant at the 1% level).

Adult outcomes (age 32)

Tables 2.7 and 2.8 present the probit results for the age 32 employment outcomes.

Table 2.7
Probit: dependent variable - unemployed for >1 year over 5 years prior to age 32

	β	Z
Troublesome/antisocial	0.349	1.69
Restless/Poor concentration	0.115	0.56
Neurotic	0.197	1.12
Low non-verbal IQ	0.281	1.51
Low family income	0.382	1.78
Poor parental supervision	-0.124	-0.58
Harsh discipline by parents	-0.074	-0.42
Large family	0.081	0.39
Parental conflict	-0.005	-0.03
Disrupted family	-0.093	-0.47
Constant	-1.318	10.05
N	376	

Notes
1.significant at 1% level significant at 5% level significant at 10% level.
2.Robust standard errors used for z-values

Table 2.8
Probit: Unstable employment record (age 32)

	β	Z
Troublesome/antisocial	0.010	0.05
Restless/Poor concentration	0.197	1.03
Neurotic	-0.150	-0.88
Low non-verbal IQ	-0.131	-0.72
Low family income	0.026	0.12
Poor parental supervision	-0.058	-0.26
Harsh discipline by parents	-0.092	-0.50
Large family	-0.049	-0.25
Parental conflict	-0.006	-0.03
Disrupted family	0.018	0.10
Constant	-0.712	-6.18
N	369	

Notes
1.significant at 1% level significant at 5% level significant at 10% level.
2.Robust standard errors used for z-values

None of the childhood explanatory variables are statistically significant in the model of job stability at age 32. Childhood antisocial conduct is, however, associated with a higher likelihood of lengthy spells of unemployment, an association that is statistically significant at the 10% level. The predicted probability for observing this outcome for the antisocial group is 17% compared to 9% for the rest of the cohort. Low parental income is also linked to a higher risk of unemployment at age 32: the estimated effect on this variable is significant at the 10% level.

2.9 *Conclusions*

This chapter explored the relationship between childhood psychosocial problems and future economic attainment within a cohort of British males of largely working class origin. A number of relationships were explored using multivariate methods of estimation applied to a data set containing a rich and varied array of information relating to child development and teenage and adult labour market attainment. More specifically, the reported econometric estimations give an indication of the degree of inter-temporal association between outcomes observed at age 8-10 and later employment status and earnings attainment. It is therefore important to stress that *casual* pathways between childhood problems and adult outcomes within the Cambridge cohort have not been examined. The impact of childhood conduct problems on adolescent and adult employment outcomes, for example, are likely to be mediated via other processes including poorer schooling outcomes and the development certain life-styles and personality characteristics that are not generally conducive to stable employment patterns. Moreover, antisocial conduct observed at age 10 will in itself be determined by prior exposure to environmental/familial factors and genetically inherited behavioural tendencies - chapter 1 discussed in more detail some of the salient risk factors linked to adverse psychosocial development.

There were two key findings:

Restlessness/poor concentration at age 8-9 was associated with lower earnings at age 32 - Employees who were classified as being restless and having difficulty concentrating on school-based tasks at age 10 were estimated to earn around 12% less than their peers. This finding is certainly consistent with existing evidence showing of relatively poor educational attainment among children who experience attention deficit problems and hyperactivity (see chapter 1). It could also reflect a persistence of these problems into adulthood with implications for work-related productivity. Neither antisocial conduct nor neuroticism at age 30 were found to be linked to lower earnings at age 32.

Childhood antisocial conduct was found to be significantly associated with an increased risk of teenage unemployment and employment instability, though less strongly linked to poor employment outcomes identified at age 32 - Those subjects who experienced a relatively high job turnover and lengthy spells of unemployment after leaving school were significantly more likely to have been rated as troublesome when they were aged 8-9. This is consistent with existing evidence on the relationship between childhood aggression/antisocial conduct and poor employment outcomes in late adolescence observed within much of the literature reviewed in chapter 2. The results are not only of statistical significance, but the linear predictions from the probit estimations also translate into significant predicted risk differentials between those who were antisocial at age 8-9 and the remainder of the cohort. Children with conduct problems generally face a higher risk of under-achieving at school (see chapter 1), so it is perhaps unsurprising that these relationships were observed. The greater likelihood of unemployment and job instability for those who were troublesome during their late childhood could also reflect an underlying preference for choosing not to work as would be characteristic of a more general antisocial "syndrome" (Caspi et al., 1998).

The degree of association between childhood antisocial conduct and these kinds of employment outcome weakens somewhat further along the working life cycle. While there was still a statistically significant association with extended spells of unemployment at age 32 (at least at the 10% level of significance), the relationship with higher levels of job turn-over is completely dissipated. Neither childhood neuroticism nor restlessness/poor concentration was associated with any of the unemployment or job instability outcomes at ages 18-19 or at age 32.

2.9.1 Study limitations

The findings presented in this chapter offer fairly robust indicators of the strength of association between measures of childhood psychosocial development and future economic attainment - at least within the exclusively male and predominantly working class cohort who were studied. There are, however, some limitations associated with the findings.

After using imputed values for missing data on each covariate, the final estimation samples each comprised of all 32-year-old males for whom there were observable data on each economic variable of interest. Not all subjects who were included in the original cohort of boys recruited to the Cambridge cohort were therefore included in the estimation samples either due to death, failure to trace those still alive (94% were successfully included in the age 32 wave of interviewing and 95% eligible for follow-up at age 18.19) or missing data on specific items relating to the outcome variables of interest. The results presented in this chapter should, therefore, be viewed with a degree of caution, at least to the extent that the failure to observe everybody at follow-up may be non-random. Systematic loss to follow-up represents a particular problem for econometric estimation where the outcome variable of interest that drives the tendency to select out of a study over time is unobservable. For example, it is plausible that individuals who have spent extensive periods out of work may be more difficult to trace or interview because they are more geographically mobile and because they have more unstable life-styles. This could lead to a downward bias when assessing the degree of association between a troublesome childhood and future measures of economic and social status. Non-traceability was in fact not a major problem in the Cambridge cohort - a high proportion of the original 411 recruits were successfully contacted and interviewed.

The Cambridge cohort has also a rather limited sample size, at least when compared to some of the larger longitudinal data sets in existence within the UK. This may have also contributed to a lack of statistical significance in certain instances. For example, comparisons of future attainment between groups with and without a specific psychosocial characteristic within a comparatively small data set may be made less reliable when the outcomes of interest are relatively infrequently occurring events (e.g. long spells of unemployment).

It would be inappropriate to assume that the findings reported here would necessarily apply to other cohorts of a different age and from a more representative social background. The Cambridge cohort is exclusively male - a function of the original purpose of the study, which was to examine delinquent development through time (delinquency was less frequently observed among girls at the inception of the study; (Farrington, 1995)). Because the cohort are from a fairly homogeneous working class, inner-urban background, there is likely to be considerably less variation in earnings across workers than might have been observed with more socially representative and heterogeneous cohort of a similar age. For example, the standard deviation in weekly earnings in the Cambridge cohort at age 32 is only 10% of that reported for weekly earnings at age 30 within a large British cohort born in 1970 (these data are looked at in the following chapter).[3] A "ceiling effect", resulting from intergenerational economic and social immobility, may have limited full earnings potential within the CSDD, which in turn could suppress differences between workers who had different psychosocial characteristics in childhood, at least when compared to what might be observed within a more nationally representative and socially diverse group of individuals.

The associations observed in this chapter may also, to some extent, be unique to individuals of a specific age. For example, an examination of a younger cohort from a similar social background, may have yielded evidence of a more significant earnings disparity in relation to childhood psychosocial development with access to higher education becoming more widespread through time (reducing previously existing constraints on social mobility). Many children with serious behavioural problems face a higher risk of experiencing poorer schooling outcomes and therefore a lower chance of selection into higher education (see evidence cited in chapter 1). To the extent that educational attainment enhances future earnings potential, this would serve to widen economic disparities across adults with different developmental histories.

The policy environment to which different age cohorts are exposed may also vary considerably at crucial points in their development. The long-term developmental prognosis for a 10 year old with serious behavioural problems born in 1950 may differ significantly compared to an otherwise similar 10-year-old born in 1990. As will be

[3] Both standard deviations were compared using a GDP deflator (HM Treasury, 2004a).

discussed in chapter 4, social policy in relation to health, education and social care has only relatively recently began to target in a concerted fashion mental health and behavioural difficulties in childhood and adolescence. Moreover, the employment consequences associated with childhood disadvantage may also depend on the precise labour market conditions to which specific age cohorts are exposed. For example, the changing demand for labour relative to its supply, long-term shifts in employment incentives governed by the social security system, or changes in legislation (e.g. governing the extent to which employers can use information on criminal convictions) may all serve to narrow or widen differences in employment participation rates between individuals with more problematic psychosocial developmental trajectories.

2.9.2 Policy issues

Despite these draw backs, the results presented here begin to signal some important policy issues. Recent policy statements from the UK government have indicated a desire to limit childhood disadvantage with a view to promoting life-time opportunity and personal wellbeing, with an explicit reference made to the importance of targeting behavioural and psychological development at an early stage (HM Treasury, 2003b). The evidence presented here, combined with many of the findings reported in chapter 1, suggests that interventions that can either prevent or ameliorate psychosocial problems prior to entry into the labour market could have some important long-standing benefits for those individuals affected.

Inattentiveness/hyperactivity and antisocial conduct were noticeable candidates in this regard within the Cambridge cohort: there was evidence that the former negatively impacts on earnings while the latter seemed to be more important in terms of affecting the likelihood of future selection into stable paid employment, particularly at the earlier stages of the working life cycle. It should be stressed, however, that the multivariate analyses presented earlier provide estimates of *average* effects: in reality, children who present with specific developmental problems are likely to be heterogeneous in terms of the extent to which the problems they experience limit their future economic and social development. This is particularly noteworthy with respect to antisocial conduct. Children in the Cambridge cohort who were more badly behaved in this regard were estimated to face a greater average risk of experiencing poor teenage employment outcomes and lengthy periods of unemployment at age 32. However, by no means all children with this characteristic went on to experience adverse employment outcomes. In fact, those men in paid employment at age 32 who had also been behaviourally problematic at age 10 were found to fair no worse in terms of how much they earned each week compared to their peers. Further exploration of the data point to a greater prevalence of persisting antisocial tendencies among those who were badly behaved at ages 8-9 who also went on to have a relative high level of job turnover when they were teenagers compared to antisocial boys who experienced more stable employment patterns: 18% of the former had received multiple criminal convictions up to age 17 compared to just 2% of the latter. The antisocial-unstable employment group were also significantly more likely to have reported involvement in violent behaviour (fights etc.) and heavy drinking at age 18-19. A key question for policy is therefore whether there are effective means of selecting out those children who present with behavioural problems that are more likely to become persistent through time - with attendant consequences for employment - with a view to exposing high risk groups to interventions that are effective at improving long-term behavioural trajectories. This issue is returned to in subsequent chapters.

In chapter 3 the types of longitudinal relationships explored here are examined within a larger cohort of British adults. Again the emphasis is on examining the relationship between psychosocial difficulties observed in late childhood and labour market attainment, though exclusive attention is paid to outcomes observed at age 30. The adults who are studied were part of a nationwide birth cohort, born in 1970. These data provide an opportunity to examine employment outcomes separately for men and women who were from a more diverse and nationally representative social background.

3 Psychosocial development in late childhood and economic attainment: evidence from a British birth cohort

Summary

The relationship between economic attainment at age 30 and psychosocial characteristics identified in late childhood are examined within a national birth cohort of British men and women born in 1970. Attention deficit problems in childhood were found to be the most damaging of psychosocial problems identified at age 10, particularly with respect to earnings. Workers who were more prone to anxiety or poor coordinatory skills at age 10 had a higher chance of living in a low income household when they were 30. Male subjects who had higher age 10 antisocial conduct scores were statistically less likely to be economically active at age 30 - though the predicted incremental risk of being inactive is small in absolute terms for those who had more serious behavioural problems. Male workers who were more severely antisocial as children were estimated to earn significantly more than their peers, particularly those employed in skilled occupations, as were women in employed in managerial occupations.

3.1 Introduction

This chapter develops further the analyses presented in chapter 2. It explores the degree of association between adult economic attainment and childhood psychosocial development in a larger and more socially representative birth cohort of men and women who were born in 1970. Three measures of economic status at age 30 are examined: **1.** weekly earnings; **2.** participation in paid employment and other activities relating to skills and human capital development, and; 3. exposure to low household income (as defined using a conventionally applied definition of relative poverty). After presenting some descriptive comparisons of age 30 outcomes across individual's who had differing psychosocial profiles at age 10, the chapter goes on to describe a series of econometric estimations that seek to parameterise the key relationships of interest conditioning on a wide range of additional factors identified when the cohort were aged 10. Parameter estimates from the modelling of age 30 earnings are subsequently combined with cross-sectional earnings data for different ages taken from a national survey of the UK workforce with a view to projecting forward the effect of psychosocial difficulties on earnings at age 30 over the remaining working lifecycle. These projections seek to enable some estimate to be made of the long-term cumulative impact on employment income associated with psychosocial problems in late childhood.

The chapter begins by describing the 1970 birth cohort and then provides a description of the main indices that were used to measure psychosocial development when the cohort were aged 10, the measures of adult economic attainment that were utilised and a description of other explanatory variables that were included in the main estimations. The methods of analysis are then described followed by a presentation of the results. The chapter concludes with a discussion of the findings, including an assessment of the study's main limitations and an outline of some of the key policy issues arsing from the findings.

3.2 The 1970 British Cohort Study[1] [2]

The 1970 British Cohort Study (BCS70) is one of four large scale national and on-going birth cohort studies currently in existence in the UK (NR. Butler et al., 1986; Bynner et al., 2000). The other three include the 1946 birth cohort, otherwise referred to as the National Survey of Health and Development (Wadsworth, 1991; Wadsworth & Kuh, 1997), the 1958 birth cohort, also known as the National Child Development Study (Centre for Longitudinal Studies, 2004) and the Millennium cohort study instigated in 2000 (Centre for Longitudinal Studies, 2004). Initially covering all 17,198 children born in England, Scotland, Wales and Northern Ireland over a 1-week period during April 1970, the BCS70 was originally designed as a study of obstetric and neonatal care and

[1] The BCS70 is currently directed from the Centre for Longitudinal Studies, Institute for Education, University of London.

[2] More details regarding the response to the age 30 survey can be found in Bynner et al. (2000).

birth outcomes (Chamberlain et al., 1973, 1975), and has subsequently broadened into a more general study of health, educational and social development within a nationally representative birth cohort. Along with the other British Birth cohorts, the BCS70 has become an increasingly important source of data for examining the impact of social disadvantage and cognitive and non-cognitive (psychosocial) aspects of child and adolescent development on future adult economic and social outcomes (Feinstein, 2000; Schoon et al., 2002; Feinstein, 2003; Feinstein and Bynner, 2004; Brassett-Grundy, 2004). Since 1970 their have been a series of major data collection sweeps: in 1975 (when the cohort were aged 5); 1980 (age 10), 1986 (age 16) and 1996 (age 26) (Butler et al., 1986; Bynner et al., 1997; Osborne et al., 1984). The fifth and latest wave of interviewing took place in 1999/2000 when the cohort were aged 30 (Bynner et al., 2000).

3.2.1 Characteristics of the age 30 sample

The bulk of the analyses presented in this chapter relate to those births who were successfully traced and interviewed at age 30. Of the 17,198 individuals comprising the original cohort, 11,261 (65%) were successfully included in the age 30 data sweep. Forty-nine percent of those followed-up were male while 94% were classified as being white and of British origin. Sixty-seven percent were either married or co-habiting at age 30[3] - slightly less than the proportion of those who males who were married or cohabiting at age 32 in the Cambridge cohort. Nearly 60% of those who were either married or cohabiting had at least one child. Over 40% of BCS70 males and females were employed in either manual or non-manual skilled occupations. This compares with

[3] These proportions are estimated for those subjects for whom specific characteristics at age 30 (e.g. marital status) could be identified.

43% of the Cambridge cohort at a similar age. Over 40% were also employed in a managerial or professional position compared to only a third of the Cambridge cohort, while only 2% of BCS70 males and females were working in unskilled jobs at age 30, compared to 7% of those followed-up in the by the CSDD.

Those followed up at age 30 were born into and brought up within a varied range of circumstances, as reflected by differences in individual, parental and wider environmental factors identified during earlier data sweeps. At age 10, 47% had a father employed in a skilled occupation while the fathers of just over 5% of the 10-year-old sample who were working in unskilled jobs. Twenty-seven percent were living in public housing in a town or city. A small number - only 0.5% - were living away from their parents in a residential care setting, while just over 1% were either in the care of social care agencies or had experienced formal care arrangements prior to age 10. As a whole, the BCS70 children were clearly not as socially disadvantaged as the boys who were recruited to the Cambridge cohort. Over 85% of 10-year-olds in the BCS70 had lived with the same parents from birth up to age 10 years. Just over a quarter had experienced a significant illness, handicap or developmental problem prior to that age. In terms of their schooling, the vast majority had attended state run schools with only 2.5% attending an independent sector school.

3.3 Methods

3.3.1 Indexing psychosocial development at age 10

An educational questionnaire, self completed by teachers when the BCS70 were aged 10, contained 53 separate items relating to the behavioural and psychological development of each child successfully followed-up. Teachers were asked to rate the relevance of a specific characteristic in relation to the child in question. Scoring on each item was subsequently standardised on a scale ranging from 1 to 47. The majority of the items used in the BCS70 instrument were drawn from established measures, including the Connors Teacher Rating Scale (Conners, 1969) and the Rutter Teaching Scale (Rutter, 1967). Items typically included psychosocial indicators of relevance to the themes addressed in current chapter, including aspects of antisocial conduct (e.g. bullying and property damage), hyperactivity, attention deficit problems and items relating to emotional wellbeing (e.g. nervousness and anxiety).

The teacher ratings served as the basis for developing more concise indices of psychosocial development based on the information contained in each of the item ratings. The age 10 data also include a series of maternal ratings relating to a similar, though a not identical, set of characteristics. This instrument was, again, based on established measures developed by both Conners (1973) and Rutter et al. (1970). In line with previous studies of the BCS70 data, the teacher ratings were considered to be the preferred source of data on childhood psychosocial development on the basis that teachers are more likely to provide independent and dispassionate assessments of the child in question (Osborne & Milbank, 1987). Nevertheless, the maternal data were retained for use within the multivariate estimations relating to economic attainment with a view to assessing the sensitivity of the findings to the instrumentation and the source of the ratings used in generating an index of psychosocial development across different domains.

Following-on from previous work using the BCS70 childhood data (Berglund, 1999; Brassett-Grundy & Butler, 2004b; Feinstein, 2003), a principle components analysis (PCA; Tabachnick & Fidell, 2001) was used as a data reduction tool with a view to generating a series of numerical indices relating to each of the main age 10 constructs of interest. PCA - a type of latent variable analysis - utilises the correlation structure across multiple ratings made by teachers and parents in order to identify a set of component factors that reflect some underlying latent characteristic of interest. Each component (z_i) is defined as a linear combination:

$$z_i = a_{i1}x_1 + a_{i2}x_2 + ... + a_{in}x_n \qquad [3.1]$$

where $x_1,...,x_n$ are, in this instance, a set of continuous teacher or parental ratings. The weights associated with each indicator $a_{i1},...,a_{in}$ are estimated in order to maximise the variance in z_i across children in the age 10 sample. Separate components are sequentially generated, each accounting for a decreasing amount of the variance across individuals. Each component is assumed to be orthogonal (uncorrelated) with previously generated components. Standardised component, or "factor", scores are generated by PCA each based on the weighted combination of indicators expressed in equation [3.1], and each having a mean of zero with a unitary standard deviation. These can be used as ordinal measures of the severity of a given latent construct for use within multivariate estimation, therefore overcoming the problem of colinearity when using multiple indicators within a single multivariate estimation.

A more complete set of results from the PCA are presented in the appendix to this chapter. Three main psychosocial components of interest were extracted from the PCA using the teacher ratings, along with an additional index relating to coordinatory skills. These are subsequently used in the multivariate modelling relating to adult economic attainment described later. The list below labels each extracted component from the PCA carried out on the teacher ratings and provides a list of those individual items that were found to be most highly correlated with each latent component:

- ***Antisocial conduct*** (highly correlated with teacher ratings of bullying, teasing of others, temper outbursts, property damage, impulsiveness, quarrelling with other children, ease of frustration, sulky/sullenness, complaining about things, interfering with others, restlessness).

- ***Attention deficit problems*** (day dreaming, cannot concentrate on tasks, confused/hesitant, squirmy/fidgety, inattentiveness, fails to finish tasks, listless/lethargic, forgetful on complex tasks).

- ***Anxiety*** (obsessed about unimportant tasks, afraid of new situations, cries for little cause, behaves nervously, fussy/over-particular, worried/anxious, relations with others tearful/unhappy).

- ***Coordination problems*** (trips and bumps into things, clumsy at games, difficulty picking up small objects, drops things, accident prone, fearful in movement).

Five components extracted from the maternal ratings were retained for inclusion in the multivariate modelling:

- ***Emotional problems*** (miserable/distressed, irritable, sullen/sulky, outbursts of temper).

- ***Antisocial conduct*** (destroys belongings, fights, not much liked, takes others belongings, disobedient often, often tells lies, bullies others, interferes with other children).

- ***Restless-impulsiveness*** (very restless, squirmy-fidgety, hums or makes odd noises, restless/overactive, impulsive/excitable, given to rhythmic tapping).

- ***Attention deficit problems*** (cannot settle to do anything, inattentive, difficulty concentrating on tasks).

- ***Coordination problems*** (noticeably clumsy, trips or falls easily, drops things being carried).

3.3.2 Measures of economic attainment at age 30

Four measures of economic status at age 30 are used:

- ***Weekly gross earnings*** - derived from data on gross earnings over a specified period of time using self-report data derived from interviews with those members of the BCS70 who successful followed-up at age 30. The measure includes those who were employed in both full-and part-time jobs.

- ***Occupational status*** - a five point multinomial outcome scale based on the registrar general's occupational classificatory system, identifying jobs of decreasing skill and educational requirements and pay - ranging from unskilled occupations through to managerial and professional jobs.

- ***Economically active*** - a dichotomous outcome variable identifying those subjects who were either working part-time or in full-time employment or at least participating in an educational programme or government work training programme.

- ***Low income status*** - a dichotomous outcome variable identifying those subjects at age 30 who were living in low income households based on a conventionally applied definition of relative poverty. An individual is defined as living in a poor household if equivalised household income from all sources was less than 60% of the national median.[4] This measure was chosen primarily because of its acceptance as a key social policy indicator within UK government (Department for Work and Pensions, 2004).[5] Sixty-percent of median equivalised household income was around £146 per week in 1999/2000 (age 30 household income and earnings data within the birth cohort relate approximately to this period). The self-employed were excluded from this measure because the aggregated

[4] Equivalence scales are routinely use to measure poverty, reflecting the need to standardise for the differing resource needs and scale economies associated with households of varying size and age composition. Equivalised household size was based on the modified OECD scale (Organisation for Economic Co-operation and Development, 2003) which attaches differential weights to household members of different ages: a weight of 1.0 is given to the first adult in a household, 0.5 to other household members aged 14 and over and 0.3 to persons aged under 14 years. Equivalised income per household member is therefore total net disposable income divided by the equivalised size of the household in question.

[5] Different thresholds have been applied in other contexts. For example, a recent study of poverty dynamics in six OECD countries used a threshold of 50% of the median national equivalised income (Antolín et al., 2001).

equivalised income statistics reported by the UK government leave out those who work for themselves (Department for Work and Pensions, 2004).

Descriptive statistics relating to each of the age 30 outcome measures are presented in Table 3.1.

Table 3.1
Economic attainment at age 30: descriptive statistics

	MALES				FEMALES			
	Mean	**Std. Dev**	**%**	**N**	**Mean**	**Std. Dev**	**%**	**N**
Economically active								
(0=no; 1=yes)	0.92	0.28	92.0	5430	0.76	0.43	76.0	5752
Low income status								
(0=no; 1=yes)	0.30	0.46	30.0	4379	0.30	0.46	30.0	4990
Occupational status	2.65	0.85		4830	2.71	0.81		4241
1.Professional			7.97				4.43	
2.Managerial/technical			34.27				35.68	
3.Skilled			44.99				46.36	
4.Semi-skilled			10.70				11.41	
5.Unskilled			2.07				2.12	
Gross weekly earnings (£)	536.54	1752.63	_	4467	350.85	1161.35	_	3856
Log of weekly earnings	5.93	0.71	_	4467	5.366	0.94	_	3856

3.3.3 Other explanatory variables

As in chapter 2, the multivariate estimations also condition on a range of other covariates measured when the age 30 sample were 10-years-old. Again, these were included as a means of controlling for characteristics that might jointly co-vary with the psychosocial indicators and the age 30 economic variables of interest. The general model of adult attainment described in chapter 1 (diagrammatically described in figure 1.1) provided a general framework of reference for the econometric specifications reported in this chapter. As with the analyses in the previous chapter, decisions regarding which variables to include in the specifications were also made with reference to the psycho-developmental literature as well as, in certain instances, intuition and expert guidance on what factors might potentially confound estimated associations between the main childhood psychosocial variables of interest and adult economic attainment.

The nature and breadth of childhood measures covered by the BCS70 are somewhat different to those generated by the CSDD (see previous chapter), but they offer potential indicators of the same types factors that were controlled for when modelling employment outcomes within the Cambridge cohort. They include measures of: cognitive skills attainment; childhood health and development; indicators of non-cognitive attainment including aspects of motivation (including self-esteem and "locus of control"); indicators of the quality and quantity of parental time and other resource investments in child development (hours of employment, parental health and education, family income); evidence of severe social disability within the family and stability of upbringing (taken into care, parental separation); neighbourhood characteristics and schooling inputs (independent versus state school attendance, pupil-teacher ratio).

These variables are defined in more detail below:

Child-specific characteristics at age 10:

- ***Cognitive skills attainment*** - combined verbal and non-verbal test scores of cognitive attainment derived from the British Ability Scales administered at age 10 (Elliot et al., 1978) - a higher score indicating a greater level of cognitive attainment. Poor cognitive skills are known to limit future attainment (see evidence cited in chapter 1) and are also correlated with less favourable psychosocial outcomes in childhood and adolescence (evidence also cited in chapter 1).

- ***Motivational measures*** - the Child Health and Education Study, which was responsible for the design and conduct of the age 10 interviews, sought to include indicators of child motivation as an explanatory factor in their original investigations into the reasons for variability in educational attainment (Butler et al., 1997). Two measures of motivation were used: the LAWSEQ scale of self-esteem (LAWSEQ; Lawrence, 1981), with higher scores indicating higher self esteem; and the CARALOC measure of "locus of control" - the tendency to attribute success and failures either to internal factors such as effort or to external factors such as chance (Rotter, 1954). The literature review of chapter 1 cites studies that have shown a link between these aspects of non-cognitive development and future attainment in the labour market. They are also both intertwined with the kinds of childhood psychosocial outcomes of are of central interest in the current chapter.

- ***Significant health or developmental problems*** - a dichotomous variable identifying whether, at age 10, the child had experienced any significant illness, handicap or developmental problem. This variable was derived from medical examination forms completed by a medical officer for each child using existing official health records and actual medical examinations. If significant health problems and disability at earlier stages of an individual's development limit educational development and future attainment (a-priori this seems plausible) then it would make sense to control for these influences if health problems and disability have at least some effect on childhood emotional or behavioural outcomes.

Parental characteristics:

- ***Education*** - two dichotomous measures, based on self-report data from parental interviews, identifying mothers and fathers who had obtained formal qualifications. This variable is included as an indicator of both the quality and quantity of parental inputs.

- ***Hours of work*** - two variables, derived from the parental interviews at age 10, measuring the number of hours worked by each parent over the working week. Increased parental labour supply would imply a substitution away from time spent with the family. A-priori, the working pattern of mothers, who generally have primary caring responsibilities, may have a potentially greater significance for psychosocial development in childhood.

- ***Health*** - two dichotomous indicators of self-reported parental health since the child's fifth birthday up to age 10. These were derived from responses to questions asking parents to indicate whether they had suffered any severe prolonged illness (medical, surgical or psychiatric) or any handicap or disability. Parental health is also included as an indicator of the quality of parental inputs.

Characteristics of the family environment:

- ***Income*** - a 7 point ordinal scale of total gross weekly family income based on parental self-classification into specific income bands (1=£35/week or less up to 7=£250/week or more; 1980 values). This is included as a measure of parental investment opportunities.

- ***Taken into care*** - a dichotomous variable based on parental response to questions concerning whether the study child had previously been taken into care by statutory agencies. This served as an indicator of the presence of more serious problems, or social disabilities, within the family associated with a subject's upbringing and family circumstances. These factors are unlikely to promote higher levels of future attainment. Moreover, if children who experience this level social disadvantage are also generally more emotionally disturbed or behaviourally maladjusted then it would seem sensible to control for this when looking at psychosocial outcomes as predictors of future economic success.

- ***Lived with same parents*** - a dichotomous measure based on parental response to questions asking whether the child, at age 10, had lived with the same two parents since birth serving as a measure of exposure to parental separation and disruption to family life. As with the analysis of the Cambridge cohort, this variable was included given that family stability might influence psychosocial development and (independently) affect other features of childhood development of potential significance for adult attainment.

- ***Number of children living in household*** - derived from parental interviews at age 10. A larger family would imply lower marginal allocations of time and other resources to each family member – implying reduced levels of parental investment.

School and neighbourhood characteristics:

- ***Attended independent sector school at age 10*** - a dichotomous variable derived from age 10 educational questionnaires.

- ***Staff - pupil ratio at school*** - again derived from the age 10 educational questionnaire using data on the number of children and number of teachers in attendance in the classroom at the child's school of attendance. Both this and the above variable act as indicators of the quality of schooling to which each child was to up to age 10. Schooling quality could affect the future chances of success in the labour market while at the same time the quality of school inputs might potentially impact on psychosocial outcomes (evidence for this was cited in chapter 1).

- ***Residence in relatively disadvantaged neighbourhood*** - a dichotomous measure based on the mother's description of the area in which the family lived when the child was age 10. A "disadvantaged area" is defined here as either residence on a council estate or an urban locality dominated by privately rented accommodation and overcrowding. Evidence cited in chapter 1, for example, identified area-level disadvantage as a potential determinant of adverse behavioural outcomes. To the extent that children from disadvantaged localities might, on average, be expected to have poorer adult economic outcomes (though this may be more to do with the quality of the home or school environment than neighbourhood factors *per se*) the inclusion of a neighbourhood variable of this type would again seem reasonable.

Descriptive statistics relating to each of the explanatory variables (including standardised psychosocial scores derived from the PCA) are presented in table 3.2.

3.3.4 Estimation methods

The general specification of the empirical models were similar to those described in chapter 3. Ordinary least squares estimation with a logged dependent variable is again used to model weekly earnings variability as a function of age 10 characteristics. The earnings regressions are carried out for the entire sample and also by different occupational classifications (managerial, professional, skilled etc.) with a view to assessing the degree to which psychosocial problems in childhood relate to earnings for workers with differing levels of skills attainment. Existing evidence linking psychosocial problems to poor achievement at school (as cited in chapter 2) suggests that that they should also indirectly limit progression to higher levels of occupational status. However, it is plausible that psychosocial difficulties may still have some influence on future earnings, conditional on given levels of skills and educational attainment achieved, not least if behavioural and psychological traits observed in childhood persist into adulthood with possible implications for earnings potential within specific occupational categories.

Table 3.2
Explanatory variables: descriptive statistics

	Males			Females		
	Mean	**Std. Dev**	**N**	**Mean**	**Std. Dev**	**N**
Antisocial conduct (PCA standardised score: teacher ratings)	0.009	1.006	2987	-0.105	0.913	3181
Attention deficit problems (PCA standardised score: teacher ratings)	0.107	1.027	2987	-0.208	0.917	3181
Anxiety (PCA standardised score: teacher ratings)	-0.111	0.997	2987	0.114	0.967	3181
Poor coordination (PCA standardised score: teacher ratings)	-0.041	1.020	2987	0.062	0.943	3181
Antisocial conduct (PCA standardised score: maternal ratings)	0.059	1.021	4269	-0.125	0.849	4597
Restlessness-impulsiveness (PCA standardised score: maternal ratings)	0.124	1.047	4269	-0.172	0.902	4597
Attention deficit problems (PCA standardised score: maternal ratings)	0.080	1.052	4269	-0.106	0.899	4597
Emotional problems (PCA standardised score: maternal ratings)	-0.057	0.987	4269	0.009	0.965	4597
Poor coordination (PCA standardised score: maternal ratings)	-0.024	0.980	4269	0.037	0.995	4597
Cognitive attainment (BAS combined scores)	76.415	13.933	3950	75.199	13.404	4225
Locus of control (CARALOC score)	19.580	4.892	4002	19.458	4.771	4301
Self - esteem (LAWSEQ score)	15.996	4.208	4082	14.829	4.513	4343
Health problems up to age 10 (=-no; 1=yes)	0.290	0.451	4592	0.250	0.432	4892
Mother has formal qualifications (0=no; 1=yes)	0.480	0.500	4450	0.467	0.499	4754
Father has formal qualifications (0=no; 1=yes)	0.625	0.484	4341	0.608	0.4883	4549
Hours of work: father	45.301	12.557	4279	45.030	12.452	4501
Hours of work: mother	21.640	15.143	3527	21.803	14.624	3726
Health problems from child's 5th birthday: mother (0=no; 1=yes)	0.128	0.334	4664	0.134	0.341	4966
Health problems from child's 5th birthday: father (0=no; 1=yes)	0.117	0.322	4664	0.126	0.331	4966
Family income (scale 1-7)	4.072	1.257	4360	4.052	1.262	4629
Taken into care (0=no; 1=yes)	0.016	0.126	4673	0.017	0.129	4968
Lived with same parents (0=no; 1=yes)	0.884	0.320	4702	0.867	0.339	5008
Number of children living in household	2.526	1.028	4694	2.526	1.065	5011
Attended independent sector primary school (0=no; 1=yes)	0.030	0.159	4382	0.020	0.153	4640
Staff-pupil ratio at school	20.443	9.260	4181	20.816	9.333	4432
Residence in relatively disadvantaged neighbourhood (0=no; 1=yes)	0.299	0.458	4671	0.315	0.464	4985

Probit estimation is used to analyse the association between psychosocial characteristics at age 10 and both the dichotomous age 30 dependent variables (whether economically active; exposure to low household income/poverty). Occupational status is an oridinal multinomial outcome variable (with lower occupational status given a higher numerical coding on a 1-5 scale). The association between the age 10 covariates and occupational status is therefore examined using an ordered probit model (Greene, 2003). A score that indexes an individual's latent tendency towards a specified level of occupational status is modelled as a linear combination of a set of relevant explanatory variables:

$$Z_i = \sum_{j=1}^{k} \beta_j X_{ij} + \varepsilon_i \qquad [3.2]$$

The β_j s are unknown parameters requiring estimation, while a series of 'cut points' are also estimated which, combined with the linear predictions derived from [3.2], are used to estimate the probability of a specific outcome, n, occurring. The probabilities are estimated as:

$$\text{Pr(outcome} = n) = \Pr\left(k_{n-1} < \sum_{j=1}^{k} \alpha_j X_{ij} + \varepsilon_i \le k_n \right)$$

$$= f\left(k_n - \sum_{j=1}^{k} \alpha_j X_{ij} \right) - f\left(k_{n-1} - \sum_{j=1}^{k} \alpha_j X_{ij} \right) \qquad [3.3]$$

where k_k are the cut points requiring estimation and f is the standardised cumulative normal distribution.

All the multivariate estimations are carried out for males and females separately. As already noted, the main analyses were conducted using the principle component indices based on teacher ratings of childhood psychosocial characteristics. For comparative purposes, separate estimations are also carried out using psychosocial indices derived from the age 10 maternal ratings.

3.3.5 Missing data on explanatory variables

The non-return of age 10 questionnaires (maternal self completion forms, educational questionnaires etc.), or non-response during interview to specific questions of relevance, meant that complete age 10 data on each of the explanatory variables to be included in the multivariate estimations were not available for subjects with complete data on each measure of economic attainment at follow-up. As with the Cambridge cohort data this leads to a substantial loss of information when conducting a complete case analysis on those observations for whom data on the age 30 outcome measures can be observed. Multiple imputations (as described in more detail in chapter 2) are therefore again used to replace missing data on each explanatory variable. Five data sets with complete information on each covariate were generated, with separate multivariate estimations carried out on each. Model parameters, variances and standard errors are derived using Rubin's method described in chapter 2. The sample sizes reported in the results tables therefore refer to the full estimation samples covering subjects for whom there were complete data on each age 30 dependent variable of interest.[1]

[1] The NORM multiple imputations software was again used to generated the multiple imputed data sets (Schafer, 1999).

3.3.6 Lifecycle projections

Coefficient estimates from the earnings regressions are used to make a series of projections from age 30 up to retirement. Average lifecycle earnings are approximated from pooled-cross-sectional earnings data for different ages (over three quarters during 1998-99 - roughly the same time during which the age 30 cohort were interviewed) taken from the UK Quarterly Labour Force survey (QLFS; Labour Market Trends, 1999). The QLFS is an important source of micro-level labour market data in the UK. It is a large random survey of around 60,000 households sampling over 155,000 individuals. Each quarter is made up of 5 waves of around 12,000 households who are interviewed over 5 successive quarters. Within any one quarter the survey captures around 70,000 of the working population. Many of the UK's routine micro and macroeconomic statistics are based on the QLFS. The current study uses a pooled cross-section of just over 30,000 employees aged between 16 and 64 years, sampled from three quarters of the QLFS during 1998 and 1999.[2] Krueger (2003) and Dustmann et al. (2003) have also used this type of methodology - combining econometric estimates relating to earnings at a given age with age-specific cross-sectional earnings data - in order to project the observed effect of varying school class size on earnings over the working life cycle.

The projections are compared for workers who were positioned at the 50th (median) and 90th percentiles on a given age 10 psychosocial index. The median is taken to reflect a "typical" age 10 score. A 1.8% growth in earnings over time is assumed which (at the time of writing) corresponds to the UK Treasury's estimate for long-term growth in

[2] This same pooled cross-section was recently employed by the author and a colleague to examine mental health problems and absenteeism within the labour force (Almond & Healey, 2003).

productivity in the UK economy (HM Treasury, 2003a). The projections are made from age 30 up to retirement age which is assumed to be age 65 for males and age 60 for female employees. Earnings differentials at any given point in the life-cycle (y_t^*) between workers who had different psychosocial scores at age 10 are estimated using the compound growth/depreciation formula:

$$y_t^* = \bar{Y}_t - \left[\bar{Y}_t (1-\beta)^{\delta} \right] \qquad [3.4]$$

where $\bar{Y}_t$ is the mean (annual) earnings for males/females reported in QLFS at age t, β is the estimated coefficient on any given psychosocial index variable derived from the OLS regressions on log of earnings, while δ is the difference between the median the 90th percentile scores on a specific psychosocial index.

Projected earnings differentials at each age are then summed over the remaining lifecycle and described as a present value (PV) equivalent in order to account for inter-temporal preferences over future income streams. Thus:

$$\text{PV} = \sum_{t=30}^{64} y_t^* \Big/ (1+r)^{\lambda} \qquad [3.5]$$

where r is an appropriate discount rate and λ is the length of the remaining working lifecycle starting at age 30. Two discount rates are employed: a 3.5% discount rate - that used by the UK government to discount future costs and benefits of public programmes

(HM Treasury, 2004b) - and 6% - closer to the implied private rate of discount based on market yields on long-term government bonds. All values are discounted back to age 10 with a view to adopting an appropriate time horizon when considering investments in child and adolescent development (either by public agencies or parents) at that age.

3.4 Results

3.4.1 Descriptive comparisons

This section initially presents, at a descriptive level, evidence of the degree of association between the age 10 psychosocial indices and age 30 economic attainment. The patterns of association described do not, of course, hold constant any other co-varying factors that might also be related to economic status. Nevertheless, they are initially suggestive of some interesting relationships within data. Those who were located in the highest quartile on each of the age 10 indices derived from the principle components analysis (using the teacher ratings only) - i.e. employees who were more problematic children with respect to each area of psychosocial development covered - are identified separately from the rest of the age 30 sample. This distinction is somewhat arbitrary and is imposed simply for descriptive purposes.

Table 3.3 looks at average earnings. Males in paid employment who were in the top quartile on the antisocial conduct index at age 10 have higher average weekly earnings than their working peers at age 30: the differential is around 15%. The corresponding earnings gap is smaller and in the opposite direction for females. It is also interesting to note that of those males who were in the top 1% of earners, 31% has been in the top quartile of the antisocial conduct index at age 10 compared to only 23% who were outside the top 1% earnings bracket.

Table 3.3
Average (mean) earnings at age 30 and age 10 psychosocial index scores

	WEEKLY EARNINGS (£)	
	Males	**Females**
Antisocial conduct		
Top quartile	610	328
Rest of study sample	514	358
Attention deficit problems		
Top quartile	401	274
Rest of study sample	578	372
Anxiety		
Top quartile	494	282
Rest of study sample	550	372
Coordination problems		
Top quartile	498	341
Rest of study sample	549	354

Males and females whose attention deficit scores were in the top quartile at age 10 have lower average earnings. Females in the top quartile earn around 26% less than those outside the top quartile - the corresponding differential for males is around 30% less per week. Higher anxiety scores at age 10 are also associated with lower earnings among male and female workers - respectively a 24% and a 10% differential between the top quartile and the rest of the sample. There is also a negative association between earnings and coordinatory problems at age 10, but the corresponding differentials are much less marked.

The direction of association between occupational status and antisocial conduct at age 10 for males is the opposite to that observed for earnings (table 3.4): a considerably higher proportion of unskilled (and therefore lower paid) workers at age 30 (32%) were located in the highest quartile on the antisocial index in late childhood compared to those in a professional or managerial occupation (19% and 22.5% respectively).

Table 3.4
Occupational status at age 30 and age 10 psychosocial index scores

	IN TOP ANTISOCIAL QUARTILE	IN TOP ATTENTION DEFICIT QUARTILE	IN TOP ANXIETY QUARTILE	IN TOP POOR COORDINATION QUARTILE
MALES				
% professional	19.0	7.8	30.0	22.1
% managerial	22.5	17.3	23.5	25.3
% semi-skilled	26.9	35.8	27.5	27.1
% unskilled	32.0	41.0	32.0	32.0
FEMALES				
% professional	20.2	8.0	21.8	22.9
% managerial	22.6	15.3	21.0	22.3
% semi-skilled	31.8	35.5	25.8	22.2
% unskilled	20.0	44.4	30.0	16.7

Note
Statistics based on values from single imputed data set.

Occupational status appears to be less significantly related with antisocial conduct for females. However, for both males and females the strength of association between occupational status and deficits in attentiveness at age 10 are particularly noticeable. Only 7.8% of professional males (8% of professional females) were within the top quartile on the attention deficit index at age 10 compared to over 40 % of both male and female unskilled workers. The relationship between occupational status and anxiety in late childhood is stronger for females: 30% of unskilled women were within the top quartile on the anxiety index at age 10 compared to 21% both managerial and professional females. A higher percentage (32%) of men in unskilled occupations had more severe coordinatory problems in childhood compared to those in professional and managerial jobs. The corresponding association is weaker for females.

Table 3.5
Employment at age 30 and age 10 psychosocial index scores

	IN TOP ANTISOCIAL QUARTILE	IN TOP ATTENTION DEFICIT QUARTILE	IN TOP ANXIETY QUARTILE	IN TOP POOR COORDINATIO N QUARTILE
MALES				
% not in paid employment	31.4	38.4	28.0	30.7
% in part-time employment	27.2	30.9	27.2	25.9
% in full-time employment	23.7	23.9	24.0	24.8
FEMALES				
% not in paid employment	27.7	33.5	29.2	27.8
% in part-time employment	26.6	27.5	26.7	23.7
% in full-time employment	22.8	19.5	22.0	24.1

Note
Statistics based on values from imputed data set.

Thirty-eight percent of males (33 % of females) who were not in paid work were in the top quartile on the attention deficit index compared to 23.9% (20% for females) in full-time employment (table 3.5). These differences are less marked for childhood antisocial conduct, anxiety and coordinatory problems. Exposure to low household income is also more strongly associated with attention deficit problems at age 10 when compared to the other psychosocial measures (table 3.6): 34% of males (33% of females) living in a low income household were in the top quartile of the attention deficit index in late childhood compared to only 22% (21 % of females) who where above the relative poverty threshold.

Table 3.6
Low income at age 30 and age 10 psychosocial index scores

	IN TOP ANTISOCIAL QUARTILE	IN TOP ATTENTION DEFICIT QUARTILE	IN TOP ANXIETY QUARTILE	IN TOP POOR COORDINATION QUARTILE
MALES				
% not in low income household	23.7	21.7	23.2	24.7
% in low income household	24.5	34.0	28.7	29.8
FEMALES				
% in low income household	23.6	21.3	24.4	23.5
% in low income household	26.7	32.8	25.8	27.9

Note
Statistics based on values from imputed data set.

3.4.2 Multivariate estimations

Weekly earnings

A series of diagnostic tests were implemented in order to test for functional form mis-specification and heteroskedasticty.[3] There was generally no evidence of functional form mis-specification based on a the application of a link test (Pregibon, 1981). A test for the presence of heteroskedasticity Breusch & Pagan (1979) conducted on the earnings regression for males rejected the null hypothesis of homoskedastic error variances. Robust standard errors (White, 1980) are therefore used to calculate test statistics for the model coefficients, thereby correct for bias variance estimation in the male earnings equations. The hypothesis that the error variances in the female earnings equation are homoskedastic could not be rejected, with no subsequent adjustment made

[3] The appendix to the chapter provides a more complte set of results, including models estimated on each multiply imputed data set and diagnostic test results.

to the estimated standard errors. Following Manning & Mullahy (2001), a Park test (Park, 1966) supported the adoption of an OLS estimator with a log-transformed dependent variable given the observed distribution of the earnings data.[4]

Table 3.7 reports the results from the OLS regression on the log of weekly earnings for males and females. The amount of variation explained by each of the estimations carried out on the five complete data sets containing multiply imputed values yielded R-Squares of around 6-7% for males and 9-10% for females. The psychosocial variables in table 3.7 are those derived from the age 10 teacher ratings. For males, more severe antisocial conduct at age 10 is associated with higher weekly earnings at age 30, therefore backing up what was observed at a descriptive level. The estimated effect is statistically significant at the 1% level. The same direction of association for the antisocial conduct variable is observed for females, but the effect is comparatively weak and not close to statistical significance at conventional levels.

[4] Heavy tailed log-scaled residuals derived from a generalised linear model of earnings weekly earnings were observed for both males and females.

Table 3.7
OLS regression: dependent variable - log of weekly earnings (age 30)

	MALES		FEMALES	
	β	**t-ratio**	**β**	**t-ratio**
Antisocial conduct	0.046	3.53	0.022	0.96
Attention deficit problems	-0.035	-2.53	-0.087	-3.80
Anxiety	-0.027	-1.78	-0.376	-1.45
Coordination problems	-0.023	-1.28	-0.005	-0.30
Health probs: mother	-0.016	-0.45	0.036	0.79
Health probs: father	-0.051	-1.39	0.015	0.32
Formal quals: mother	0.088	3.34	0.052	1.40
Formal quals: father	0.028	0.99	0.000	0.02
Family income	0.046	4.27	0.077	5.76
Number of children in household	-0.002	-0.21	-0.018	-1.12
Working hours: mother	-0.001	-1.19	-0.001	-1.08
Working hours: father	0.000	0.51	-0.001	-0.92
Lived in disadvantaged neighbourhood	-0.055	-1.92	-0.115	-2.99
Independent school	0.142	1.48	0.126	1.19
Staff-pupil ratio at school	-0.000	-0.46	-0.004	-1.68
Health problems up to age 10	-0.001	-0.04	0.029	0.75
Locus of control (Caraloc score)	0.008	2.68	0.008	1.83
Self-esteem (Lawseq score)	0.006	1.80	0.009	2.46
Cognitive attainment (BAS combined score)	0.003	3.37	0.009	6.11
Taken into care	-0.297	-2.62	0.059	0.44
Same parents since birth	-0.008	-0.21	0.045	0.97
Constant	5.224	47.12	4.164	24.04
N	4466		3855	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used for t-values in male earnings equation.

The coefficients reported in the table are estimates of the marginal proportional change in earnings associated with a unit change in each psychosocial index. These marginal effects can therefore be used to compare the percentage earnings differential between individuals who were positioned at different points within the age 10 psychosocial score distributions. A male who was located at the 90th percentile of the antisocial conduct index at age 10 is estimated to earn almost 7% more than an otherwise similar worker who was located at the median. The differential increases to 9% when comparing those who were at 90th percentile with those who were positioned at the 25th percentile.

Higher attention deficit problems at age 10 are strongly associated with lower earnings at age 30 for both male and female workers. In both instances the effects are highly significant statistically. A male worker who was at the 90th percentile on the attention deficit index is estimated to earn around 5% less than a male who was positioned at the median, and 7% less than a similar worker who was positioned at the 25th percentile at age 10. The income deficits are considerably larger for females: a woman who was positioned at the 90th percentile on the attention deficit index is estimated to earn 12% less than a similar worker at the median age 10 score for girls (and around 17% less than those who were positioned at the 25th percentile).

More severe anxiety and coordination problems at age 10 are also negatively associated with earnings though the effects are much weaker and do not achieve statistical significance at the 5% level. The age 10 anxiety variable is significant at the 10% level within the male earnings equations, though the estimated coefficient suggests a much smaller proportional differential in earnings across the age 10 anxiety score distribution compared to the effects estimated for attention deficit and antisocial conduct problems.

Workers whose mothers were better educated are predicted to earn more, though the effect of this variable is only statistically significant in the male earnings regression. Males and females who lived in higher income families at age 10 are also estimated to earn significantly more than workers from poorer backgrounds. Those who resided in a relatively disadvantaged neighbourhood when they were age 10 were estimated to earn significantly less than workers who grew up in other types of locality: this effect appears to operate independently of parental education and family income. Male and female workers who scored more highly on tests of cognitive attainment at age 10 and who had a higher level of self esteem and "locus of control" were also estimated to earn more than their peers. Male workers who had experienced statutory care arrangements by age 10 appear to be particularly disadvantaged with respect to earnings, though the same significance of effect is not observed for females.

Table 3.8 presents the earnings regressions that used the psychosocial indices based on maternal ratings. For brevity, the table excludes details relating to the other explanatory variables (a complete set of results are provided in the appendix).

Table 3.8
OLS regression: dependent variable - log of weekly earnings (age 30)
(Psychosocial maternal ratings at age 10)

	MALES		FEMALES	
	β	**t-ratio**	**β**	**t-ratio**
Antisocial conduct	0.009	0.71	-0.001	-0.04
Restlessness-impulsiveness	-0.009	-0.72	-0.050	-2.69
Attention deficit	-0.003	-0.29	-0.026	-1.43
Emotional problems	-0.010	-0.88	-0.015	-0.92
Coordination Problems	-0.038	-2.80	-0.015	-0.84
N	4466		3855	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard used for t-values in male equation.
3. All other age 10 explanatory variables also included in each model but are not reported in the table

In general, the estimated associations are in the same direction to those observed using the indicators that were based on teacher-ratings. However, the strength of association with age 30 earnings is much weaker, both in terms of estimated effect size and statistical significance. There are two exceptions. More severe coordination problems at age 10 have a negative and statistically significant association with male earnings at age 30 while the restlessness-impulsiveness variable derived from the maternal rating in negatively and significantly associated with female earnings at age 30.

Tables 3.9 to 3.13 present the findings from a series of regressions on log of earnings estimated separately for workers at different levels of occupational status (again, other explanatory variables are not reported). Five separate estimations were carried out, each relating to males and female workers employed in: professional occupations; managerial/technical occupations; skilled non-manual occupations; skilled manual occupations; and partly-skilled or unskilled occupations grouped together. The diagnostic tests described earlier again generally supported the adoption of a semi-logarithmic specification and robust standard errors are used where there was evidence of heteroskedastic error variances.

Table 3.9
OLS regression by occupational status: dependent variable - log of weekly earnings (age 30): professional

	MALES		FEMALES	
	β	**t-ratio**	**β**	**t-ratio**
Antisocial conduct	0.047	0.69	-0.025	-0.20
Attention deficit	-0.054	-0.67	-0.075	-0.60
Anxiety	-0.010	-0.21	-0.059	-0.77
Coordination problems	0.016	0.18	-0.023	-0.38
N	364		179	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate t-values (males and females).

Table 3.10
OLS regression by occupational status: dependent variable - log of weekly earnings (age 30): managerial/technical

	MALES		FEMALES	
	β	**t-ratio**	**β**	**t-ratio**
Antisocial conduct	0.034	1.66	0.061	2.06
Attention deficit	-0.019	-0.62	-0.043	-1.02
Anxiety	-0.026	-0.95	-0.044	-1.35
Coordination problems	-0.017	-0.68	-0.000	-0.02
N	1522		1377	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate t-values (males and females).

Table 3.11
OLS regression by occupational status: dependent variable - log of weekly earnings (age 30): skilled non-manual

	MALES		FEMALES	
	β	**t-ratio**	**β**	**t-ratio**
Antisocial conduct	0.079	2.52	0.008	0.23
Attention deficit	0.015	0.42	-0.046	-1.48
Anxiety	-0.053	-1.38	-0.021	-0.72
Coordination problems	-0.061	-1.69	-0.006	-0.20
N	561		1502	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate t-values (males and females).

Table 3.12
OLS regression by occupational status: dependent variable - log of weekly earnings (age 30): skilled-manual

	MALES		FEMALES	
	β	**t-ratio**	**β**	**t-ratio**
Antisocial conduct	0.052	2.39	0.018	0.33
Attention deficit	-0.041	-1.76	-0.127	-1.43
Anxiety	-0.017	-0.94	-0.052	-0.88
Coordination problems	-0.016	-0.67	-0.016	-0.27
N	1408		287	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate t-values (males and females).

Table 3.13
OLS regression by occupational status: dependent variable - log of weekly earnings (age 30): semi-skilled & unskilled

	MALES		FEMALES	
	β	**t-ratio**	**β**	**t-ratio**
Antisocial conduct	0.057	1.81	0.006	0.09
Attention deficit	0.028	0.79	-0.000	-0.01
Anxiety	-0.027	-0.83	-0.039	-0.68
Coordination problems	-0.027	-1.00	-0.012	-0.21
N	545		501	

Note
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate t-values (males and females).

These additional analyses offer some interesting findings that are hidden when looking at earnings status across the entire occupational range. For males, increasing antisocial conduct at age 10 is associated with higher earnings across all occupational categories – this is consistent with the findings from the single earnings regression carried out across the full occupational range: point estimates range from 0.034 for males employed in managerial/technical jobs to 0.079 for those working in skilled non-manual occupations. While no formal test of any differences by occupational category was carried out, it is still noteworthy that the estimated positive effect of increasing antisocial conduct on female earnings for those working in a managerial/technical position is somewhat larger than the corresponding effect for other occupational categories. This effect is statistically significant at the 5% level. The lack of significance in other occupational regressions for females may be down to limited sample size and statistical power (e.g. for professional females). However, the insignificance of the female antisocial conduct variable in the main earnings regression (Table 3.7) would seem to suggest that, in general, female earnings in other occupational categories are unlikely to be positively related to childhood antisocial conduct. All of the remaining psychosocial variables are negatively signed for all male and female regressions across the various occupational classifications. Again, it is important to stress that significance testing may be of limited power given the size of the estimation samples.

Occupational status

Table 3.14 presents the ordered probit results with respect to occupational status. There is no formal means of testing for heteroskedasticity within this type of modelling framework, though robust standard errors are utilised on the assumption that, with micro data of the type used here, heteroskedastic error variances are likely to be the rule rather than the exception (Greene, 2003). The female occupational status equation satisfied a link test for appropriate functional form. However, the male occupational status results should be viewed with some caution as there is some evidence of functional form mis-specification.

The positive sign on the attention deficit variable in both the male and female ordered probit equations imply that workers who had more severe problems of this nature at age 10 were *less* likely to select into more skilled and better paid types of job (higher scores on the dependent variable indicate a *lower* level of occupational status). The same direction of effect is also observed for antisocial conduct at age 10, though the effect is not statistically significant.

Table 3.14
Ordered probit: dependent variable - occupational status (age 30)

	MALES		FEMALES	
	β	Z	β	Z
Antisocial conduct	0.041	1.52	0.007	0.25
Attention deficit problems	0.126	5.15	0.134	5.72
Anxiety	0.115	0.47	0.007	0.24
Coordination problems	0.006	0.29	-0.012	-0.59
Health probs: mother	0.035	0.72	-0.035	-0.66
Health probs: father	0.066	1.12	-0.083	1.52
Formal quals: mother	-0.139	-3.40	-0.182	-4.01
Formal quals: father	-0.141	-3.29	-0.073	-1.64
Family income	-0.093	5.83	-0.091	-5.62
Number of children in household	0.003	0.18	0.032	1.60
Working hours: mother	0.000	0.21	0.000	0.72
Working hours: father	0.001	0.42	0.001	0.56
Lived in disadvantaged neighbourhood	0.160	3.58	0.151	3.16
Independent school	-0.246	-2.12	0.142	1.48
Staff-pupil ratio at school	0.000	0.18	-0.001	-0.46
Health problems up to age 10	-0.001	-0.02	-0.001	-0.04
Locus of control (Caraloc score)	-0.015	-3.03	-0.024	-4.96
Self - esteem (Lawseq score)	0.006	1.80	-0.001	-0.23
Cognitive attainment (BAS combined score)	-0.018	-11.87	-0.017	-8.39
Taken into care	-0.016	1.11	0.071	0.43
Same parents since birth	0.056	1.01	-0.049	-0.83
N	4830		4240	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate z-values (males and females).

Neither of the other age 10 psychosocial variables (anxiety and coordinatory problems) are associated with age 30 occupational status for either males and females. A higher locus of control score at age 10 is strongly associated with higher occupational status, as are higher age 10 cognitive attainment scores. Both male and female workers who had more educated parents and who lived in a higher income household at age 10 are predicted to have a higher status job. Workers who attended an independent sector school when aged 10 are also predicted to be in more skilled and generally higher waged jobs, while those who lived in a relatively disadvantaged neighbourhood were less likely to select into jobs of higher status at age 30. The use of psychosocial indices based on maternal ratings gave rise to a similar set of findings (Table 3.15). Again, the attention deficit index is the only age 10 psychosocial variable associated with occupational status at age 30 for both males and females: those who had lower attentiveness (as rated by mothers) were less likely to select into higher status jobs, an association which is highly significant statistically.

Table 3.15
Ordered probit: dependent variable - occupational status (age 30)
(Psychosocial maternal ratings at age 10)

	MALES		FEMALES	
	β	Z	β	Z
Antisocial conduct	0.021	1.28	0.005	0.23
Restlessness-impulsiveness	0.023	1.38	0.004	0.20
Attention deficit	0.098	5.39	0.081	3.76
Emotional problems	0.014	0.77	0.021	1.02
Coordination Problems	0.007	0.42	-0.027	-1.38
N	4830		4240	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate z-values (males and females).
3. All other age 10 explanatory variables also included in each model but are not reported in the table.

The predicted probability of observing each type of occupational outcome is reported in Table 3.16.

Table 3.16
Attention deficit problems at age 10 and predicted probability of achieving specific occupational status at age 30: 50th versus 90th percentile on the attention deficit index

	MALES	FEMALES
50th percentile		
Professional	0.060	0.025
Managerial/technical	0.365	0.344
Skilled	0.478	0.513
Semi-skilled	0.084	0.105
Unskilled	0.010	0.014
90th percentile		
Professional	0.042	0.016
Managerial/technical	0.315	0.285
Skilled	0.513	0.539
Semi-skilled	0.111	0.138
Unskilled	0.017	0.022

These are compared for the workers who were located at the at the 50th and 90th percentiles on the attention deficit index at age 10 (using the teacher ratings) - the only statistically significant psychosocial measure in the ordered probit estimations for males and females. The predicted probability differentials are not that substantial in terms of their absolute size. For example, the predicted chance of employment in professional occupation for an otherwise typical male worker who was located at the 90th percentile on the attention deficit index is around 4% compared to 6% for a similar worker who was positioned at the median (all the predictions fix the value of the other covariates at their average value). The corresponding differential is of a similar order of magnitude for females. The predicted probability differentials are larger as regards employment in managerial occupations: 36% for males who were at the 50th percentile and 31% for those at the 90th percentile - the corresponding predicted differential is again of a similar magnitude for females.

Economically active

Table 3.17 presents the findings from the probit models concerning the likelihood of being economically active at age 30. There was no evidence of functional form mis-specification in the male probit estimations for this outcome, however the female probit estimation does fail a link test for functional form specification. Robust standard errors are used to calculate the relevant test statistics. More severe attention deficit problems at age 10 are associated with a reduced likelihood of either being in paid employment or participating in an educational programme or work training scheme at age 30. Males who had higher antisocial conduct scores at age 10 are estimated to have a lower likelihood of being economically active. All of these associations are statistically significant at the 5% level - the association between male attention deficit problems and being economically active is statistically significant at the 1% level. None of the effects relating to the other psychosocial measures are significant statistically.

Table 3.17
Probit: dependent variable - economically active (age 30)

	MALES		FEMALES	
	β	Z	β	Z
Antisocial conduct	0.089 **	-2.68	-0.031	-1.00
Attention deficit problems	-0.118	-3.33	-0.111	-3.10
Anxiety	-0.021	-0.71	-0.039	-1.18
Coordination problems	-0.018	-0.52	-0.020	-0.66
Health probs: mother	-0.077	-1.00	0.010	0.17
Health probs: father	-0.049	-0.50	-0.012	-0.19
Formal quals: mother	0.003	0.05	0.080	1.72
Formal quals: father	0.123	1.32	0.017	0.39
Family income	0.071	2.79	0.053	2.71
Number of children in household	-0.042	-1.65	-0.101	-5.13
Working hours: mother	0.000	0.04	-0.000	-0.25
Working hours: father	0.002	1.08	-0.001	-0.69
Lived in disadvantaged neighbourhood	-0.241	-3.42	-0.126	-2.55
Independent school	-0.271	-1.36	-0.176	-1.21
Staff-pupil ratio at school	0.006	1.92	0.006	2.23
Health problems up to age 10	-0.190	-2.73	0.029	0.59
Locus of control (Caraloc score)	0.010	1.41	0.013	2.51
Self - esteem (Lawseq score)	-0.004	-0.61	-0.002	-0.39
Cognitive attainment (BAS combined score)	0.007	2.39	0 .009	3.63
Taken into care	-0.397	-2.13	-0.133	-0.91
Same parents since birth	0.134	1.70	0.144	2.26
N	5429		5751	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate z-values (males and females).

Larger family income, having lived with the same parents since birth, higher levels of cognitive attainment at age 10 and attending a school with a higher staff to pupil ratio are all associated with an increased likelihood of being in employment at age 30 for both males and females. Having lived in a more disadvantaged neighbourhood at age 10 is associated with a lower likelihood of being economically active at age 30. Males who had experienced being taken into care were less likely to be economically active, as were men who had experienced serious health and developmental problems prior to age 10. Having a mother with a higher educational attainment was associated with an increased likelihood of being economically active at age 30, while women who were observed to have a greater "locus of control" during late childhood were also predicted by the model to have a higher probability of being economically active.

When using psychosocial indices derived from the maternal ratings (table 3.18), more severe antisocial conduct is significantly associated with a reduced likelihood of being economically active at age 30 for both males and females (statistically significant at the 1% level). However, neither the maternal ratings-based index of attention deficit problems at age 10 or any of the other psychosocial maternal variables were found to a have a statistically significant association with this outcome.

Table 3.18
Probit: dependent variable - economically active (age 30)
(Psychosocial maternal ratings at age 10)

	MALES		FEMALES	
	β	Z	β	Z
Antisocial conduct	-0.131	-5.35	-0.066	-2.85
Restlessness-impulsiveness	-0.019	-0.69	-0.019	-0.80
Attention deficit	-0.043	-1.53	-0.013	-0.52
Emotional problems	-0.033	-1.10	-0.026	-1.27
Coordination Problems	-0.005	-0.18	0.013	0.66
N	5429		5751	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate z-values (males and females).
3. All other age 10 explanatory variables also included in each model but are not reported in the table.

While the relationship between being economically active at age 30 and childhood attention deficit problems and antisocial conduct (for males) are statistically significant, these findings do not translate into large probability differentials between subjects who were positioned at the median and 90th percentiles on the relevant age 10 indices (Table 3.19). The largest predicted probability differential is observed between females located at the median on the attention deficit index (% chance of being economically active=80%) versus those at the 90th percentile (=75%). Table 3.19 shows that, for male antisocial conduct and attention deficit at age 10, the corresponding differentials are comparatively small.

Table 3.19
Economically active: predicted probabilities from probit estimations

	MALES	FEMALES
Antisocial conduct:		
50th percentile	0.958	–
90th percentile	0.947	–
Attention deficit problems:		
50th percentile	0.959	0.800
90th percentile	0.942	0.752

Low income

The probit estimates relating to low income status at age 30 are presented in Table 3.20. There was some evidence of functional form misspecification with respect to the female equation. Robust standard errors are again utilised for the calculation of test statistics. For males, antisocial conduct at age 10 is associated with a reduced likelihood of exposure to low household income at age 30, though the effect is only marginally significant statistically at the 10% level. All the other age 10 psychosocial indicators - attention deficit problems, anxiety and coordination problems are linked to a higher risk of exposure to low income for males. For females, higher attention deficit problems observed at age 10 and more severe coordinatory problems are significantly linked to a higher risk of exposure to low household income at age 30.

A higher level of cognitive attainment at age 10 and having a mother with a higher level of academic attainment was found to be associated with a lower risk of exposure to low income status at age 30 for males and females. Higher family income was also associated with a lower likelihood of being below the poverty threshold, though only for males, while women who had a higher "locus of control" were predicted to be less likely to be living in a low income household at age 30. Living in a larger family with more children and in a relatively disadvantaged neighbourhood at age 10 was associated with a higher likelihood of exposure to low income for males and females.

Table 3.20
Probit: dependent variable - low income status (age 30)

	MALES		FEMALES	
	β	Z	β	Z
Antisocial conduct	-0.039	-1.65	0.000	0.01
Attention deficit problems	0.096	2.81	0.097	3.60
Anxiety	0.052	2.32	0.023	0.64
Coordination problems	0.061	2.74	0.051	2.10
Health probs: mother	-0.089	-1.27	-0.049	0.81
Health probs: father	0.048	0.69	0.036	0.58
Formal quals: mother	-0.208	-4.10	-0.137	2.92
Formal quals: father	-0.085	-1.51	-0.050	0.94
Family income	-0.083	-3.98	-0.078	4.06
Number of children in household	0.047	2.17	0.083	4.31
Working hours: mother	0.002	1.39	0.002	1.27
Working hours: father	0.002	0.86	0.001	0.27
Lived in disadvantaged neighbourhood	0.098	2.01	0.139	3.00
Independent school	-0.212	-1.17	0.089	0.52
Staff-pupil ratio at school	-0.001	-0.28	-0.002	0.95
Health problems up to age 10	0.059	1.13	0.028	0.61
Locus of control (Caraloc score)	-0.007	-1.30	-0.013	2.31
Self - esteem (Lawseq score)	-0.001	-0.09	-0.004	0.85
Cognitive attainment (BAS combined score)	-0.009	-4.77	-0.011	6.10
Taken into care	0.116	0.68	0.257	1.63
Same parents since birth	0.043	0.59	-0.101	1.56
N	4378		4989	

Notes
1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate z-values (males and females).

The psychosocial variables based on maternal ratings are, statistically, weaker predictors of experiencing low income status (table 3.21). However, the noteworthy exception is that for males and females antisocial conduct is *positively* associated with the risk of exposure to low income status at age 30 (contradicting the findings based on the teacher ratings) - the effect is statistically significant for females at the 1% level though only significant at the 10% level for males.

Table 3.21
Probit: dependent variable - low income status (age 30)
(Psychosocial maternal ratings at age 10)

	MALES		FEMALES	
	β	Z	β	Z
Antisocial conduct	0.041	1.89	0 .088	3.45
Restlessness-impulsiveness	0.002	0.10	0.025	0.93
Attention deficit	0.041	1.68	0.045	1.89
Emotional problems	0.009	0.42	-0.005	-0.21
Coordination Problems	0.027	1.06	0.000	0.00
N				

1. significant at 1% level significant at 5% level significant at 10% level.
2. Robust standard errors used to calculate z-values (males and females).
3. All other age 10 explanatory variables also included in each model but are not reported in the table.

Table 3.22 presents the probability predictions derived from the probit models for low income status (again using the probit results based on teacher ratings). The predicted probability differentials between subjects located at the 90th and median percentile of the score distribution are compared for attention deficit problems, anxiety (males only) and coordinatory problems.

Table 3.22
Low income status: predicted probabilities from probit estimations

	MALES	FEMALES
Attention deficit problems:		
50th percentile	0.200	0.264
90th percentile	0.239	0.309
Anxiety		
50th percentile	0.200	–
90th percentile	0.221	–
Poor coordination		
50th percentile	0.200	0.264
90th percentile	0.224	0.289

Those subjects who had greater psychosocial problems within each of these domains were predicted to be at greater risk of exposure to low income at age 30. However, the excess risk associated with having been at the 90th percentile within each of the score distributions is, again, not that substantial in absolute terms: the largest risk differential arises when comparing female subjects at the 90th and median percentile on the age 10 attention deficit index.

3.4.3 Lifecycle earnings projections

Figures 3.1 and 3.2 present projections of earnings over the remaining working life cycle up to retirement.

Figure 3.1
Life-cycle projections: male earnings from age 30

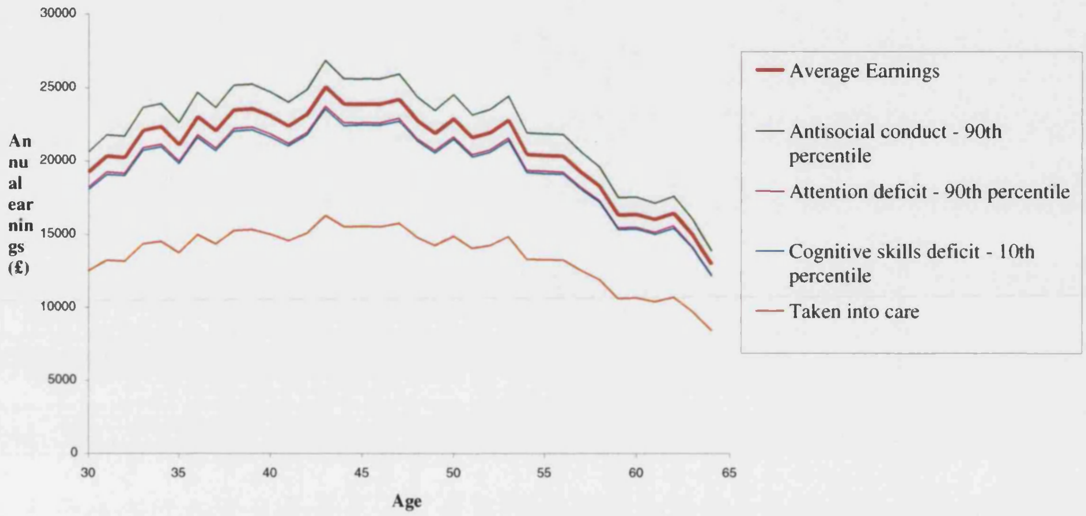
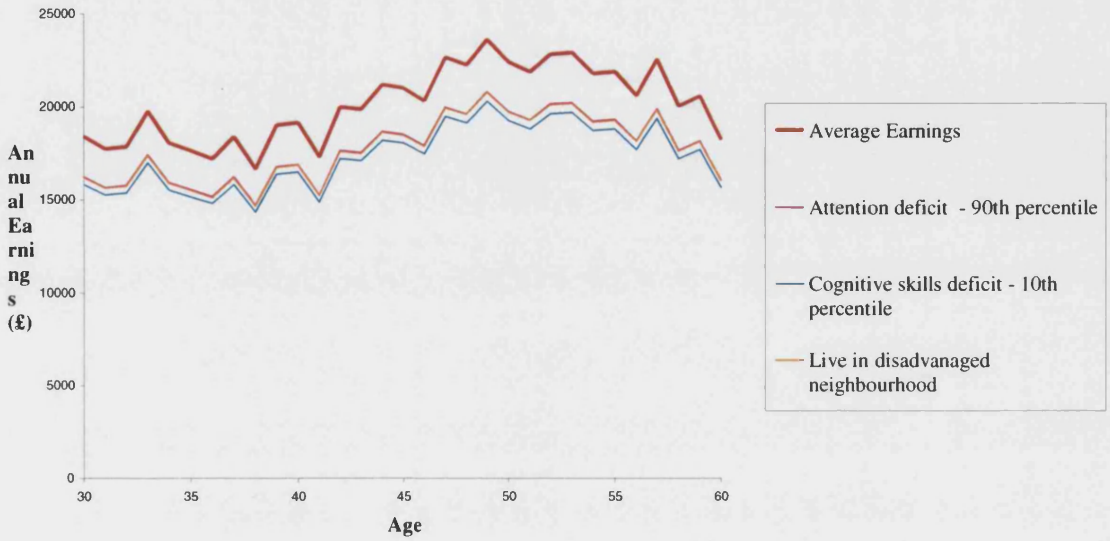


Figure 3.2
Life-cycle projections: female earnings from age 30



Trajectories for those age 10 psychosocial variables that were found to have a statistically significant association with male and female earnings are presented - antisocial conduct (for males only) and attention deficit problems (for males and females). The projections assume that a worker who had the median score at age 10 would, other things equal, would go on to earn average earnings over their remaining working life: as already explained, earnings for male and female workers at specific ages derived from the Quarterly Labour Force Survey. The methods section described how the parameter estimates from the earnings equations are used to generate the earnings trajectory for workers who were positioned at the 90th percentile on each psychosocial indicator of relevance. These projections are also compared with those relating to other sources of childhood disadvantage: experience of being taken into care prior to age 10 (for males); having lived in a relatively disadvantaged neighbourhood at age 10 (for females); and deficits in cognitive attainment (for males and females) with earnings projections for those who were located at the BAS test score median compared with those workers who were positioned at the 10th percentile.

Both figures show a typical inverse U shape pattern as earnings varying with age (Polachek & Siebert, 1993). The exact shape differs for males compared to females reflecting the differing patterns of labour supply for both genders up until retirement. Male earnings peak at around the 45-55 year age range, declining on average up until retirement age at 65. Female earnings are relatively low during the earlier stages of the working life cycle (age 30 to age 40) when women are more likely to select out of paid employment to have children.

Figure 1 shows that, for males, having experienced being taken into care prior to age 10 is associated with a significantly disabling impact in terms of earnings potential. The earnings trajectories associated with more severe attention deficit problems and a deficit in cognitive attainment at age 10 are similar for males, while the projection for those male workers who were located at the 90th percentile on the antisocial conduct measure is significantly above average earnings. For females, the projected loss of income associated with high levels of attention deficit is similar to that projected for those women who lived in relatively disadvantaged neighbourhoods at age 10. The largest projected earnings differential for females is associated with a deficit in cognitive skills observed in late childhood.

Table 3.23 describes these earnings differentials in present value terms: as already explained, age 10 is treated as the index year for discounting purposes with a view to providing a rough indication of the value of discounted income streams looking forward from late childhood.

Table 3.23
Age 10 characteristics and projected loss of earnings over the working life-cycle from age 30 to retirement: present value estimates

	MALES		FEMALES	
	3.5% discount rate	**6.0% discount rate**	**3.5% discount rate**	**6.0% discount rate**
Antisocial conduct: 90th versus 50th percentile	+£15,898	+£7389	–	–
Attention deficit: 90th versus 50th percentile	-£11,951	-£5554	-£22,735	-£4843,
Cognitive attainment: 10th percentile versus 50th percentile	-£13,696	-£6366	-£26990	-£6823
Time in care	-£78,060	-£36,281	–	–
Lived in disadvantaged neighbourhood	–	–	-£23,048	-£4988

Note
Earnings are expressed at 1998/1999 prices.

Earnings projections using two alterative rates of discount are presented - 3.5% and 6.0%. The values in table 3.23 serve to reinforce the main conclusions drawn from Figures 1 and 2. The most significant impact on earnings, at least for male workers, relates to having had an experience of being taken into care prior to age 10: this is associated with a negative earnings differential of around £78,000 in present value terms - over £2000 per year over a 35 year period (using the 3.5% discount rate). The projected costs in terms of lost earnings associated with attention deficit problems are not as significant as this, but are clearly of a similar order of magnitude to those associated with other sources of disadvantage in childhood, including deficits in cognitive attainment. Men and women who were at the 90th percentile on the age 10 attention deficit index are projected to earn respectively around £330 and £750 per year below the average (again using the 3.5% discount rate) over their remaining working lives. The present value of the increased male earnings associated with antisocial conduct at age 10 exceeds the deficit in earnings linked to attention deficit problems - around £450 per year from age 30 to retirement.

3.5 Conclusions

Following on from the analysis of economic attainment in the Cambridge cohort described in chapter 2, this chapter has used multivariate econometric methods to estimate the strength of association between psychosocial development measured at age 10 and various indicators of adult economic attainment at age 30 with a British birth cohort born in 1970. It is again important to stress that the emphasis has been on quantifying the degree of association between the main variables interest with no explicit attempt to fully model any causal linkages over time of relevance to the relationship between psychosocial development and future economic attainment.

This concluding section discusses the main results reported in this chapter in more detail, highlights some of the limitations of the study and outlines some issues of potential relevance to policy arising from the findings.

Childhood anxiety was found to be associated with a greater risk of low-income status and lower earnings for males (though the latter effect was only statistically significant at the 10% level). There was no association between economic status and childhood anxiety among females - Using a widely accepted definition of relative household poverty, childhood anxiety was found to be positively associated with the likelihood of exposure to low income at age 30 among males, with less statistically convincing evidence that men who were more anxious in their late childhood earned less. This is partially consistent with some of the evidence viewed in chapter 1. For example, two of the studies reviewed found male earnings to be positively related to higher self-esteem in childhood and adolescence (a correlate of anxiety and emotional wellbeing more generally). In fact self-esteem was also found to be positively related to earnings in the estimations reported here, independently of childhood anxiety, though the effect was much more convincing for females compared to males. Greater anxiety was found to be unrelated to the likelihood of being economically active at 30 for both sexes. Again, this is partially consistent with the evidence reported in chapter 1. No relationship between childhood anxiety and unemployment at age 33 was found in the 1958 (NCDS) British birth cohort, though evidence from a smaller Finnish study did find a link between extended periods of adult unemployment and childhood emotional distress.

It is important to stress that the *timing* of emotional problems during the course of an individual's development may be of significance: the findings reported here only consider anxiety measured in late childhood. The onset of emotional problems during adolescence, or the persistence of difficulties from childhood into the teenage years, may have the greater potential to harm educational attainment at school and may also be a more robust correlate of adult mental wellbeing (thereby having the greater potential to limit economic progression in later years). The importance of dealing with the timing and trajectory of psychosocial problems during child and adolescent development within future research will be considered again in the concluding chapter.

Attention deficit problems in late childhood were found to be associated with lower economic status at age 30 - More severe attention deficit problems were found to be linked to an elevated risk of low-income status at age 30 and a reduced likelihood of being economically active. These associations are statistically robust, though the predicted probability differentials with respect to both of these age 30 outcomes, when comparing individuals who were located at the 90^{th} and at the median percentiles on the attention deficit index, are not particularly substantial. The relationship between childhood attention deficit problems and earnings is both statistically significant and non-negligible in terms of effect size, particularly with respect to female earnings: the projected loss of income over the working life cycle is comparable to that associated with significant deficits in cognitive skills observed at age 10 and the loss of earnings potential associated with having lived in a relatively deprived neighbourhood.

The significance of the association between attention deficit problems in childhood and lower adult economic attainment is consistent with findings from other studies, most notably those that have shown that children with this type of developmental problem tend to be relatively low achievers at school (see chapter 1). In addition, a severely impaired ability to concentrate on basic tasks can also become a more persistent problem over an individual's life-course (Brassett-Grundy & Butler, 2004b; Faraone et al., 1993): a chronic inability to concentrate on work-related tasks could in principle harm skills accumulation and productivity which, in an efficient labour market, would be penalised. In general there were no significant earnings effects in relation to increasing childhood inattentiveness within any of the other occupational categories for men or women (with the possible exception of males employed in skilled-manual jobs). These findings need to be tempered by the fact that some of the occupational specific regressions were carried out using relatively small samples of workers. Notwithstanding this limitation, the subsequent ordered probit estimations also suggest that workers who had higher attention deficit problems at age 10 were more likely to select into lower skilled and lower waged occupations. Taken together, these results would begin to imply that any lasting damage on future attainment resulting from more severe deficits in attentiveness may be largely transmitted through mediating factors that are more important in affecting selection into higher status and better paid work. Lower academic achievement at school is an obvious example.

Antisocial conduct at age 10 is associated with a higher risk of economic inactivity at age 30 - Thirty-year-olds who were rated as more antisocial either by teachers or by their mothers in late childhood were predicted to have a lower probability of being economically active - though the effect for females is only significant when using and index of behaviour based on maternal ratings. The probability differential of observing this outcome between those whose behaviour was relatively problematic and those who had more typical behavioural patterns at age 10 is not, however, particularly large.

The observed direction of association between antisocial conduct and the likelihood of being economically active is at least consistent with much of the existing evidence that was reviewed in chapter 1, and it perhaps should be of no surprise that an effect of this nature is observed given the known link between child and adolescent conduct problems and the elevated risk of failure at school, future delinquency and other adverse social outcomes. The results reported here are also partly consistent with those described in chapter 2, though in the Cambridge cohort a much stronger link was observed between troublesome behaviour at ages 8-9 and teenage employment outcomes.

Antisocial conduct in late childhood was found to be associated with higher earnings among male employees and for women employed in managerial occupations - While there can be no doubting the persistent behavioural problems and social failings of many antisocial and aggressive children, the evidence presented in this chapter suggests a more complex story than that painted by studies that exclusively focus on future employment participation. Male workers who were relatively badly behaved when they were aged ten were estimated to earn significantly more: comparing those who were at the median and the 90th percentile on this behavioural index yields an earnings premium of around 7%. While in general no corresponding premium is observed for females, there was evidence that female managers who were more badly behaved in late childhood earn more than their occupational peers: again comparing those at the median and the 90th decile on the relevant index, the pay premium is quite substantial - close to 10%. No corresponding positive effect is observed for professional females (the coefficient on the antisocial conduct variable is in fact negative in the professional female regression) though the relatively small sample size casts some doubt on the reliability of this particular finding.

How do these findings compare to existing evidence? US evidence based on data from the NLSY is, on balance, suggestive of a negative association between indicators of antisocial behaviour and social maladjustment during adolescence and adult earnings (Burgess & Propper, 1998; Cawley et al., 2001). There is also some support for these findings using British longitudinal data, specifically those presented by Gregg et al. (1999) using the NCDS. Feinstein, 2000), using the BCS70, reported no significant relationship between childhood antisocial behaviour and hourly wages among males at age 26, though a significant and positive wage effect was observed for females (wages were not studied by occupational status). There may be a number of reasons for the differences in the findings between that study and those reported here. Firstly, both studies consider employment outcomes at a slightly different phase of the working cycle within the 1970 cohort (age 26 versus age 30), while the explanatory variables employed in both studies differ. These factors could contribute to the different results obtained. Moreover, Feinstein considers *hourly wages* at age 26 while the study reported here looked at *weekly earnings*: it is therefore possible that higher earnings at age 30 among male workers who were more antisocial at age 10 (not observed by Feinstein) may be explained by labour supply decisions affecting the number of hours worked for a given wage. This issue may warrant further exploration.

Using data from the National Child Development Study, and also contrary to the findings of this chapter, Bowles et al. (2001a) report a negative and statistically significant association between childhood aggression and future earnings for both males and females, though men in "high status" occupations who were more aggressive in childhood are predicted to earn more than their occupational peers. The study described by Bowles and colleagues used childhood aggression as an instrument for adult personality type in a structural earnings model controlling for IQ, socio-economic status in childhood, schooling attainment and years of education. They do not, however, condition on a more complete set of childhood background variables which may account for the discrepancy between their results and those reported here. It is also unclear from their published work as to the exact content of their childhood aggression measure: it may indeed relate more specifically to aspects of antisocial conduct that are more damaging in terms of future earnings potential.

3.5.1 Study limitations

The findings are subject to a number of limitations and caveats, some of which were also of relevance to the findings from the Cambridge cohort. Chapter 2, for example, discussed some of the limitations associated with drawing conclusions from results derived from longitudinal studies relating to individuals of a specific age: the developmental trajectories of adults born in different periods may vary due to the social, economic and policy-related environments to which they are exposed. These caveats also apply here. Limitations that are more specific to the findings described in this chapter are considered below.

Model specification

There was some evidence of functional form misspecification within the probit estimations relating to the probability of being economically active and exposure to low income status at age 30 for females, and within the ordered probit model of occupational status for males. Subsequently, the results derived from these models should be treated with a degree of caution, though searching for a better fitting functional relationship is not easy without prior theoretical guidance as to what form this might take.

A more general problem relating to specification concerns the possible inter-dependence between explanatory variables. All the models of adult attainment presented in this chapter (and those described in relation to the Cambridge cohort) seek to estimate the effect of each psychosocial characteristic on future attainment after accounting for differences in other age 10 factors that might themselves be jointly related to psychosocial characteristics and economic status at age 30. This inter-dependence may arise because other childhood characteristics have an important casual role to play in affecting future outcomes, either independently or via any influence they have on psychosocial development. However, the converse may also be true: emotional wellbeing and behavioural development could, plausibly, have a role in directly affecting other age 10 explanatory variables of significance for future attainment. Attention deficit problems, for example, could limit cognitive development, and maybe self-esteem, in instances where learning or social interaction are severely affected. The findings presented might therefore be best viewed as lower-bound estimates of the key relationships of interest.

The data

The problem of incomplete data was partly addressed using the multiple imputations methodology where data were missing on covariates included in the econometric estimations. However, all the models of economic attainment at age 30 were only estimated using observations for whom earnings and other employment outcomes could be observed. Those individuals who were either unsuccessfully traced and interviewed (close to 30% of all individuals listed on the BCS70 address data base) or for whom there were missing data on key employment variables, despite inclusion in the age 30 wave of interviewing, were excluded from the model estimations.

It is important to re-emphasise that any non-random loss of information due to non-response is an issue of potential concern for reasons that were outlined in chapter 2.

Hawkes & Plewis (2004), for example, model the probability of non-response at age 33 within the National Child Development Study (NCDS) and find some evidence of a systematic relationship between response failure and case characteristics identified at previous data sweeps. These include poor employment outcomes, lower reading attainment and behavioural problems. The characteristics of the types of birth cohort examined here are therefore likely to change over time as a result non-random loss to follow-up. This in turn could affect the types of longitudinal relationships examined in the current chapter - not least if more socially problematic individuals are more difficult to trace. However, the findings of Hawkes and Plewis at the same time do offer some encouragement given that they also find that the characteristics of responders and non-responders at within the NCDS were found to be not too dissimilar, at least in terms of observable characteristics identified at earlier time points.

There was some inconsistency between the findings based on indices of psychosocial development that used teacher ratings compared to those that were derived from maternal ratings of behaviour and psychological development. The strong positive association between the teacher ratings index of antisocial conduct and male earnings is not observed when using the maternal equivalent, while the strength of relationship between the maternal measures and the other age 30 employment outcomes are generally much weaker. Maternal ratings of behaviour could be more prone to measurement error: teachers may offer a comparatively more dispassionate and accurate assessment of psychosocial development compared to parents. This was in fact the rationale for relying on the teacher ratings of childhood behavioural and psychological development within previous work conducted on the BCS70, as well as in the study described here. Increased measurement error could partly explain the weaker statistical associations that were observed when using the maternal indices: more "noisy" indicators of child development will have a tendency to bias downwards an estimate of the true association between a given explanatory variable and the dependent variable of interest (Dougherty, 2002). However, this cannot not explain why the association between antisocial conduct and low-income status was statistically much stronger (with an opposite direction of effect for males) when using the maternal measures. It is only possible to speculate as to what the reasons for this might be. It could, for example, reflect a correlation between maternal ratings and unobserved heterogeneity with respect to parental characteristics: for example, certain types of mothers (e.g. those with more negative attitudes towards their child which perhaps signalling a lower level of parenting quality) may have a greater tendency to rate a child's behaviour as more problematic. Crucially, these unobservables may also independently influence future attainment.

Choice of employment outcomes

The age 30 outcomes studied in this chapter only provide a "snap-shot" of an individual's economic positioning at age 30, with no account taken of the persistence, or dynamics, of employment patterns and experience of poverty. Hills (2002) highlights the importance of distinguishing between income or employment "blips" that involve transitory periods of economic disadvantage, and exposure to more sustained periods of low income or unemployment. In terms of the "snap shot" measures that were studied here, the risks of exposure were not predicted to be that substantial. However, the story could change when looking at the association between psychosocial development and the presence of more persistent social problems over time. The analysis of employment outcomes in the Cambridge cohort, for example, did find that antisocial boys at ages 8-9 faced a significantly greater chance of extended periods of unemployment, though this was most notably observed during the late teenage years.

Lifecycle projections

The lifecycle projections, which attempt to give a more complete assessment of the long-term impact of psychosocial problems on earnings potential, are subject to a number of limiting assumptions. The proportional effect on income associated with varying severity of psychosocial difficulties in late childhood is assumed to remain constant over the working lifecycle. Whether this assumption is realistic is open to question. Further exploratory work using earnings data based on older birth cohorts might offer some guidance on how realistic an assumption this is.

The present value of future income projections is also sensitive to the choice of discount rate. Choosing an appropriate rate at which to discount the future will always involve a value judgement as to whether private or social inter-temporal preferences over future income streams are considered to be the more appropriate. Government implicitly takes the view that, privately, individuals place too low a weighting on the future consequences of public policy - at least as revealed within financial markets, by currently adopting a social rate of discount that is significantly below market interest rates. Given that the types of projections presented in this chapter could in principle inform policy judgements concerning the long-term impact of publicly funded services for children and adolescents, then a greater reliance on the present value estimates that use the 3.5% social discount rate could be viewed as more appropriate.

3.5.2 Policy issues

The evidence presented in this, and in the previous chapter, suggests that policy makers will have the potential to alter developmental trajectories and economic outcomes experienced in adulthood by changing psycho-developmental trajectories, assuming that effective programmes of intervention exist. In terms of promoting future earnings potential, for example, evidence from the 1970 birth cohort suggests that the largest gains are likely to be associated with the prevention, or at least the limitation, of attention deficit problems. A more detailed discussion of the policy implications arsing from the work presented in this, and the previous chapter, is left to the final concluding chapter. However, two issues of particular note are highlighted here.

Firstly, there is evidence that the damage to future earnings potential associated with attention deficit problems is transmitted through mediating factors that limit the potential for selection into more skilled and better paid jobs. Given that educational attainment is likely to play a key role in this regard, interventions that seek to prevent failure at school among children who are known to have more serious difficulties with attentiveness and concentration could serve to limit a significant source of the individual harm associated with this type of developmental problem. In fact, failure to detect learning difficulties of this nature until the latter stages of a child's schooling may represent an important missed opportunity to alter less favourable learning trajectories thereby limiting the scope for improving the chances of educational success and occupational progression.

Secondly, children prone to antisocial behaviour should not be treated as a homogeneous group. While a substantial body of evidence suggests that some will face a significant risk of exposure to a life-time of persistent behavioural problems and poor employment outcomes, many will also select into a stable pattern of employment, and, on average, may actually be more highly rewarded in terms of how much they earn. As already emphasised in chapter 2, the challenge for policy and professional practice will be to effectively target those badly behaved children who are the more likely to become social and economic failures in the future without some form of corrective intervention. This in turn raises an important question concerning the degree to which public services and practitioners (e.g. teachers, mental health professionals, social workers etc.) are already effective in selecting out those troublesome children who are the more likely to develop life-course persistent problems. These and other related issues are returned to in the concluding chapter. The following chapter considers more closely some of the potential efficiency- and equity-related justifications for targeting pubic resources at children and adolescents who experience psychosocial problems during the course of their development. It also examines the structure of current public service arrangements and recent developments in public policy towards child and adolescent mental health and behavioural development.

4 Service arrangements and policy development

Summary

This chapter considers various potential justifications for public intervention in the psychosocial development of children and adolescents, including arguments concerning the requirement of public policy to meet certain "basic human needs" as well as various efficiency-and equity-related considerations. Public service provision for children with behavioural and emotional problems has been historically patchy. Multi-agency responsibility for service delivery has contributed to this, with limited incentives to engage in the coordinated commissioning and funding of services. Recent policy initiatives have begun to address these perceived inadequacies with an increased commitment to invest public resources in child and adolescent mental health services, as well as the implementation of systemic reforms that encourage the central coordination of service planning and strategic planning across different agencies.

4.1 Introduction

This chapter considers the public policy response towards childhood psychosocial development within a British context, providing a contextual backdrop for the final empirical chapter which considers in detail the costs associated with the delivery of public services targeted at emotional and behavioural problems experienced by children and adolescents. A variety of potential justifications for public intervention in child and adolescent psychosocial development are initially considered. This is followed by an overview of current service arrangements and recent developments in policy.

4.2 Why intervene?

It is argued that a key tenet of social policy in the UK - of which child welfare policy is an important element - is concerned with the enablement of individuals, through government intervention, to be in a position to be able to meet certain basic human needs (Glennerster, 2003; Titmuss, 1958). While there has been some debate as regards what should constitute these fundamental human requirements, Glennerster (2003), using a philosophical framework originally developed by Maslow (1954), describes a hierarchy of basic needs ranging from the physiological (the need for food, shelter and medical care where necessary), the need for safety from physical attack, to need to love and belong, the need for self-esteem and the need for "self-actualisation" - i.e. for individuals to be in a position of autonomy when making decisions that can determine their own life course. Some of these primary objectives are of particular relevance when considering child and adolescent wellbeing: protection against abuse and neglect and the targeted reduction of childhood poverty - a central theme of recent government social policy (Stewart, 2005) - clearly relate to both the physiological and personal safety components of the list of basic needs described above. Preventing or limiting the harm associated with psychosocial problems might also be seen as instrumental in meeting some of these basic needs: interventions that improve child and adolescent mental health and behavioural development might conceivably promote self-esteem. In more extreme circumstances, the detection and treatment of severe emotional problems by relevant agencies could have important safety and life-saving implications if they can effectively reduce the risk of suicidal behaviour or self-harm (Gunnell & Frankel, 1994). Moreover, the provision of resources that enable basic needs to be met may also subsequently help to promote more favourable developmental pathways: chapter 1, for example, cited evidence of a link between poverty and abuse and neglect and the incidence of behavioural and emotional problems experienced during childhood and adolescence.

Beyond a needs-based justification for public intervention, there are also likely to be some important efficiency - and equity-related factors that would provide some justification for public agencies taking an active interest in child and adolescent psychosocial development. Three areas of concern are identified here: informational failures within the family; public externality; and the equity of economic outcomes that partly depend on the distribution of personal endowments acquired at birth and accumulated through child and adolescent development.

4.2.1 Psychosocial outcomes as informational failures

In the economic model of the family as a decision making unit (Becker & Tomes, 1979; Leibowitz, 1974) parents seek to make utility maximising choices over the allocation of time and money. Levels of parental investment in the social, educational and health-related development of children are therefore seen to be primarily driven by the marginal costs and benefits associated with alternative resource allocations: household income, input prices (including the opportunity cost of time and the purchase of goods and services), as well as the relative value that parents place on the current and future wellbeing of their offspring compared to other utility enhancing pursuits, are all factors that will enter into the familial cost-benefit equation. Chapter 1 has already suggested that this is a useful positive framework of analysis within which to consider the linkage between childhood psychosocial development and future attainment, not least given the extensive body of evidence pointing to the importance of parental inputs and heritable characteristics in influencing behavioural and emotional development. However, the economic model of the family also carries some important normative implications, most notably that parents are in the best position to judge what is best for themselves and for their own children. Moreover, if the preferences and values of parents are viewed as entirely sovereign, then it becomes more difficult to justify any external involvement or interference from public agencies.

This non-interventionist approach becomes somewhat less difficult to justify when accepting that, in many situations, parents are not necessarily engaged in a process of *informed* decision-making with respect to the upbringing of their children. Public services could therefore be seen as playing a crucial "agency" role, in terms of guiding parents towards making the "right" choices, at least in terms of the allocative decisions they might otherwise have made had they been more fully informed. This should not be confused with *paternalistic* motivations underpinning the statutory duty of social welfare agencies to intervene is cases where parents or carers engage in patterns of behaviour that are likely to be systematically harmful to the immediate and long-term wellbeing of a child: neglect, and physical and sexual abuse are obvious examples.

In the context of psychosocial development there are a number of examples of policy initiatives that are suggestive of public services acting as informational agents. For example, many of the pre-school programmes within the government's recently implemented Sure Start initiative (Hall, 2000) are concerned with promoting better parenting skills with a view to encouraging improved behavioural and emotional outcomes at a later age. While these types of early intervention seek to educate and inform on aspects of parenting with a view to preventing future problems, other types of initiatives seek to guide parents towards a better approach to managing children who have already developed problematic behavioural tendencies - most notably these would include parenting programmes that specifically target persistent antisocial conduct (Scott, 1998; Woolfenden et al., 2002).

Psychiatrists, paediatricians, psychologists, social workers and other practitioners operating within the health and social welfare system also take on an important agency role, offering guidance and expertise to parents on what they believe to be the best options available for dealing with a specific type of psycho-developmental problem.[1] Government itself can seek to reinforce the agency role of public services through directives and legislation. The Special Educational Needs and Disabilities Act 2001 (Department for Education and Employment, 2001), for example, places a statutory requirement upon local education authorities to provide information and advice to parents on available options for children identified with special educational needs, including those arising from behavioural and emotional difficulties.

4.2.2 Psychosocial development and externality

Behavioural problems not only impose significant costs on the immediate family (Knapp et al., 1999), but will also impose wider "externalities", providing a further case for public intervention. Classroom disruption, bullying, property damage and theft of property are examples of some of the harmful externalising behaviours linked to behavioural problems in childhood. For a sub-group of children, antisocial tendencies will continue to persist through adolescence and into adulthood, with classroom disruption and bullying superseded by more socially harmful behaviours. Problem drinking and drug use, for example, are known to carry significant external costs - including costs imposed on health and social welfare agencies, as well as the costs linked to drug and alcohol - related crime (Heien & Pittman, 1993; McDonnell & Maynard, 1985). Healey et al. (1998), for example, have reported an annual median cost of drug-related crime of over £1700 (mean £8000 plus) within a British sample of problem drug users (1997/1998 prices). Aggression and violent conduct can also be a

[1] The agency role of the physician has been widely discussed within the health economics literature (Arrow, 1963; Folland et al., 2001).

characteristic feature of a life-course persistent antisocial personality. Atkinson et al. (2005) estimate the cost of injuries and psychological distress arising from a "statistical" assault to be in excess of £5000 per household, with the costs associated with more serious violence (e.g. a serious wounding) increasing to more than £35,000 (2003/2004 prices). Scott et al. (2001) provide more direct evidence of the sizeable longer-term external costs associated with childhood antisocial conduct, the most significant element arising from costs to the criminal justice system - (close to £3000 per year, undiscounted, over an 18 year period for a child with a behavioural disorder; 2000/2001 prices).

A major impetus behind interventions that seek to prevent, or at least ameliorate, disruptive behaviour are likely to relate to the desire to limit these wider social harms. Statutory powers to implement exclusion from mainstream schools and the direct involvement of youth justice services where delinquent behaviour has become a persistent issue could be seen as more direct policy responses to the external costs arising from psychosocial problems. Parenting programmes, drug treatments for hyperactivity or behavioural therapies delivered by publicly funded child and adolescent mental health services may also have an important role in limiting these social costs, assuming they are found to be an effective means of altering adverse developmental pathways. The nature and evidence regarding the effectiveness of some of these interventions are discussed in more detail in the concluding chapter.

4.2.3 Public intervention, equity and psychosocial development

"Individuals' choice sets are determined not only by the social and economic barriers they face but by their initial resources or endowments, which include their natural abilities and the resources they acquire through inheritance, gifts, family background, education prior to the age of majority, etc. Equalisation of choice sets may require judicious manipulation of economic and other barriers in order to advantage the less well endowed." (Le Grand, 1991; pages 92-93).

The distribution of income and wealth across society has always been an issue of major importance within British economic and social policy. Le Grand et al. (1992) identify both inheritance and what they call "life-time accumulation" as major determinants of the distribution of economic resources. This idea relates closely to the model of adult economic status developed by Becker & Tomes, (1979) and others referred to in chapter 1. Individuals may inherit endowments in the form of inter-generational resource transfers, which might then be saved and converted at some later date into future income flows. Other inherited endowments, of a non-financial nature, include the inherent "abilities" of an individual, either passed on genetically or acquired through parental or public investments in health, cognitive, educational, and psychosocial development. These endowments may themselves have a direct bearing on future economic status. This was, to some extent, empirically illustrated in chapter 3: British adults who had a less socially disadvantaged childhood, who were more cognitively skilled at age 10, and who seemed to possess personal characteristics linked to childhood aggression ended up, on average, earning a greater income compared to their peers. Moreover, depleted levels of endowments will also affect an individual's ability to accumulate other forms of personal capital through time, including that relating to educational attainment or work-related skills accumulation. This thesis has already made reference to the fact that children with significant attention deficit problems have a much lower chance of going on to achieve more advanced levels of educational attainment (see evidence cited in chapter 1). This in turn would seem to limit their future earnings capability later in life, as suggested by the empirical findings presented in chapters 2 and 3.

On equity grounds, to what extent should disparities in economic status arising directly from differences in individual endowments - including those relating to psychosocial development - be viewed either as socially acceptable, or worthy of correction through public intervention? Le Grand (1991) makes a convincing case for judging the fairness of an outcome, or a distribution, according to the nature of the process that brought it about and, crucially, the extent to which observed outcomes are the consequence of well informed choices and decisions made by individuals. It would seem reasonable to suggest that personal endowments accumulated from birth and through childhood and adolescence are acquired largely as a result of factors beyond an individual's control - i.e. inherited genetic characteristics and exposure to specific familial circumstances and social environments. The allocation of public resources towards interventions that seek to promote more favourable developmental trajectories could therefore be seen as a justifiable means of correcting these inherent inequities.

4.3 Psychosocial development in childhood and adolescence: services and policy development

4.3.1 Current structure of services for children with emotional and behavioural problems

A variety of agencies in the UK deal directly with children and adolescents experiencing psychosocial difficulties. The National Health Service (NHS), local authority education and social services departments, youth justice services and the police represent those agencies are likely to have the more significant level of involvement (Knapp et al., 1999; Ford et al., 2003). Children with emotional or behavioural difficulties might be seen by a variety of NHS professionals, depending on the nature and severity of the problems experienced. In the British Child and Adolescent Mental Health Surveys, for example, the parents of children included in by the surveys reported contacts with primary care services, child and mental health services (including visits to see child psychiatrists and psychologists) as well as contacts with paediatricians, school-based nursing staff and other children's health services (Ford et al., 2003). Local authorities typically offer professional input from of educational psychologists, social workers, and youth justice workers (the latter particularly for adolescents involved in persistent delinquent behaviour). Teachers and other school support staff also play a significant role in terms of identifying special educational needs and other difficulties at school, providing additional help where emotional or behavioural problems are interfering with learning, and meeting with parents to discuss problems. The following chapter will show that teaching inputs are in fact likely to represent a major component of the public cost of targeting psychosocial problems.

A useful conceptual model of NHS and other services for children with behavioural and emotional problems has been developed by the Health Advisory Service (Audit Commission, 1999; Ford et al., 2005; The NHS Health Advisory Service, 1995). This descriptive framework breaks down services into four separate tiers of increasing specialisation:

Tier 1

- General practitioners
- Health visitors
- Residential social workers
- Youth justice workers
- School nurses
- Teachers

These are non-specialist staff who might be in a position to target the early development of problems, to provide less specialist forms of treatment where difficulties are not too severe as well as pursuing activities that promote behavioural development or mental wellbeing.

Tier 2

- Clinical child psychologists
- Educational psychologists
- Paediatricians
- Community psychiatric nursing staff or nursing specialists
- Child psychiatrists

At this level of specialisation, staff will typically seek to identify more severe or complex problems which may trigger treatment at this level, or referral on to an increased level of specialisation. Consultation will take place with families and professionals from services located in tier 1.

Tier 3

- Social workers
- Clinical psychologists
- Community psychiatric nurses
- Child and adolescent psychiatrists
- Art, music, drama therapists
- Child psychotherapists
- Occupational therapists

These are specialist services for the children and adolescents with more severe, persistent and complex psychiatric disorders. They will typically engage in treatment and, where necessary, referral to tier 4 services. They might also provide consultation and training for professionals in tiers 1 and 2.

Tier 4

- Highly specialised outpatient teams
- Day hospitals
- Inpatient units

These are much less frequently used services for those with the most severe and complex service needs. For example, inpatient units will typically admit children and adolescents who have a severe mental illness or who represent a significant suicide risk.

In addition to those services listed under the various tiers of specialisation described above, some children may also be referred by their local educational authority to a special school or pupil referral unit. This can only result after a statutory assessment (or "statementing"), involving teaching staff, parents and the local authority, of whether behavioural or emotional problems have led to the development of any special educational needs. Around 18% of special needs within primary school-aged children and close to 30% of special needs identified among children and adolescents of secondary school age, are associated directly with "behaviour, emotional and social difficulties" (Department for Education and Skills, 2004c).

4.3.2 Policy and service development

Historically, the immediate and longer-term wellbeing of children - in terms of their education, health and the protection from abuse and neglect - has always been a significant element within the British social policy agenda (Daniel & Ivatts, 1998; Glennerster, 2000). The 1944 Education Act is still the corner stone of modern educational services – including provision for universally available free education up to the age of 16, the creation of separate primary and secondary schooling systems and the introduction of a statutory school leaving age. The introduction of the NHS in 1946 widened access to children's maternity and children's health care with all services delivered free at the point of use. Prior to this, around 50% of families in Britain were excluded from the pre-existing National Health Insurance scheme with adverse implications for child and adolescent health and physical development – particularly in more deprived parts of the country (Daniel & Ivatts, 1998). The 1944 Education Act is still the corner stone of modern educational services - including provision for universally available free education up to the age of 16, the creation of separate primary and secondary schooling systems and the introduction of a statutory school leaving age. The introduction of the NHS in 1946 widened access to children's maternity and children's health care with all services delivered free at the point of use. Prior to this, around 50% of families in Britain were excluded from the pre-existing National Health Insurance scheme with adverse implications for child and adolescent health and physical development -particularly in more deprived parts of the country (Daniel & Ivatts, 1998). Paediatric, maternity and community health services for children are now an established part of the modern-day NHS. The 1948 Children's Act was the first major piece of post-war government legislation specifically concerned with the welfare of children at risk or without parents. In fact, up to 1989, there have been six major pieces of child legislation in England and Wales largely dealing with the welfare of at risk children, usually in the aftermath of widely publicised incidents of physical and sexual abuse. More recently the 2004 Children's Act (Department for Education and Skills, 2004) was passed by parliament.

Services targeted at children and adolescents' psychosocial problems have also developed through time as part of the British system of health and local authority publicly funded services (an overview of the existing structure of these services was described in the previous section). However, until recently, publicly funded services for children and adolescents experiencing psychosocial difficulties have, arguably, been relatively low on the health and social welfare policy agenda. A House of Commons Health Committee report from 1997 (Health Committee, 1997) into child and adolescent mental health services concluded that public policy towards mental health and behavioural problems in children and adolescents had been, up to that point, fragmented. The Health Committee report quotes from a 1995 Health Advisory Service Report - one of the first major policy documents recognising a perceived inadequacy in the state of child and adolescent mental health service arrangements:

"Mental health services of children and adolescents are, essentially, unplanned and historically determined. Their distribution is patchy and they are very variable in quality and composition. The work they do deems unrelated in strength or diversity to systematically considered local need" (The NHS Health Advisory Service, 1995; page xxix).

An inquiry into the state of mental health services for children and adolescents carried out by a major mental health charity also described a service that was seriously under-resourced and significantly fragmented in terms of a lack of coordination or strategic planning across the various public agencies responsible for provision (The Mental Health Foundation, 1999). Consultation with service professionals revealed that access to services was largely dependent on where a family lived, and whether their general practitioner was knowledgeable on matters concerning the mental wellbeing and behavioural development of children and adolescents.

A major independent review by the Audit Commission (1999) of child and adolescent mental health services in England and Wales found little evidence of any systematic relationship between geographical indicators of the need for child and adolescent mental health services within given localities and per capita expenditure by health authorities on these types of services. While there was evidence of improvement in the policy response and commissioning arrangements at the time of the report, less than half of all health authorities were reported to have a written policy on securing services for children with mental health and behavioural problems, with only 43% of authorities having a specific commissioning plan in place. A lack of coordination across health and local authority services was also identified as a major failing of existing arrangements.

A variety of factors are likely to lie behind the historical lack of a concerted policy response toward the psychosocial development of childhood. The 1997 House of Commons Health Committee report referred to earlier highlighted a lack of recognition, even ignorance, over the degree to which mental health and behavioural problems in childhood are worthy of public concern:

"There has been a low level of awareness of mental health problems, disorders and illnesses in children and adolescents coupled with the belief that a child will simply "grow out of it." (Health Committee, 1997; page xxix).

If true, this will have naturally inhibited the development of a concerted policy response, not least under circumstances whereby higher profile and more politically sensitive health and social problems are in a stronger position to compete for scarce public resources.

In addition, the involvement of multiple agencies in dealing with the varying educational and social needs arising from psychosocial problems has almost certainly contributed to the absence of any strategic development of services. Perennial budgetary pressures, combined with differing organisational objectives, are notorious for creating incentives for cost-shifting across agencies, as well as constructing barriers against a multi-agency based strategic co-ordination of service provision (Audit & Commission, 1986; Fernández & Forder, 2002; Lewis, 2001). Within child and adolescent mental health services, adverse organisational incentives have, in the past, been evident in a reduction of local authority input into service provision (particularly the withdrawal of social workers and educational psychologists working with children with mental health and behavioural difficulties) without any compensatory increase in service provision by the NHS (Health Committee, 1997).

Publicly expressed concern over the state of services for children and adolescents, a change of government in 1997, and growing awareness of the prevalence of child and adolescent psychopathology and its long-term implications all undoubtedly played some part in promoting a greater awareness and commitment to the improved financing and development of child and adolescent mental health services from the late 1990s. In 2001 the Department for Education and Skills, as part of its *Excellence in Schools* initiative, published a guidance document with a view to helping "...teachers and others, working alongside mental health professionals, to promote children's mental health and to intervene effectively with hose children experiencing problems" (Department for Education and Skills, 2001); page iv). Around the same time, the Secretary of State for Health announced a new National Service Framework (NSF) for Children, following those already initiated in areas such as coronary health and adult mental health services. The NSF was aimed at developing national standards for services relating to the health-related wellbeing of children with a view to improving both service quality and reducing variability in access. The NSF for Children was concerned with health and social care provision for children in general, as well as the interface between health and educational services, including the continued development of child and adolescent mental health services. The final NSF document - outlining a ten-year plan for the development of children's health services in England - was recently published in 2004 (Department for Education and Skills and Department of Health, 2004). Similar developments in policy discourse have also taken place in Scotland and Wales (Public Health Institute of Scotland, 2003; The National Assembly for Wales, 2001).

The Green Paper *Every Child Matters* (HM Treasury, 2003b), announced by the Chief Secretary to the Treasury in 2003, was a direct response to the independent and statutory inquiry into the death of Victoria Climbié (Laming, 2003). While it related exclusively to policy development in England, the devolved governments in both Wales and Scotland also took an active interest in the Green Paper's development with a view to adapting areas of policy development arising from recommendations experiences taking shape in England. As regards policy towards psychosocial development of children and adolescents, the Green Paper contains two important advances. Firstly, there appeared to be a move towards a more holistic approach to developing services targeted at child welfare. The development of services and the implementation of organisational reform as a means of improving protection against abuse and neglect is still of central importance in *Every Child Matters*. However, it also explicitly moves beyond the exclusive consideration of those children who are at immediate risk of abuse and neglect, and considers a broader set of policy-related outcomes, including those of relevance to psychosocial development: reductions in antisocial behaviour and educational failure and improving access to child and adolescent mental health are noticeable examples. The Green Paper subsequently made an explicit commitment to increase annual investments in child and adolescent mental health services over a three-year period - recognition of the concerns about resourcing of these services raised previously by the Audit Commission, the Mental Health Foundation and others.

A second advancement with the Green Paper was the commitment to improving multi-agency coordination in the development of services – largely a response to the systemic deficiencies identified in the inquiry into the circumstances surrounding the death of Victoria Climbié. A number of new initiatives were highlighted, including the appointment of lead professionals for children known to be in contact with more than one agency (of particular relevance to many children with serious behavioural or emotional difficulties) and the development of Children's Trusts covering educational services, social services and child and adolescent mental health services delivered by the NHS. Again, this would appear to respond to publicly expressed concerns regarding the historically fragmented and uncoordinated approach to planning services. Many of the organisational reforms proposed in the Green Paper have been subsequently incorporated in to the 2004 Children's Act (Department for Education and Skills, 2004).

As well as major policy documents and legislation, the government has also implemented specific policies or programmes of investment in service developments that are either concerned with problem prevention or the promotion of favourable developmental outcomes, as well as the specific targeting of children who have already developed significant behavioural or emotional problems. The Child and Adolescent Mental Health Service Innovation Grant is an example. This was awarded to 24 specific projects dealing with early intervention and prevention, improving the mental health of children looked after under statutory care arrangements, the prevention of family breakdown and reductions in school exclusions (Kurtz, 2003). The Sure Start initiative, a programme targeted at pre-school children and families living in disadvantaged areas, has also been a major development. This began in 1999 as part of a more general policy programme aimed at preventing social exclusion (Hall, 2000). It involved the funding of locally provided programmes partly aimed at improving the social, emotional and learning development of children from an early age (Kurtz, 2003). Five hundred programmes were operational by 2004 covering a third of children identified as living in socially disadvantaged families. Elsewhere, the Home Office implemented its "On Track" initiative involving the allocation of resources (£250 million of government funding) to 24 pilot projects targeting children identified as being at high risk of developing into career delinquents (Johnston, 2000).

The adoption of Sure Start and related initiatives marks an increasing level of awareness regarding the significance of the school years in terms of long-term psychosocial development and the need for an increasing recognition that intervention in family relationships may reduce the risk of adverse social outcomes further down the line (Harker & Kendall, 2003). Those who argue for this approach point to a body of evidence linking the promotion of better parenting to beneficial long-term outcomes (e.g. Aronen & Kurkela, 1996). Parenting programmes have also been advocated for the families of older children who have already developed severe behavioural problems – particularly where antisocial conduct is the main problem of concern (Scott, 1998; Webster-Stratton & Hammond, 1997). As noted earlier in this chapter, the Sure Start approach, and the development of parent-focussed interventions more generally, might generally be viewed as a means of addressing some of the informational failures likely to be associated with parental decision-making and child-upbringing during the pre-school years. It also represents a significant break with previous attitudes towards public policy and child welfare. Daniel & Ivatts (1998) suggest that British social policy towards children has, in the past, been largely driven by a "liberal standard" whereby external intervention in family affairs has generally been limited to extreme cases of neglect and abuse. The active promotion by government of programmes that seek to educate and train families on approaches to better parenting is a clear break with this tradition.

4.4 Concluding remarks

The public financing and delivery of services that target emotional and behavioural problems in childhood and adolescence are potentially justifiable on a number of grounds. Correction for both informational failures within the family and the public externalities associated with the development of persistent antisocial conduct and hyperactivity were both cited as examples. The allocation of scarce educational, NHS and other public resources towards children experiencing psychosocial difficulties might also be regarded as a means of correcting for inequalities in natural endowments acquired from birth and through childhood and adolescence, and the pursuit of a more equitable distribution of educational attainment, skills accumulation and earnings potential. The findings of chapters 2 and 3 suggest that correcting for the impact of attention deficit problems might be particularly beneficial in this regard. The delivery of public services targeting psychosocial problems requires a commitment to allocating scarce resources away from other socially beneficial activities. Given the intractable problem of scarcity, this will inevitably involve opportunity costs to government and society more generally. The costs of intervention are explored in more detail in the following chapter.

5 The costs of intervention

Summary

Data from a follow-up study of children who were included in the British Child and Adolescent Mental Health Surveys are used to estimate the costs to the health and education systems arising from emotional and behavioural difficulties in childhood and adolescence. The study estimates mean costs over a three year period for children and adolescents identified as having an emotional or behavioural disorder. By an order of magnitude, the education system is estimated to incur the greatest cost, including the cost of special education resource provision and teaching time within a mainstream school environment. Multivariate statistical methods are also used to examine the variation in mental health and education service costs across children and adolescents who had some level of contact with services. While sensitive to the effect of "outliers", the findings suggest that services are, to some extent, responsive to increasing levels of social and educational impairment.

5.1 Introduction

Using service utilisation data from the British Child and Adolescent Mental Health Surveys (Meltzer et al., 2000), this chapter presents new estimates of the costs of health care and education resource by children and adolescents with an emotional or behavioural disorder. Unit cost estimates are combined with parental reported information on the volume of resources consumed by a sample of 5-15 year olds with a view to estimating the relative cost impacts associated with the use of health and education services specifically in response to behavioural and emotional difficulties. Because the service utilisation data were collected at the individual level, there is also scope for examining in more detail, using multivariate statistical methods, the reasons behind the wide variations in resource use and costs observed across children and adolescents covered by the survey who had some level of service involvement.

Specific attention is paid to estimating the average (mean) costs of health services and educational resources targeted at children with more commonly occurring medically defined child and adolescent mental disorders, namely conduct disorders, hyperkinetic disorders and emotional disorders. A description of the main characteristics of these diagnostic groupings - based on the World Health Organisation's ICD-10 mental and behavioural disorder classificatory system - is provided in figure 5.1 (World Health Organisation, 1993).

Separate analyses of individual variations in costs are restricted to mental health service contacts and educational resources, and include all children who were reported to have had received some level of response from these types of services as a direct result of emotional or behavioural problems they were experiencing, irrespective of whether the problems they were experiencing were of sufficient type or severity to be medically classified as a mental disorder. This provided larger estimation samples and also introduced greater variation to the data in terms of individual level costs, measures of problem severity and other background characteristics. These analyses are primarily concerned with examining the extent to which to which costs vary with the level of social and educational impairment arising from behavioural or emotional difficulties, and thereby providing some indication of the extent to which resources are targeted on children and adolescents in greater "need" of intervention.

Figure 5.1

These descriptions are derived from: World Health Organisation (1999), *Pocket Guide to the ICD-10 Classification of Mental Disorders*, Churchill Livingston, Edinburgh.

Hyperkinetic disorders (including hyperkinesis and other hyperkinetic disorders)

The definite presence of abnormal levels of inattention, hyperactivity and impulsivity that are pervasive across situations and persistent over time, and which are not caused by other disorders such as autism or affective disorders.

- Inattention: e.g. - difficulty concentrating on tasks at school, easily distracted by external stimuli.
- Hyperactivity: e.g.- often fidgets with hands or feet or squirms in seat, often runs about or climbs excessively in situations which it is inappropriate.
- Impulsivity: e.g. - often interrupts or intrudes on others, often blurts out answers before questions have been completed.

Conduct disorders (oppositional defiant disorder, conduct disorder, unsocialised conduct disorder, socialised conduct disorder, other conduct disorder)

A repetitive and persistent pattern of behaviour in which the basic rights of others or major age-appropriate norms and rules are violated, lasting for at least 6 months. Examples of behavioural characteristics are:

- Unusually frequent temper tantrums
- Actively refuses adults requests or defies rules
- Often spiteful of vindictive
- Often tells lies to avoid obligations or to obtain favours
- Frequently initiates physical fights
- Destroys other people's belongings
- Exhibits physical cruelty to animals

Emotional disorders (separation anxiety, specific phobia, social phobia, panic, agoraphobia, post traumatic stress disorder, obsessive compulsive disorder, generalise anxiety disorder, other anxiety disorder, depressive episode, other depressive episode)

- Mainly exaggerations of normal developmental trends rather than phenomena that are qualitatively abnormal in themselves. They include mood (depressive)-related disorders and those relating to childhood anxiety.

5.2 *Data and cost measurement*

5.2.1 *The British Child and Adolescent Mental Health Surveys*[1]

The British Child and Adolescent Mental Health Surveys follow on from other government-sponsored epidemiological surveys of mental disorders within the British population. There have in fact been five previous surveys concerned with the adult population aged 16-64, all carried out by the Office of National Statistics (ONS). The Child and Adolescent Surveys, which focus on the 5-15 age group, and again designed and conducted by the ONS, build on existing epidemiological research into the prevalence of psychiatric disorder within younger age groups. These include studies relating to specific disorders (e.g. hyperactivity/attention deficit problems - (Taylor et al., 1991) and more general surveys conducted on samples of children drawn from specific localities within the UK (the Isle of Wight, Rutter, 1989; Rutter et al., 1976; Oxford and Edinburgh, Platt et al. 1988; and Inner London, Rutter et al. 1975). The ONS surveys had a number of aims, including the measurement of the prevalence of mental disorder within the child and adolescent population in Britain, an assessment of the impact on those children and adolescents affected (e.g. on school attainment, keeping friendships and participating in leisure activities), an assessment of the burden placed on others (e.g. teachers and parents) and exploration into levels and patterns of service use within the sample (Meltzer et al., 2000).

The main "baseline" survey (time 1) was carried out in 1999 and was supplemented by two follow-up surveys conducted at 20 months (time 2) and at three years post-baseline

[1] The main report of the British Child and Adolescent Mental Health Surveys can be found in H. Meltzer et al. (2000).

(time 3). Using centralised records held by the Child Benefit Centre as a sampling frame, a representative sample of 5-15 year olds were initially surveyed at baseline. All children were drawn from postal code sectors in England, Wales and Scotland covering 90% of all British children (families with no recorded post code or whose post code was under revision were excluded from the sampling frame for the baseline survey). Four hundred and seventy-five postal sectors were sampled with the probability of being selected related to postal sector size. Stratification was carried out by socio-economic grouping and regional health authority. Thirty children aged 5-15 from each postal sector were sampled giving a potential achievable sample of 14,250. In total 12,529 individuals were considered to be eligible for inclusion: reasons for exclusion included non-traceability, failure to satisfy the 5-15 age criterion, death and the child being in foster care. Information was finally collected on 10,438 children and adolescents - 83% of those considered to be eligible. The survey involved interviews with parents, children (those aged 11-15) and the use of teacher reports.

The examination of costs described in this chapter builds on the analysis of parental-reported service use over two follow-up periods (amounting to three years) for a selected sample of 2461 children/adolescents covered by the initial baseline survey who were successfully followed up across all time points (Ford et al., 2005). All 929 children who were identified as having a psychiatric disorder at baseline and a 1 in 3 sample of those without any disorder (3063 children) were followed-up. Parents were subsequently mailed a postal questionnaire with several attempts to engage persistent non-respondents via telephone. In total 2932 completed the questionnaire - 73.4% of those eligible. The majority of non-responders were contact failures rather than refusals. The time 2 postal questionnaire served partly as an initial screening device enabling the identification of those parents who reported that they had contacted a service for help with any behavioural or emotional difficulties experienced by their child.

Those parents who indicated that they had been in contact with frontline professionals (e.g. primary health care, teaching staff) or specialised services (e.g. child and adolescent mental health services, specialist education services) were invited to take part in a semi-structured telephone interview asking for more detail concerning contact with services, including frequency of use over the period since the baseline survey was conducted. Large numbers of parents reported meeting with teachers in response to emotional and behavioural problems. Limited research resources within the follow-up surveys therefore prevented telephone interviews with all parents reporting contact with frontline education professionals. Telephone interviewing was therefore based on the following selection criteria:

- All parents who reported contact with specialist services for emotional and behavioural difficulties (n=296).

- All parents reporting contact with primary care services since time 1 but who were not included in the above (n=61).

- All parents reporting that their child had definite problems at time 1 and time 2 according to an index of psychopathology but who had not sought professional help for emotional and behavioural difficulties (n=38).

- All parents reporting contact with teachers for emotional and behavioural difficulties who had children identified as having a psychiatric disorder at time 1 (n=55).

- Twenty-five percent of parents only reporting contact with teachers in response to emotional and behavioural difficulties with children who did NOT have a psychiatric disorder at time 1 (n=40)

- All parents who reported contacting "other professionals" for emotional and behavioural difficulties but not included already (n=9).

Four-hundred-and-thirty-nine parents were successfully interviewed via telephone at the first follow-up representing 88% of those selected based on the above criteria. The most frequent reason for non-response was failure to contact rather than active refusal to participate (Ford et al., 2003). No telephone interviews were conducted with parents who reported no contact with services in the postal survey.

The second (time 3) follow-up was a repeat of the initial baseline survey (Meltzer et al., 2003) and aimed to recruit all 5-15-year-olds whose parents had participated at the time 2 follow-up postal survey. In total 2461 children were successfully followed-up (a response rate of 89% of those eligible for participation – the vast majority of non-response was again down to contact failure). Telephone interviews regarding service use over the one year period between time 2 and time 3 were carried out on 403 parents (a response rate of 85%). Those successfully interviewed included:

- All parents reporting contact with specialist services over the preceding year in response to emotional or behavioural difficulties (n=237).

- All parents who reported meeting with teachers and primary care services over the preceding year in response to a child's behavioural and emotional difficulties - excluding those covered by the above (n=174).

- All parents reporting that their child had definite problems at time 1 and time 3 based on an index of psychopathology who did not report any service contacts (n=63).

Table 5.1 summarises the characteristics of the follow-up sample and the complete sample who were surveyed at baseline.

Table 5.1
Sample characteristics

		Participated in both follow-ups (n=2461)	Complete baseline survey sample (n=10438)
Mean age		9.9	9.9
Male (%)		51.6	49.9
Mean reading quotient		104.7	103.7
Emotional disorder (%)		9.3	4.3
Conduct disorder (%)		8.9	4.7
Hyperkinetic disorder (%)		2.8	1.3
	White	94.3	91.4
Ethnicity (%)	Afro-Caribbean	1.7	2.4
	Asian	2.1	3.9
	Other	1.9	2.4
Family type	Traditional	70.4	66.5
(%)	Lone parent	18.8	22.3
	Reconstituted	10.7	11.2
Weekly parental income<£199 per week (%)		19.3	23.7
Homeowners (%)		74.8	67.8
Non-manual occupation (head of household; %)		54.8	51.1
Mean age of mother at birth		28.2	27.6

Notes
Reading test quotient measured using British Ability Scale Reading Test

5.2.2 *Measurement of service use*

The data on service contacts were constructed by combining information reported in the telephone interviews (the only source of information on the volume of use among those parents who reported service contacts) with information on whether or not services had been used as reported in the time 2 mail questionnaire and main time 3 survey interviews (Ford et al., 2005). Parents who were asked equivalent questions on contact with services (i.e. whether or not they had made any contact) in the context of both the telephone interviews and in the time 2 postal questionnaires or main time 3 survey interview generally gave responses that were reasonably consistent (Ford et al., 2003). This offers some reassurance as to the reliability of the service use measures.

All questionnaires and interviews asked parents to detail whether they had contacted services over a defined retrospective period - in practice a two-year period at the first follow-up and a one-year retrospective period at the second follow-up interview. The telephone interviews also asked for details regarding the frequency and the usual length of each contact made. The semi-structured telephone interviews were developed by the principle investigator of service utilisation within the follow-up sample (Tamsin Ford, Institute of Psychiatry), and contained questions on service contacts drawn from existing research tools (Ascher et al., 1996; Beecham & Knapp, 2001; Stiffman et al., 2000). All cost estimations are carried out in relation to total service contacts for the entire three year follow-up period based on the contact data collected retrospectively at each follow-up survey.

The questions regarding service use asked parents to indicate contacts that were made specifically in response to concerns about a child's "emotions, behaviour and concentration". However, during the telephone interviews it was found that parents were also indicating professional contacts that were not strictly related to these kinds of difficulty. The main service use investigators have therefore used interview responses to grade each reported service contact on a 0-4 scale of relevance to emotional and behavioural problems (0= no relevance): only those contacts graded at 3 and 4 were included as an assumed response to emotional-behavioural difficulties (for example, contacts with paediatricians in the management of epilepsy were excluded, unless discussions related to mental health or behavioural problems). Service use and cost estimations should therefore be seen as an approximation of the volume of resource use and costs directly attributable to emotional and behavioural difficulties experienced over a three year period.

Parents were questioned about contact with: primary health care services, children's health services, mental health services; paediatric services; teachers (including the provision of additional help to children at school and parent-teacher meetings), specialist education professionals; social services; the police and youth justice services; private professionals and voluntary sector agencies. The cost estimations described here are restricted to health and education service contacts. Contact with privately paid for professionals and voluntary sector services (e.g. self-help groups, psychotherapists, home tuition) are not examined. These is evidence that these cost items are unlikely to be of any great significance - Harrington et al. (2000) have estimated that private and voluntary sector costs amounted to only 1% of total service-related costs in a treatment sample of children with behavioural problems. Issues of confidentiality prevented the accessing of data on the frequency of contact with local authority social services, thereby precluding estimation of costs relating to contact with social workers and other social services professionals. While there exclusion is far from ideal, there is again evidence suggesting that they are unlikely to account for a significant proportion of total service-related costs (Harrington et al., 2000; Romeo et al., 2005).

Seven percent of the sample had been cautioned or had some other form of involvement with the police, while a smaller percentage also came into contact with the youth justice services. The relative infrequent contact with these services, combined with missing frequency of contact data across the follow-up surveys for some individual cases, precluded the reliable estimation of police and youth justice costs as a separate item using the statistical methods describe later. While this is a limitation - public service costs relating directly to crime and antisocial behaviour by children adolescents with behavioural problems have been shown to be significant in a long-term follow-up study of children with conduct problems (Scott et al., 2001) - it should not detract from the fact that resource consumption within the health and education systems are, based on current evidence, likely to account for a significant proportion of the costs to public agencies associated child psychopathology (Romeo et al., 2005; Scott et al., 2001).

The main study of service use conducted by Ford et al (Ford et al., 2003; Ford et al., 2005) also highlighted some additional problems associated with the service utilisation measures. Firstly, there was evidence that teacher contacts resulting from behavioural and emotional difficulties in the classroom were being under-reported by parents at the time 2 follow up. Education costs relating to teacher contacts are therefore likely to be biased downwards. Secondly, questions relating to service use were only asked of parents whose children were identified as having experienced any behavioural or emotional problems based on the Development and Well-being Assessment measure which used to identify psychiatric disorder using ICD-10 criteria at time 3 (DAWBA; (Goodman et al., 2000). This is likely to have led to an underestimation of the true level of service contacts during the second follow-up period (behavioural or emotional problems may have been ameliorated because of contact with service professionals) and may have also led to the potentially inappropriate exclusion of parents from more in-depth interviewing by telephone regarding frequency of service contacts. This problem affected 189 cases in total. The parents of 41 of these children had in fact already been interviewed by telephone given that their children had been identified for inclusion based on other evidence of emotional or behavioural difficulties identified at baseline (a criteria for selection with respect to telephone interviewing). Thirty-five were ineligible for inclusion in the cost analyses because they had not been followed-up at both time 2 and time 3. The overwhelming majority of the remainder (110) had been classified as having a psychiatric disorder at baseline that had resolved by time 3. With the exception of one child who had been prescribed medication for hyperactivity, all these children were not reported by their parents to have been in contact with services over the first follow-up period. The main service use investigators have therefore assumed that they were not in contact with services over the second follow-up. The child known to be receiving medication at the second follow-up was assumed to have the same level of service contact as reported for the first follow-up period.

5.2.3 Unit costs

Unit costs seek to estimate the long-run marginal *opportunity* cost attributable to the utilisation of resource inputs during specific contacts made with service staff and professionals or with regard to visits to specific service-related facilities (Beecham & Knapp, 2001). "Opportunity costs" reflect an endemic scarcity of resources in society compared to the need and demand for welfare enhancing goods and services provided either by the market or by government (Mishan, 1988). As such, there will always be alternative productive uses to which human skills, capital and other resources can be allocated. *Marginal* costs seek to reflect that value that an efficiently operating market places on the next best alternative use of a resource utilised on producing an additional unit of output - a unit of "output, in this instance, effectively being the additional child dealt with either by the health and education systems. In taking a *long-run* perspective, all resources inputs are assumed to vary as services respond to each additional child or adolescent with emotional or behavioural difficulties - including those resources that are normally viewed as fixed over a short-run time horizon within health and education settings (e.g. buildings, equipment and human resources). "Units" of resource within the ONS surveys were typically measured in terms of the total minutes of contact with specific types of health or education professionals over a retrospective period (e.g. school nurses; psychiatrists; educational social workers) or, less frequently, in terms of discreet units of contact with specific facilities (e.g. visits to an accident and emergency department, inpatient beds days, day hospital visits).

The main source of unit cost data on health service use was provided by the Unit Costs of Health and Health and Social Care handbook published by the Personal Social

Services Research Unit (PSSRU; Netten & Curtis, 2003). All the unit cost estimates reported in this volume follow standard economic principles when estimating long-run marginal costs (Beecham & Knapp, 2001): staffing costs (salaries and additional "on-costs"), running costs, overheads and administrative costs and the estimated value of capital invested in buildings and equipment are all included. However, a number of important cost items of relevance are not covered by the PSSRU handbook and required separate estimation using data from other published sources. The unit costs associated with special schools provision for children and adolescents were taken from *Education Cost Statistics for 2000-2001* published by the Chartered Institute for Public Finance and Accountancy (CIPFA, 2001). These provide annual costs per pupil associated with attendance at special schools in England and Wales. These estimates make no distinction between residential or day placements: annual CIPFA cost estimates were therefore adjusted upward (for children with funded residential placements) or downward (for day placements) in order to make some allowance for the likely general magnitude of difference between these types of special school referrals. A 40% difference is assumed based on the proportional difference in local authority residential and day care costs for elderly people published in Netten & Curtis (2003).

A number of parents reported involvement with Special Educational Needs Tribunals - independent judicial bodies charged with the settlement of disputes between parents and local education authorities over the special educational needs provision for a child. Estimates of the annual costs of conducting tribunals (covering salaries, administration, accommodation and staff training) were derived from the Report of the Review of Tribunals carried out by Lord Leggatt for the Department for Constitutional Affairs (Lord Chancellor's Department, 2001).

Teacher costs were derived from the mid-point of the relevant salary scales published by the National Union of Teachers (National Union of Teachers, 2004) with an add-on for salary related costs (e.g. pension contributions) and institutional overheads incurred by schools and local education authorities. The costs of special educational needs officers (SENCOs) employed within schools in order to co-ordinate the special needs requirements of pupils were derived from the senior teachers' salary scale. Contact with teaching support staff (e.g. learning assistants) were costed using the mid-point salary on the unqualified teacher pay scale.

A small number of local authority-funded health and education professionals and health service facilities also have no published unit costs. In these instances a judgement was made as to which existing unit costs relating to other kinds of services would provide the most accurate approximation. For example, day hospital attendances (a rare occurrence) were valued using the unit cost estimated for NHS day care for adults with mental health problems; community nurses were valued using the unit cost for a primary care nurse (as were school nurses); and family therapists costs were based on unit costs for clinical psychologists.

Table 5.2 provides an indication of the breadth of services covered by the costing exercise, grouped by service category, with the associated unit cost used in each case. An upward adjustment was made to all unit costs applied to services used by children living in London in order to reflect the higher costs of delivery in the capital – London adjustments were based on those provided by Netten and Curtis (2003) and using salary adjustments reported for teachers working in inner- and outer-London. All costs are expressed at their 2002/2003 values. Costs relating to specific service items (e.g. contact with psychiatrists, extra help received from teaching staff) are estimated simply by multiplying the relevant unit cost estimate by the parental-reported volume of services used. All estimates were made with reference to the three year follow-up period from baseline.

Table 5.2
Unit costs for health and educational services

	UNIT COST
Primary care	
General practitioner	£1.91 per minute
Health visitor	£1.20 per minute
Paediatrics/children's health services	
Paediatric inpatient	£234.00 per day
Paediatrician	£4.18 per minute
A & E	£57.00 per visit
Community nurse	£0.52 per minute
School nurse	£0.52 per minute
Dietician	£0.55 per minute
Occupational therapy	£0.68 per minute
Speech therapy	£0.67 per minute
Physiotherapy	£0.65 per minute
Mental health services	
Psychiatric inpatient	£236.00 per day
Child psychiatrist	£4.33 per minute
Psychologist	£0.65 per minute
Family therapy	£1.10 per minute
Counselling	£0.54 per minute
School counselling	£0.75 per minute
Community psychiatric nurse	£1.17 per minute
Frontline educational resources	
Teachers	£0.63 per minute
Teaching assistants	£0.39 per minute
Special educational needs coordinators	£0.73 per minute
Special educational needs tribunals	£2495.00 per case
Special educational resources	
Educational social worker	£1.05 per minute
Educational psychologist	£1.15 per minute
Special school status	Day school (non-London): £7708.00 per academic year Residential school (non-London): £10792.00 per year

Notes
1. All costs in 2002/2003 prices
2. Adjustments have been made to account higher costs of London-based services.

Costs are grouped into four broad categories:

- ***Primary care costs*** - including contact with GPs and health visitors.

- ***Paediatrics and child health service costs*** - Including contact made with paediatricians, paediatric inpatient stays, community nurses, school nurses, dieticians, physiotherapists, occupational therapists, speech therapists and visits to accident and emergency departments.[2]

- ***Mental health service costs***[3] - Including contact with child psychiatrists, child psychiatric inpatient stays and child psychiatric day hospital visits, counselling services provided in school and elsewhere, psychologists, family therapists, and community psychiatric nursing staff.

- ***Frontline education resources*** - Including parental meetings with teachers, extra help provided in the school by teaching staff and learning support assistants, contact with special educational needs officers and involvement with special educational needs tribunals.

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[2] None of the children in the follow-up sample visited a paediatric day hospital facility. This item is therefore not covered in the children's health services cost estimations.

[3] Two children were reported to have attended a course of art/music/drama therapy. Complete data for costing this item over the entire three year follow-up period was only available for one child - though this individual was eventually excluded because of missing data on other service items: children with missing data on specific service items are automatically dropped from grouped cost estimates. The treatment of missing cost data is described later in the chapter.

- ***Special education resource costs*** - Including attendance at special schools and contact with educational social workers and educational psychologists.[4]

These groupings of individual service components generally match those used in the existing study of service contacts based on the ONS data (Ford et al., 2005).

5.3 Cost estimation: statistical issues

The estimation of mean costs for each service category introduces three important statistical problems: the estimation of statistical uncertainty surrounding the average estimates; the adjustment of the mean values to reflect aspects of survey design and selective follow-up; and the handling of missing data on parental reported service use and cost.

5.3.1 Confidence interval estimation

Statistical uncertainty surrounding estimated means was measured using standard errors and 95% confidence intervals generated via a non-parametric bootstrapping of the cost data (Efron & Tibshirani, 1993). The (right) skewed nature of costs within the sample - not untypical when dealing with resource use data of this type - invalidates standard methods of inference and uncertainty measurement which assume normality (Thompson & Barber, 2000). The bootstrap involves repeated sampling (with replacement) from the

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[4] The parents of some children also reported that their children had been in contact with a behavioural support teacher. Cost estimates for this service item for all but two children could not be determined due to missing data on frequency of contacts. Moreover, due to missing information on other specific items, the same children are not included in the mean estimates for special educational resource-related costs. Observable costs linked to teaching support for behavioural difficulties were not hugely expensive (unlike, for example, attendance at a special school) and contacts of this nature were also relatively infrequently observed compared to, say, involvement with education social workers or psychologists. The exclusion of this item is therefore unlikely to seriously affect mean cost estimates.

cost data with a view to generating a sampling distribution of mean costs upon which the bootstrapped standard errors and confidence intervals are based. The non-parametric nature of this approach implies that no prior assumptions are made regarding the way the cost data are distributed across the population of interest.

5.3.2 Adjusting for survey design and loss to follow-up

Estimating mean costs for the general population of children and adolescents with a mental disorder requires making some adjustments for sampling design. The follow-up study is highly selective: only 1 in 3 of the non-disordered children identified at baseline were included in the sampling frame for the follow-up surveys while all cases with a mental disorder identified at baseline were included for follow-up. Moreover selective non-response also changed the characteristics of the follow-up sample compared to the original baseline survey: families from more socially advantageous backgrounds were more likely to participate, while the parents of children with a mental disorder were less likely to be successfully interviewed in the later surveys. Existing sampling weights developed by the main follow-up survey investigators and the Office of National Statistics were therefore applied to the cost estimates in order that the estimated means across different types of disorder reflect the relative proportion of children and adolescents with different types of disorder that would be expected within the general population (Ford et al., 2005). These weights are in turn multiplied by sampling weights developed by the ONS in order to adjust for over-sampling in Wales and Scotland relative to England and to weight the main baseline survey (from which the follow-up surveys are drawn) back to the general population with respect to the age and gender structure of 5-15 year olds living in private households. It should be stressed that the population weights make no attempt to adjust for the effects of sample selection and non-response on observed rates of service use (and therefore costs) within the follow-up survey.

Sampling within the main baseline survey also involved selecting families from primary sampling units (PSU) defined by postal code sector. This introduces a degree of non-randomness into the sampling design with families drawn from the same PSUs being more likely to share similar social characteristics compared to families drawn from other areas. This "clustering" will therefore lead to the underestimation of true population variances and standard errors. Unbiased standard errors are crucial for making correct statistical inferences and for appropriately estimating 95% confidence intervals around mean cost estimates. All standard errors are therefore adjusted to allow for the effects of clustering. Population weights and adjustments for sample clustering are applied to the cost data using an option within the Stata (version 8) statistical software package designed specifically for analysing complex survey data. Taylor series linearization methods are used to adjust estimated means and standard errors using the derived weights and adjustment factors (Heeringa & Liu, 1998; Stata & Corporation, 2005).

5.3.3 Treatment of missing data

Costs can only be estimated where there are complete cost data on all individual service items of relevance (e.g. child psychiatrists, extra help from teachers, school nurses etc.). The unobservability of costs arose primarily due to missing information relating to the volume of services used: some parents whose children were known to have made contact with services were not interviewed regarding service contacts (due either to failure to contact or active refusal), while for some parents who were successfully interviewed the frequency or length of service contacts (or both) could not be determined.

With the exception of frontline education resources, costs data on each service category were missing for between 19% and 24% of all cases included in the follow-up surveys. Complete frontline education costs could only be estimated for approximately half the sample. The multiple imputation method, described in more detail in chapter 2 is again used, this time to impute cost values where parental self-report data on resource consumption are missing (Rubin, 1987; Schafer, 1999). To reiterate, the valid use of any imputation method requires that the missing data on the outcome of interest is not systematically related to the value of the outcome itself (in the instance volume of resource use and cost) - implying that the data are either "missing at random" (MAR) or missing completely at random" (MCAR) to use the standard terminology (Rubin, 1987).[5] There was no reason to suspect that systematic non-random processes are responsible for missing cost data in the follow-up surveys, though the likelihood of observing a missing cost observation may depend on observed sample characteristics that could also influence cost. Multiple imputation methods condition imputed cost values on these observables. Five complete data sets were generated containing imputed and observable cost data using the NORM multiple imputations software (Schafer, 1999). All the mean costs and standard errors reported here are again based on the

[5] Briggs et al. (2003) provide a useful hypothetical example of health utilisation data used for costing purposes that are not missing at random. A survey is administered to patients asking them for information on their use of health care resources after receipt of a treatment. Some of the questionnaires are not returned because the patients have been taken into hospital with complications relating to the treatment. Missing service use information in this instance should be viewed as non-random as non-response will be directly related to the outcome (cost) variable of interest - patients admitted to hospital will typically cost more than the rest of the patient population who were surveyed.

formulae developed by Rubin (1987) for generating parameter estimates from multiply imputed data sets (described in more detail in chapter 2). Crucially, this method allows for the non-stochastic nature of data imputations to be reflected in estimates of variance and 95% confidence intervals.

5.4 Health and education service costs: results

Table 5.3 lists summary statistics for each individual cost component. These relate to the entire three year follow-up period and are based entirely on the observed cost data (i.e. without any imputations for missing values). All the services listed are the ones that were included in the mean cost estimates for each service category.

Table 5.4 presents estimates of the mean cost per child for the three-year follow-up period for all children with a behavioural or emotional disorder. Each estimate is re-weighted to allow for the effects of sample selection and drop-out with additional re-adjustment for survey design at baseline. Costs are presented for each service category along with an annual equivalent (costs divided by the three-year follow-up period), while an estimate of the mean total cost, based on the sum of costs across each service type, is also presented. All the mean cost estimates reported in this chapter relate to all children and adolescents who were identified as having a disorder at baseline irrespective of whether their parents reported that they had used services.

Table 5.3
Costs over three year follow-up for mentally disordered children/adolescents (N=445): summary statistics for each service item

	MEAN (£)	MEDIAN	STD. DEV	N
Primary care				
General practitioner	33.53	0.00	163.75	361
Health visitor	5.96	0.00	75.26	366
Paediatrics/children's health services				
Paediatric inpatient	3.80	0.00	34.16	367
Paediatrician	46.00	0.00	192.94	363
A & E	1.58	0.00	11.13	361
Community nurse	1.80	0.00	33.68	368
School nurse	1.79	0.00	12.03	351
Dietician	0.29	0.00	2.97	366
Occupational therapy	1.80	0.00	23.62	368
Speech therapy	31.84	0.00	406.98	365
Physiotherapy	4.35	0.00	38.64	367
Mental health services				
Psychiatric inpatient	4.49	0.00	86.11	367
Child psychiatrist	86.03	0.00	446.54	366
Psychologist	29.71	0.00	178.70	366
Family therapy	1.81	0.00	24.55	368
Counselling	6.10	0.00	44.86	368
School counselling	29.38	0.00	239.14	360
Community psychiatric nurse	5.01	0.00	61.38	367
Frontline education resources				
Parental meeting with teachers	95.69	0.00	303.21	355
Extra time spent with children at school (teachers and teaching assistants)	1516.37	0.00	7287.21	321
Special educational needs coordinators	14.84	0.00	57.90	360
Special needs tribunals	73.55	0.00	408.43	351
Special education resources				
Educational social worker	6.60	0.00	38.80	365
Educational psychologist	12.13	0.00	61.07	351
Special school status	1380.60	0.00	57.90	368

Note
Table contains *observed* costs (i.e. no data imputations for missing cost values used).

Table 5.4
Costs over three year follow-up for disordered children: mean costs for all disorders (N=445)

	MEAN COST: ALL DISORDERED CHILDREN OVER 3 YEARS (£)	95 % CI	MEAN ANNUAL (£)
Primary care	42.71	18.20-67.22	14.23
Paediatrics/children's health services	62.64	28.44 -96.83	20.88
Mental health services	174.80	69.61-279.98	58.27
Frontline education resources	2191.96	1302.85-3081.07	730.65
Special education resources	969.64	371.84 -1567.43	323.21
Total cost	3441.91	2327.98-4555.85	144.97

Notes

1. Costs estimated for all 445 cases with a psychiatric disorder included in three-tear follow-up
2. All costs adjusted for selection and non-response in follow-up sample and for sample clustering in main survey design at baseline
3. Imputed values used for missing service use data
4. Total costs are the sum of costs across each service category for each child/adolescent

The findings in the table point to the relative importance, in resource terms, of education services as a source of support for children/adolescents with emotional-behavioural difficulties. For example, for the three-year period the estimated mean cost of support per child delivered by frontline education services across all children with a disorder is over 12 times the estimated mean for mental health service contacts. The bootstrapped confidence intervals are fairly wide, and indicative of the considerable degree of variance in costs within the sample.

Table 5.5
Mean costs over three year follow-up by type of disorder (N=445)

	MEAN COST (£)	95% CI	MEAN ANNUAL (£)
Hyperkinetic Disorders			
Primary care	49.44	-23.13-122.02	16.48
Paediatric/children's health services	87.76	3.50-172.02	29.25
Mental health services	336.23	32.78 - 639-69	112.07
Frontline education resources	3260.54	1137.69 - 5383.38	1086.85
Special education resources	1697.97	-10 .84 - 3406.79	565.99
Total cost	5431.78	2521.00 - 8342.57	1810.59
Conduct Disorders			
Primary care	38.18	3.76 - 72.60	12.73
Paediatric/children's health services	65.76	17.26 - 114.26	21.92
Mental health services	227.56	47.53 - 407.75	75.85
Frontline education resources	2578.97	1554.65 - 3603.30	859.66
Special education resources	961.81	22.86 - 1900.77	320.60
Total cost	3872.28	2444.01 - 5300.54	1290.76
Emotional Disorders			
Primary care	48.18	7.72 - 88.64	16.06
Paediatric/children's health services	66.13	17.67 - 114.58	22.04
Mental health services	130.05	6.66 - 253.42	43.35
Frontline educational resources	1518.68	792.84 - 2244.5	506.22
Special educational resources	955.93	12.80 - 1899.05	318.64
Total cost	2718.81	1352.44 - 4085.18	906.27

Notes
1. Costs estimated for all 445 cases with a psychiatric disorder included in three-tear follow-up.
2. All costs adjusted for selective nature of follow-up sample and non-response and for sample clustering in main survey design at baseline
3. Imputed values used for missing service use data

Figure 5.2
Health service and education resource use: mean cost for all children/adolescents with a disorder

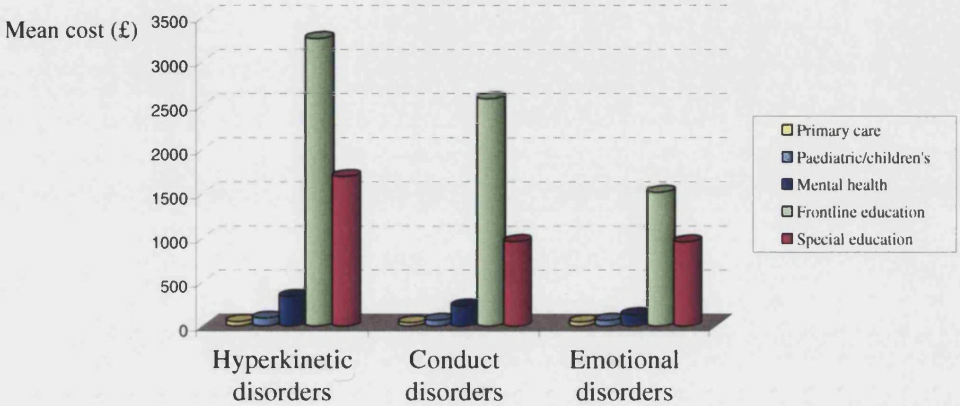


Table 5.5 describes the mean costs by type of disorder, while Figure 5.2 provides a graphical summary of the findings. Costs are generally higher for children with behavioural disorders (hyperkinetic and conduct) compared to children with emotional disorders. The overlapping confidence intervals suggest that these differences are not statistically significant at the 95% level of confidence, though the sample may be inadequately powered for detecting statistically significant differences in mean costs by disorder type.[6] The general pattern again points to a higher resource burden imposed on education services. Primary care and paediatric/children's health services are the least significant service category in resource terms.

Table 5.6 presents national annual costs estimates for the population of children with any behavioural or emotional disorder aged 5-15 living in Great Britain. These values combine the mean costs reported in table 5.4 with current estimates of the number

[6] The power of a test is the probability that it will reject a false null hypothesis (that there is no difference in cost between two groups) - or the probability of avoiding a Type II error (Bowen & Starr, 1982).

children with hyperkinetic, conduct and emotional disorders in the British population. The latter are derived using prevalence data from the British Survey of Child and Adolescent Mental Health and size of population estimates for the 5-15 age group using UK census data from 2001 (Office of National Statistics, 2004).

Table 5.6
National costs for population aged 5-15 with emotional/behavioural disorder

POPULATION AGED 5-15 WITH DISORDER	NATIONAL COST ESTIMATE	
	Primary care	£12,394,330
	Paediatric/children's health services	£18,186,480
	Mental health services	£50,753,170
871,000	Frontline education resources	£636,396,190
	Special education resources	£281,515,910
	Total cost	£126,268,870

Notes
1. Population estimations taken from the UK 2001 Census (Office of National Statistics, 2004).
2. Prevalence estimates from Meltzer et al. (2000) - estimated 10% with emotional or behavioural disorder.

5.5 Cost variations

Figures 5.3 -5.5 provide a visual representation of the degree to which mental health service and education costs varied across children and adolescents who had some contact with services over the follow-up period. There was, for example, an almost 22-fold difference between the mental health service costs of children located at the 20th and 80th percentiles in the distribution. Even larger differences are observed for frontline and special education resources. Multivariate statistical methods are used to explore in more detail some of the factors that explain this variability, with a particular emphasis placed on examining the degree to which costs are an increasing function of the severity of problems experienced by a child - in terms of both social disabilities and attainment at school. This can offer some insight into the extent to which greater resource input and costs are targeted on children whose problems are not only more serious and more

Figure 5.3
Mental health service cost distribution: service users only (excludes imputed cost data)

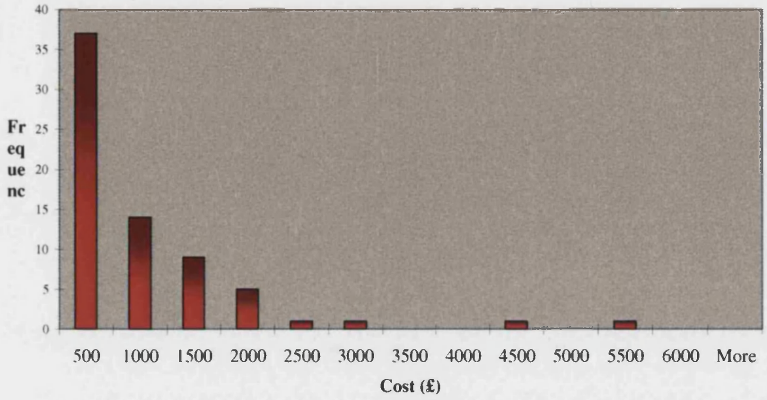


Figure 5.4
Frontline educational resource cost distribution: service users only (excludes imputed cost data)

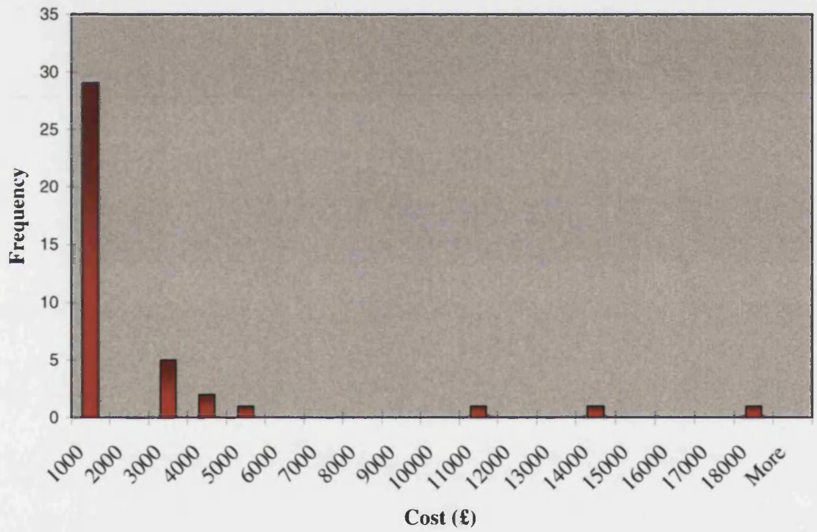
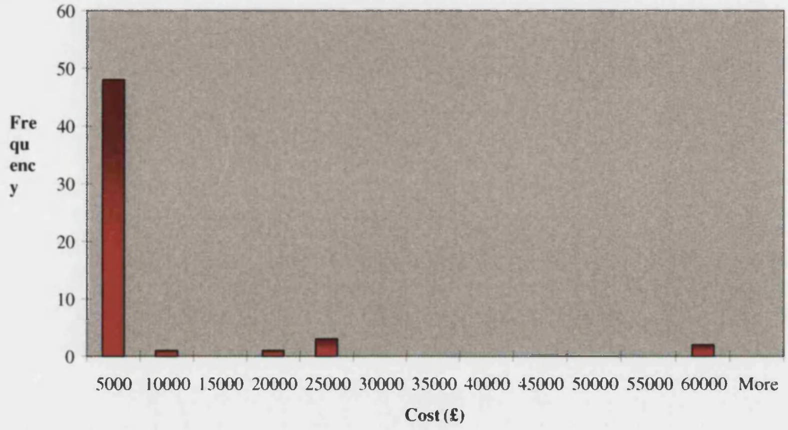


Figure 5.5
Special education resource cost distribution: service users only (excludes imputed cost data)



complex, but who might arguably also have a greater "need" for a more intensive or extensive involvement from services (an interpretation of "need" is offered later in this chapter). This idea of resource targeting is a well established concept within economics research applied to health and social care settings (Davies, 1981; Knapp, 1984).

Attention is restricted to mental health service and education costs, with cost variations examined for those children with greater than zero costs (i.e. those in contact with services). It is possible, and it is indeed conventional within many studies, to view the generation of service costs as being a multi-hurdle process. Within health services research, for example, a two-part specification is often adopted with a distinction made between those processes that drive the likelihood of referral, or some initial level of contact being made, and those that determine the volume of resource use and cost once an individual has entered the system (Duan et al., 1983; Dunn et al., 2003; Lipscomb et al., 1998). The current chapter therefore concentrates exclusively on the second stage of this two-part framework.[7]

The baseline (time 1) survey contains data on a range of characteristics relating to the children and adolescents covered by the survey (e.g. severity of impact of behavioural/emotional difficulties) as well to household and parental characteristics (e.g. parental occupational class; size of family; family functioning). No specific theoretical model is tested, though the types of variables included in the multivariate estimations include many that are typically included in studies of variations in health service utilisation and cost (Knapp, 1998). The concluding section provides some interpretation of the main findings and their policy significance.

[7] Ford has examined in more detail, using multivariate methods, those factors that influence the likelihood that children will make contact with services (Ford, 2004).

5.5.1 Statistical issues and methods of estimation

The cost data relating to each service category are not statistically well behaved in the sense that residual variations in costs, using standard OLS estimation, were found to be non-normally distributed. This precludes the use of OLS regression for examining cost variability given that an OLS estimator cannot be assumed to be efficient or unbiased where the error term is non-normally distributed. For each service category costs are subsequently modelled using a gamma generalised linear model (McCullagh & Nelder, 1989). The algorithm suggested by Manning & Mullahy, (2001) - based on an application of the Park test (Park, 1966) - was applied in order to choose a GLM estimator that offered the best fitting model (the GLM "family" includes the Poisson, gamma, inverse Gaussian (Wald) and negative binomial distributions). This pointed to the adoption of the gamma distribution. The findings from the Park test are presented in the appendix to this chapter. There are no a-priori theoretical grounds for specifying any particular functional relationship between costs and the set of explanatory variables included in a model. The cost equations specified here follow empirical convention when analysing cost data of this type and adopt a log-link link functional relationship (Dunn et al., 2003; Manning & Mullahy, 2001). A link test was used to test for correct functional form specification (Pregibon, 1981). The log-link GLM fits the following relationship to the data:

$$COST_i = \exp(\alpha_i + \Sigma\beta_i x_i) + error$$

$$= \exp\alpha_i \exp(\Sigma\beta_i x_i) + error \qquad [5.1]$$

Raw-scale costs are therefore the exponent, or anti-log, of the linear predictor contained in the parentheses. The x_i's comprise a vector of explanatory variables included in the model, while the β_i's are parameters requiring estimation.

Each GLM was applied to variations in *observed* cost outcomes, and did not therefore draw upon multiple imputations where cost data were missing. The primary reason for engaging in the multivariate estimations is to gain additional insight into any general patterns of association between cost and measured characteristics relating to those children who came into contact with services. It was felt that this could be adequately achieved without relying on data imputations for missing cost values. However, multiple imputations were used where data were missing on an explanatory variable in order to avoid observations with complete cost data being dropped from the modelling. Table 5.7 presents descriptive statistics relating to each cost dependent variable.

Table 5.7
Cost dependent variables for GLM estimation: descriptive statistics

	MEAN (£)	MEDIAN	STD. DEV.	N
Dependent variables - for all $COST_i$ >0				
Mental health services	899.06	288.94	2666.50	108
Frontline education resources	2366.49	43.43	8040.11	140
Special education resources	5050.72	138.00	12896.13	107

Notes
All reported statistics refer to observed costs for children/adolescents incurring a positive cost, including service users without a diagnosed behavioural or emotional disorder (no cost imputations used).

Two cost estimations were carried out, one based on the complete estimation sample for each service category another using a "trimmed" sample removing observations at the top and bottom 5% of cost distribution. A trimmed sample was employed in order to test the sensitivity of the main findings to the removal of outlying observations - particularly with regard to the effect sizes estimated on variables identifying problem severity. This is a potentially important consideration when analysing costs within relatively small samples, as was the case here.

5.5.2 *Explanatory variables*

The ONS surveys contain data relating to the characteristics of the participating children/adolescents, their parents and the households within which they live. Most of the variables available were included in the multivariate analysis of costs. While this approach is somewhat a-theoretical, the main concern was to provide, as far as possible, an estimate of the pure effect of problem severity on costs: severity of psychosocial difficulties could co-vary with other sources of cost-related heterogeneity. The following variables, all measured at the baseline survey, were therefore included as explanatory variables when modelling cost variations:

- ***Age of child/adolescent.***

- ***Gender*** (0=female; 1=male).

- ***Impact of emotional/behavioural problems on the child measured at baseline (rated by parents)*** - a 10-point scale covering severity of impact on various aspects of day-to-day living including: "upset or distressed"; "home life"; "friendships"; "classroom learning"; and "leisure activities". The scale is taken from the widely used and validated Strengths and Difficulties Questionnaire (SDQ; Goodman, 1999).

- ***Reading attainment at school measured at baseline*** - Z-transformed and age-adjusted reading test scores based on the British Ability Scales (Elliot et al., 1978).

- ***Occupational class (head of household)*** - identified using the Registrar General's classificatory system of occupational status (1=professional; 2=managerial/technical; 3=non-manual/skilled; 4=manual/skilled; 5=semi-skilled; 6=unskilled; 7=student/never worked).

- ***Mother's mental health at baseline*** - Anxiety - and depression-related symptoms in mothers were measured using the General Health Questionnaire (Goldberg & Williams, 1988) - an established instrument for identifying mental health problems in the adult population (scale 0-12 - increasing score representing poorer mental health).

- ***Family functioning at baseline*** - the general functioning scale of the McMaster Family Assessment Device (Miller et al., 1985) was used to measure family discord (scale 21-41 - increasing scores reflecting increasing dysfunction within the family). This instrument has been validated within clinical populations and focuses on measuring the degree of functioning across a range of domains relating to interpersonal relationships within the family environment.

- ***Large family size at baseline*** (0=less than 3 siblings; 1= 3 or more siblings).

- ***Child/adolescent lived in a single parent household at baseline*** (0=conventional or reconstituted family; 1= single parent family).

- ***The age of the mother when the index child/adolescent was born.***

- ***Ethnic origin of child/adolescent*** (0=black, Asian or any other ethnic minority group; 1= white).

Descriptive statistics for each explanatory variable are presented in Table 5.8.

5.6 Multivariate estimation: results

A series of link tests applied to the GLM estimations were suggestive of a mis-specification with regard to the models relating to mental health service and special education resource costs, though the null hypothesis of a correct functional specification cannot be rejected for the former when estimation is carried out using a trimmed sample (all test results presented in the appendix). On the assumption that error variances are unlikely to be homoskedastic (Greene, 2003) robust standard errors are used to calculate test statistics for each model (there is no formal test for hetroskedasticity of unknown form that can be applied to a GLM).

5.6.1 Costs and problem severity

The results from the GLM estimations carried out on the full estimation samples are presented in Table 5.9. Higher reading test scores are negatively related to costs for all

Table 5.8
Explanatory variables: descriptive statistics for GLM estimation samples (service users only)

	MENTAL HEALTH SERVICES			FRONTLINE EDUCATION			SPECIAL EDUCATION		
	Mean	**Std. Dev**	**N**	**Mean**	**Std. Dev**	**N**	**Mean**	**Std. Dev**	**N**
Age at baseline	10.10	3.05	69	9.57	2.89	40	10.56	2.85	55
Gender at baseline⁺ (1=male; 0=female)	0.70	0.46	69	0.70	.46	40	0.67	0.47	55
SDQ impact score	3.18	2.46	67	2.72	2.36	39	2.92	2.60	50
Reading test score	-0.38	1.16	62	-0.39	1.26	36	-0.46	1.12	49
Age of mother at birth of child	28.29	5.62	66	27.60	5.28	35	27.55	5.93	51
Mother's GHQ score at baseline (scale 0-12)	3.29	3.25	68	2.68	3.16	40	3.35	3.24	55
Ethnicity ⁺(1=white; 0=black, Asian or other)	0.91	0.28	69	0.95	0.22	40	0.93	0.26	55
Social class of parents 1.Professional 2.Managerial 3.Non-manual skilled 4.Manual Skilled 5.Semi skilled 6.Unskilled 7.Never worked/student	3.13	1.45	67	3.18	1.25	39	3.42	1.55	53
Large family ⁺ (1=3 or more siblings; 0=less than 3 siblings)	0.03	0.17	69	0.03	0.16	40	0.00	0.00	55
Family functioning score at baseline (scale 21-41)	25.66	3.02	68	25.60	3.16	40	25.67	3.35	55
Single parent family ⁺ (1=yes; 0=conventional or reconstituted family)	0.26	0.44	68	0.25	0.44	40	.28	0.45	54

Note
⁺Denotes a dummy (0-1) variable. Mean values indicate the proportion of cases with the specified characteristic

Table 5.9
GLM cost estimations: full estimation sample

	MENTAL HEALTH SERVICES		FRONTLINE EDUCATION RESOURCES		SPECIAL EDUCATION RESOURCES	
	β	Z	β	Z	β	z
Age at baseline	0.12	2.13	-0.06	-0.60	0.14	1.57
Gender at baseline	0.65	1.80	-0.74	-1.56	0.36	0.74
Age of mother at birth of child	0.06	2.15	0.15	3.56	0.10	2.65
Mother's GHQ score at baseline	0.10	1.80	-0.05	-0.32	0.04	0.56
Ethnicity	0.73	1.66	-0.66	-0.54	-1.74	-1.04
Social class of parents	0.05	0.37	0.09	0.47	-0.17	-1.44
Large family	-3.50	-4.11	-0.06	-0.07	-3.18	-6.33
Family functioning score at baseline	-0.19	-2.99	0.14	0.89	-0.18	-1.96
Single parent family	0.27	0.61	-0.69	-1.04	-0.18	-0.32
SDQ impact score	0.04	0.77	0.26	1.40	0.16	1.73
Reading test score	-0.30	-1.73	-1.02	-3.68	-1.24	-8.04
Constant	6.55	3.91	0.22	0.06	8.44	2.19
N	108		140		107	

Notes

1. significant at 1% level significant at 5% level significant at 10% level
2. Robust standard errors used for z-values

Table 5.10
GLM cost estimations: trimmed estimation sample

	MENTAL HEALTH SERVICES		FRONTLINE EDUCATION RESOURCES		SPECIAL EDUCATION RESOURCES	
	β	Z	β	Z	β	z
Age at baseline	-0.00	-0.17	-0.01	-0.16	-0.01	-0.13
Gender at baseline	0.36	1.37	-0.57	-1.25	0.77	2.20
Age of mother at birth of child	0.03	1.40	0.09	2.13	0.05	1.75
Mother's GHQ score at baseline	0.05	1.31	-0.17	-2.01	0.11	1.76
Ethnicity	0.38	1.03	-1.48	-1.46	-0.94	-0.83
Social class of parents	0.07	0.77	0.25	1.38	-0.01	-0.10
Large family	-2.07	-5.36	0.49	0.61	-3.31	-7.14
Family functioning score at baseline	-0.11	-2.04	-0.13	-2.13	-0.15	-2.18
Single parent family	-0.43	-1.70	-0.82	-1.34	-0.13	-0.28
SDQ impact score	0.16	3.69	0.20	1.28	0.26	3.33
Reading test score	0.17	-1.74	-0.85	-3.00	-1.06	-7.80
Constant	6.83	4.31	8.06	4.14	8.35	3.26
N	98		131		97	

Notes
1. significant at 1% level significant at 5% level significant at 10% level
2. Robust standard errors used for z-values

three types of service. The test score variable is statistically significant at the 1% level in both the frontline and special education resource cost equations, and significant at the 10% level in the mental health services equation. This implies that costs incurred in response to behavioural and emotional difficulties are an *increasing* function of *lower* reading attainment. SDQ impact scores are positively associated to each type of cost, though the statistical significance of these associations is less convincing: the SDQ impact variable is only statistically significant at the 10% level in the special education resource equation, thought it does not reach significance at conventional levels in the other cost equations.

The findings from the GLM estimations are, however, sensitive to the exclusion of observations located in the top and bottom 5% of the cost distribution (table 5.10), most notably in relation to the SDQ impact scores. The effect size of increasing SDQ scores on cost increases substantially within the mental health services GLM and more modestly in the special education resource model. Moreover, the SDQ variable is statistically significant at the 1% level for each of the cost models when using the trimmed sample.

Table 5.11 compares the predictive power of the full and trimmed sample estimations using the root mean squared error (RSME) - a summary measure of the average predictive capability of a model with respect to the costs of specific children (Dunn et al., 2003; Kilian et al., 2002):

$$RSME = \sqrt{\frac{1}{n}\sum\left(\hat{y} - y\right)^2} \qquad [5.2]$$

where n is the number of observations, $\hat{y}$ is the predicted cost for a specific observation and y is the observed cost.

Table 5.11
Root mean squared error from GLMs

	FULL ESTIMATION SAMPLE	TRIMMED ESTIMATION SAMPLE
Mental health services	2643.53 – 2666.78	523.00 - 527.39
Frontline education services	19493.45 – 28620.72	2739.26 – 6099.84
Special education resources	13899.53 – 19613.49	6164.48 – 7871.03

Note
Table contains range of RSME values derived from 5 multiply imputed data sets.

Not surprisingly, the predictive capabilities of each model is substantially improved on removal of the outlying data points - the RSME measure will be heavily influenced by the removal of the large predictive errors associated with children at the tail ends of the cost distribution. The concluding section to the chapter provides a more considered interpretation of these findings.

5.6.2 Other explanatory variables

Other explanatory variables were also found to be associated with cost. Children from large families are estimated to be less costly in terms of their use of mental health services and special education resources, an effect that is statistically significant at the 1% level in both cases. Maternal age at the birth of the study child/adolescent is positively associated with cost across all types of service category: the effect of this variable is statistically significant at the 5% level for frontline education services and at the 1% level for mental health services and special education resources. Age of the child is also positively associated with higher mental health service costs (significant at the

5% level), while boys are estimated to have higher mental health service costs than girls.

5.7 *Discussion*

Data on parental reported service use were used **1.** to estimate the public resource costs of health and education services delivered to 5-to-15-year-olds who were found to have a medically recognisable emotional or behavioural disorder within a major epidemiological survey of childhood mental health and behavioural problems in Great Britain and; **2.** to explore, as far as possible, the reasons for cost variability among children and adolescents who made at least some level of contact with mental health and education services in response to behavioural problems or emotional difficulties, irrespective of whether they were suffering from a recognise disorder during the baseline survey.

5.7.1 Costs of health and education services

The cost estimates presented here offer a general indication - in terms of order of magnitude - of the resource demands placed on health and education services by children and adolescents with psychosocial problems. The significantly higher costs associated with education service contacts can be attributed to a number of factors. Compared to mental health and other types of health services for this age group, a higher proportion of disordered children received some level of input from education professionals in response to the difficulties they were experiencing (Ford et al., 2005). Moreover, the frequency of reported contacts with specific types of education professional over the three-year follow-up period was more substantial compared to the extent of contact made with child psychiatrists, paediatricians, community nursing staff or other health service professionals. Differences in the frequency of contact with more expensive types of resource input also partially explain the observed cost differences across service categories. Inpatient services, for example, are traditionally the most expensive of resources provided to patient groups with long-term and complex needs (Knapp & Beecham, 1993). However, only three children in the sample were admitted to an adolescent inpatient psychiatric unit over the entire three-year follow-up period. In contrast, many more children with significant psychosocial problems were being taught within special schools, the most costly of the education resource items.

Differences in costs across types of disorder were also apparent. The higher mean costs estimated for behavioural disorders is noteworthy, partly reflecting the greater likelihood of contact being made with services among children and adolescents with a behavioural and particularly a hyperkinetic disorder (Ford et al., 2003). It may also reflect genuine differences in the resource requirements of dealing with different disorders once some level of contact with services has been established. Behavioural problems - because of their more externalising and potentially more disruptive nature (e.g. in terms of classroom conduct or behaviour within the home) - may be more likely to provoke a response from parents in terms of seeking professional help, as well as from teachers and other education professionals within the school environment. By contrast, the difficulties arising from anxiety and depression in childhood and adolescence are more internalised and as such may be more difficult to detect. They may also be interpreted by some parents or teachers as in some sense "normal" or not in need of intervention or treatment.

How reliable are the cost estimations reported in this chapter? One way to judge this is to compare the mean estimates reported here with those provided by other studies. All the existing studies of costs in the UK have tended to use samples of children who have been referred to child and adolescent mental health services. As such, it is difficult to directly compare these estimates with those reported in Tables 5.3 and 5.4, since the latter also children with an identified disorder who were reported to have not had any contact with services. A more appropriate comparator is the mean cost of service use for those children (with a disorder) who were in contact with services (this is not reported in the earlier tables) - around £3226 per child (std. deviation=£9737). This is within the range of existing published UK estimates: Byrne et al. (1999) - £1300 per child with a behavioural disorder; Harrington (2001) - £3692 per child with a behavioural disorder; Knapp et al. (1999) - around £8000 per child with a conduct disorder; and Romeo et al. (2005) - £1277 per child with a conduct disorder. All of these estimates include contacts with NHS and education services, but also tend to cover the cost of contact with social services as well as voluntary sector costs (both of these latter service components are relatively unimportant in cost terms). While less comprehensive (though still covering the most costly service elements - excluding family-related indirect costs), the cost estimates described in this chapter are nevertheless an improvement on the existing evidence in terms of providing a more nationally representative picture of the health service and education system costs associated with child and adolescent behavioural and emotional disorders in Britain.

5.7.2 Limitations of cost estimates

Selective drop-out may have led to higher health service costs than might otherwise have been expected among the general population of children and adolescents with a psychiatric disorder. Children and parents from more disadvantaged social backgrounds were under-represented in the follow-up sample (Ford et al., 2003): this type of selective drop-out by social background has been shown to bias downwards health service utilisation estimates based on the types of survey data used here (Reijneveld & Stronks, 1999). Whether this type of selectivity issue is as serious a problem in relation to the reporting of education service contacts is open to question, although, as noted earlier, there was some evidence of *under*-reporting of contacts with education professionals by parents in the follow-up surveys.

The cost estimates can only be as reliable as the resource utilisation data upon which they are based. All the service volume data used here are based on parental reporting of service contacts over a follow-up period using a semi-structured interview schedule. There is a danger that self-report data will be open to recall bias in terms of a failure to accurately report either the frequency of use of particular services, or the nature of the professional contacts in terms of the type of professional seen or facility attended. Despite these caveats there is evidence suggesting that parental, and patient self-report service contacts more generally, are at least as reliable as other sources, including administrative records (Fendrich et al., 1999; Mirandola et al., 1999; Stiffman et al., 2000).

The statistical uncertainty surrounding the estimated mean costs is considerable (as evidenced by the wide bootstrapped confidence intervals). This is partly down to the fairly limited number of children with an identified disorder contained within the follow-up study, combined with both the large variation in observed costs and the use of imputations where cost data were missing for specific cases. The degree of uncertainty is, in fact, likely to have been underestimated given that the unit cost data used to cost service contacts were implicitly treated as non-stochastic and without sampling error.

The mean estimates reported here do not distinguish children with a single primary disorder from those who were reported to have other co-existing disorders. For example, many children with a conduct disorder will also suffer from emotional difficulties and may also be prone to severe hyperactivity and attention deficit problems (Goodman, 2005). The presence of these types of "co-morbidity" are likely to increase the complexity of problems experienced by a child, which in turn may invoke a response from services.

Finally, the breadth of service coverage looked at in this chapter was not entirely comprehensive. The costs of social service contacts were not included (for confidentiality reasons the relevant data could not be accessed), though social services intervened with only a relatively small proportion of children with a psychiatric disorder over the three year follow-up period (3.7%; Ford et al., 2005). Harrington (2001) report social services costs to be only 3% of overall costs for a sample of children receiving community-based child and adolescent mental health services, while Romeo et al. (2005) estimate the cost of local authority social worker contacts to be a negligible proportion of total costs in a sample of children also attending mental health services.

Contact with the police and other youth justice services (e.g. youth justice workers) were not covered. This may be an important omission, particularly with regard to adolescents with behavioural problems that extend to antisocial behaviour and delinquency. Recent findings published by Scott et al. (2001) suggest that the crime-related costs (criminal justice system costs only) are likely to be a significant component of overall costs among adolescents with conduct problems - 64% of total costs estimated for a sample of sixteen children with a conduct disorder - though these estimates are longitudinal, referring to an 18-year period from age 10 up to age 28.

The mental health service costs reported here rely on published unit cost data that do not include an explicit allowance for the cost of medication administered to children with psychiatric disorders. Ford et al. (2003) report that, during the first follow-up period, 68.8% of children with a hyperkinetic disorder who were in contact with mental health services were prescribed methylphenidate - a psycho-stimulant drug,[1] as were almost 30% of those with a conduct disorder. Anti-depressants were prescribed to nearly 10% of children with conduct disorder who saw a mental health service professional and to just over 8% with an emotional disorder. The National Institute for Clinical Excellence report the cost of treatment with methylphenidate to be in the region of £200 per year at standard dosage levels (Lord & Paisley, 2000). Ford (2004) estimate that, within the British Child and Adolescent Mental Health Surveys, 34% of children with a hyperkinetic disorder at baseline were in contact with mental health services. Combining this with the proportion in contact with mental health professionals who were reported to have been prescribed a psycho-stimulant drug at an annual cost of £200, yields an estimated mean cost of psycho-stimulant medication of around £46 per

[1] Most commonly known by its brand name, Ritalin.

child with a hyperkinetic disorder. This is close to half the annual mean cost of mental service contacts for this type of disorder (£112.07 - see Table 5.5).

5.7.3 Cost variations

Variations in cost are not random. Moreover, the evidence derived from the multivariate estimations showed a positive association between cost and measures of problem severity based on reading test and SDQ impact scores. The estimated proportional effect using the trimmed sample would imply a substantial percentage difference in cost between children who are generally considered as "borderline" problematic (those with an SDQ score = 1) compared to those well within the abnormal score range (e.g. SDQ = 5): the difference is estimated to be equivalent to over 60% of the mean cost for entire sample who were in contact with mental health services.[2]

Frontline and special education resources costs were also found to vary positively with SDQ impact scores. However, education costs are generally more strongly correlated with reading attainment scores, irrespective of whether the top and bottom 5% of the cost distribution are removed. The differential in special education resource costs between children with borderline and abnormal SDQ scores (= 5) is estimated to be in the region of 160 % of the mean sample cost using the full sample estimation sample coefficient on this variable reported in Table 5.8. The corresponding differential for frontline education services is estimated to be around 130% of the mean cost.

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[2] The coefficient on the SDQ impact score in table 5.10 multiplied by the differences in SDQ scores at the median and 90^{th} percentiles.

The finding of a positive relation between service costs and indicators of problem severity has also been observed within smaller UK samples of children with serious behavioural problems (Romeo et al., 2005). Moreover, empirical investigations of British national epidemiological data relating to other types of heath and social care arrangements for other "client" groups have also demonstrated a similar positive association between measures of severity of disability or symptomology and resource costs: e.g. Kavanagh & Knapp (1999) - for older people with cognitive impairment and stroke; and Knapp et al. (2004) - for adult patients with schizophrenia.

5.7.4 Cost variations: limitations of analysis

Issues relating to the quality of the data and the potentially unrepresentative nature for the follow-up sample who were analysed have already been discussed in relation the cost estimations. It is, however, also worth noting that, for the purposes of multivariate estimation, the available follow-up samples are quite small, even after imputing values where data were missing on given explanatory variables. Estimated standard errors suggest a significant degree of imprecision in relation to the model parameters estimated for the explanatory variables, including those relating to severity of impact and reading attainment. Larger samples may therefore have yielded greater statistical precision.

The analysis of cost variations was also quite selective in the sense that they purely examined variations in cost conditional on some positive level of involvement with different services. There are, of course, important questions surrounding the factors that are likely to influence the likelihood of making any initial contact with services - an issue that can in principle be addressed within a more complete "two-part" modelling framework (Duan et al., 1983). Ford et al. (2003) have already examined the relationship between individual characteristics and the likelihood of making contact with services, again using the British Child and Adolescent Mental Health Surveys. As with costs for those children reported to have used services, and standardising for other child and family-related factors - SDQ impact scores were a significant predictor of the likelihood of contacting mental health services, social services, resources relating to special educational needs and paediatric services.

There was some evidence of a mis-specification of the chosen functional relationship between costs and the explanatory variables included in the modelling - most notably with regard to mental health service and special education resource costs: all the generalised linear models in this chapter were estimated using a log-link function. In the absence of any prior theoretical guidance on what kind functional form would be appropriate, the analyst is left with an array of possible specifications that might be adopted. Within the GLM framework these not only relate to the nature of the specific link-function used, but also the selection of an appropriate specification for the explanatory variables included in a model (e.g. the use of quadratic or cubed transformations with a view to estimating additional non-linear effects). Data mining has its pitfalls, and with this in mind a simple log-link specification was chosen on the basis of its wider application in other studies of health care utilisation and cost (Dunn et al., 2003; Kilian et al., 2002; Manning & Mullahy, 2001).

The multivariate estimations represent an attempt at identifying broad patterns of association between key variables of interest. No attempt was made to model causality. Moreover, some potentially important covariates were excluded - perhaps most notably the type of problem (behavioural or emotional) experienced by children in contact with services. Concerns regarding the high degree of colinearity between variables and the extent to which there was sufficient independent variation in the data led to the exclusion of these additional variables - different types of disorder significantly overlap with one another. Nevertheless, the exclusion of variables identifying disorder type may somewhat confound observed associations between costs and the main covariates of interest. For example, children with a hyperkinetic disorder generally have higher SDQ impact and lower reading attainment scores compared to children with other types of difficulty. The positive association between mental health service costs and SDQ scores (in the trimmed estimations) could therefore partly be a down to a treatment availability effect, as opposed to a pure targeting effect of resource inputs on children with more intensive "needs": services respond to hyperkinetic disorders with relative ease because there is a more widely accepted (medication-based) treatment strategy.

The models were also sensitive to the exclusion of outliers - particularly in terms of the size of estimated effects and relative predictive power. The mental health service estimations are in fact most sensitive to the inclusion or otherwise of a single case whose total package of mental health care cost in excess of £25000 over three years (the next highest cost in the distribution was only just over £5000 for the same period). While this child was not described as having any mental disorder at baseline, researchers rated his/her services over follow-up as being highly related to the presence of behavioural and emotional difficulties. However, there was some evidence of unreliable measurement associated with this specific outlying case, particularly regarding his/her parent-rated SDQ impact score. At baseline, the child was rated has having no problems in the area of leisure, schooling, home-life etc. and yet they was also identified as having a history of special educational needs, experience of a social services care placement, and contact with the police and youth justice services over the follow-up. Psychosocial difficulties are unlikely to be static, and at the time the SDQ ratings were made there may have genuinely been few problems to report in terms of social impacts, with more serious difficulties developing over the follow-up period. Either way, it is clear that the inclusion of a case with such a high cost value combined with a low baseline SDQ impact score will significantly flatten any underlying slope effect otherwise observed within a less extreme range of costs. There were generally fewer concerns that potential error in measurement among outliers was having such an extreme effect as regards those observations who were excluded when trimming the education cost samples.

Beyond concerns over data reliability, the better predictive power of the trimmed estimations and the increased significance of the SDQ and reading test variables on the exclusion of outliers is also a reflection of the challenges involved when using multivariate statistical methods to model what are inherently complex relationships. This is particularly noteworthy as regards the inability of the models to characterise the processes driving levels of service utilisation and cost towards the upper tail-end of the distribution. More generally, the predictive capabilities of these types of model are likely to be limited by the availability of data on a range of other potentially important factors. Knapp (1998), for example, has suggested that, within health and social care settings, there are likely to be a variety of reasons as to why costs will systematically differ across individuals. On the "supply-side", these are likely to include differences in the way services are delivered across localities, variations in the types of interventions offered, variations in professional practice, as well as differences in resource availability. On the "demand-side", differences in parental knowledge about services, and their preferences and levels of motivation for seeking help and the varying costs of attending services (e.g. in terms of geographical convenience) are likely to be of particular significance. Also, agencies may be responding - when allocating services - to individual needs not measured by instruments in the current data, agencies may simply miss, or misinterpret, some needs and therefore not respond appropriately or consistently.

5.7.5 Policy issues

The findings reported in this chapter suggest that the education system bears the largest cost burden when responding to child and adult adolescent psychopathology. These costs are not just restricted to the delivery of specialist services targeting the needs of children and adolescents with these kinds of difficulty: there are also sizeable costs incurred within mainstream schools - including the provision of additional teaching inputs (either by teachers themselves or support staff) as well as time spent meeting and discussing problems with parents. From a public policy perspective these resource commitments are of importance because they imply a diversion of education resources away from other socially beneficial activities (either within or outside the education sector).

Chapters 3 and 4 suggested that there may some important long-term benefits to individuals associated with either the prevention or limitation of psychosocial difficulties at an early age: hyperactivity and deficits in attentiveness were found to be the most damaging in terms of future employment outcomes. The findings in this chapter also imply that there may more immediate benefits to the education system if these types of damaging behavioural and emotional patterns can be effectively managed or prevented by interventions delivered by, for example, child and adolescent mental health services. The wider social costs in adulthood associated with serious behavioural and problems in childhood observed in other studies (Knapp et al., 2002; Scott et al., 2001) also suggests that the social benefits of limiting or preventing these types of difficulties are likely to be felt beyond the education sector - conduct disordered children, for example, are also significantly more likely to use up police time and to come into contact with youth justice services. The findings of Romeo et al. (2005) also point to the potential for important welfare gains for affected families (e.g. in terms of reduced disruption to family life), while behaviourally or emotionally disturbed children and adolescents may themselves experience improvements in both school performance (a partial determinant of whether and how well they are likely to fare in the labour market) as well their ability to make friends and form stable relationships.

A study by the Audit Commission (1999) into the state of child and adolescent mental health service provision in England and Wales reported considerable variation in resource expenditure across health authorities in England and Wales that could not be explained by differences in "need", as measured by a standard index of area-level social deprivation. Notwithstanding some of the limitations of the analyses reported in this chapter, there was also evidence of a considerable variability in resource utilisation and cost at the individual level. Some of the variability may be "legitimate" - at least to the extent that it reflects perceived differences in the need for intervention at the margin. The positive association between costs and the severity of education and social impairment may be indicative of this. "Need" is, of course, a value laden concept that can have varying interpretations (Mooney, 1992; Williams, 1978). Nevertheless, if children with increasing severity of difficulty are viewed as having a greater deficit with respect to social functioning, or with regard to meeting acceptable education standards given their age and inherent abilities, then the cost estimations reported here do imply a targeting of resources towards those who at least may have a greater *potential* to benefit from service inputs.

However, even after allowing for differences in those need-related characteristics and other background variables, the remaining variance in mental health service and education resource costs remains considerable. This points to a degree of inequality in the way that the mental health and education systems deal with "problem" children: after standardising for other background factors the multivariate estimations suggest that children and adolescents with similar levels of reading attainment and social impairment appear to be treated very differently in terms of resource targeting and cost. It could also point to the presence of systemic inefficiencies if the observance of significant cost variability, even after accounting for need-related characteristics, indicates some deviation away from a single best practice, or efficient approach, to dealing with children with a given severity of problem. While these issues would require further exploration in order to reach more concrete conclusions, the findings in this chapter are at least suggestive of a need for a more concerted review of the extent to which public services are currently responding to child and adolescent psychosocial problems in a fair and efficient manner. Some of these issues are returned to in the concluding chapter.

6 Concluding Discussion

This thesis examined two issues:

1. The relationship between adult economic attainment and psychosocial development during late childhood.

2. The economic cost of delivering public services that target emotional and behavioural difficulties experienced by children and adolescents.

A review of the literature was suggestive of a significant link between child and adolescent psychosocial characteristics and employment outcomes in late adolescence and adulthood. Much of the evidence, all using longitudinal data, either from selective samples of children or birth cohorts, points overwhelmingly to a positive association between childhood and adolescent antisocial conduct an increased probability of future unemployment and lack of employment stability. Children and adolescents with behavioural problems are known to be at greater risk of experiencing poorer educational and other social outcomes - including delinquent and antisocial personality development - so it is perhaps of no surprise that they should also experience damage to individual opportunity and economic potential. There is an indication in some studies that the presence of child and adolescent emotional problems and attention deficit problems/hyperactivity may increase the likelihood of experiencing poor employment outcomes later in life. Collectively, however, the evidence is not as extensive nor as consistent in its findings when compared to that concerning with antisocial conduct and future employment status.

A sizeable number of studies reviewed in chapter 1 tended to focus on employment stability (e.g. number of jobs held over a period) or exposure to periods of adolescent or adult unemployment. The remainder - ten in total - considered the relationship between psychosocial development and earnings for those gaining employment. Four of these considered aspects of behavioural development observed in middle and late childhood, with the remainder focussing on adolescent development. Perhaps the most intriguing findings were provided by two studies using British birth cohort data: Feinstein (2000) and Bowles et al. (2001b) both demonstrated a significant link between antisocial conduct in childhood and future earnings - however, their findings are somewhat contradictory. Feinstein reported a positive association between female wages and childhood antisocial behaviour - no significant effect is observed for males. The opposite direction of association is reported by Bowles and colleagues for workers from a birth cohort born in 1958 using a measure of childhood aggression - though male workers in higher status occupations were actually predicted to earn more if they identified as having been aggressive during childhood. Both these studies are of significance because they begin to suggest a more complex picture than might otherwise be painted when looking exclusively at the relationship between behavioural development and measures employment participation.

The empirical investigations reported in chapters 2 and 3 aimed to build on the existing evidence base regarding the longer-term employment consequences of psychosocial development. Chapter 2 focused on a cohort of males of mainly working class origin who, at age 8-9, were attending schools located within an area of inner London. Chapter 3 utilised data from a large British national birth cohort born in 1970. Both studies considered psychosocial outcomes observed during late childhood and their relation to earnings and other measures of employment status when both cohorts were in their early 30s. Chapter 2 also considered job stability and unemployment during late adolescence.

In chapter 4 some potential efficiency- and equity-related justifications for public intervention in child and adolescent psychosocial development were discussed. These included the need to correct, through appropriate forms of intervention, for informational failures inherent within parental decision making as well as the need to limit the wider social harms linked to the externalising effects of disruptive behavioural patterns. Beyond these efficiency-led justifications, chapter 4 also highlighted the importance of equity-led considerations. In more recent thinking regarding the inherent farness of social outcomes, the role of individual choice in the process that brought about an observed distribution of economic wellbeing has been argued to be of central importance. It is certainly the case that accumulation of individual endowments throughout childhood and adolescence, including those relating to behavioural and emotional adjustment, cannot be meaningfully considered as the outcome of a developmental process governed by personal choice: they may have an important pre-determined genetic component; they may be crucially influenced by the decisions, attitudes and preferences of parents and their relationship with their children; or from the general environment to which an individual is exposed during their formative years, including the type of neighbourhood where they lived and the quality of the schooling they receive. With this in mind, the expenditure of public resources on interventions that target the sources childhood disadvantage explored in this thesis could be viewed as an important compensatory adjustment for the differences in opportunity and economic potential that essentially lie beyond an individual's control.

Chapter 5 was concerned with the estimating the costs of intervention. This was conducted using service utilisation data generated from a national epidemiological survey of the prevalence of psychiatric disorders among British 5- to 15-year-olds. Estimates of the mean costs of health and educational resource use thought to be directly attributable to behavioural and emotional disorders in childhood and adolescence were described. Multivariate methods were also used to examine factors that explained variability in costs among those children and adolescents who had some level of involvement with mental health and educational services as a direct result of psychosocial problems they experienced. A particular emphasis was place on examining the degree to which resource costs vary according to the severity of problems experienced, measured in terms of social impact (e.g. family life, ability to make friends, levels of distress experienced) and a measure of academic performance.

The remainder of this concluding chapter summarises and interprets the key findings from the empirical investigations that were carried out and then discusses some of their limitations. The discussion then goes on to consider some of the policy issues arising from the findings with a concluding consideration of some outstanding issues that might be addressed through further research.

6.1 Psychosocial development and future economic attainment

6.1.1 Main conclusions

The findings support existing evidence showing that antisocial children are more likely to experience unemployment and job instability on entering the labour market within a birth cohort born in 1970. However, earnings were found to be positively

related to increasing severity of antisocial conduct in late childhood for male employees and females employed in managerial occupations.

Supporting the evidence reviewed in chapter 1, the longitudinal investigations carried out on the BCS70 data showed that 30-year-olds who had higher antisocial conduct scores at age 10 were less likely to have been economically active at that age (defined as either working or participation in an educational or work training initiative). That being said, the association was only found to be of statistical significance for males. At a descriptive level, just over 30% of 30-year-old men who were unemployed had been located in the top quartile of an index of antisocial conduct at age 10 compared to just 23% of those in full-time work. Nevertheless, conditional probability predictions (holding constant a wide range of other childhood characteristics) revealed that the difference in the chance of being economically when comparing males who were located at the median and at the 90th percentile on the antisocial conduct index were relatively small.

Chapter 2 considered length of unemployment prior to age 32 (>1 year out of work over a 5-year period). Men who experienced this outcome were more likely to have been identified as antisocial at age 10 - though the effect was only statistically significant at the 10 % level. The predicted risk differential between men who were troublesome 10-year-olds and the remainder of the cohort was, however, greater than that observed within the BCS70 cohort with respect to being economically active at age 30. There are obvious differences between the Cambridge and the 1970 birth cohorts making direct comparisons difficult, but it is noteworthy that the adult employment outcome measure used in the former builds in an element of the duration unemployment experienced which may account for the differences in effect size: the BCS70 analyses use a "snap-shot" measure of economic status at a given time point which may provide a less reliable indicator of underlying individual employability:

As well as considering adult unemployment, the analysis of the Cambridge cohort also looked at the link between childhood antisocial conduct and both job stability and unemployment in the teenage years. Troublesome conduct at ages 8-9 was found to be a significantly related to experience of more than 18 weeks of unemployment and also of having more than three jobs post school leaving. The predicted probabilities associated with these outcomes were substantially greater for the troublesome group compared to the rest of the cohort, though it was noteworthy that the effect diminishes over time: experience of a relatively high job turnover rate at age 32 was found to be unrelated to troublesome behaviour in late childhood, while the relationship between the main childhood indicators and a lengthy period of unemployment prior to age 32 was also comparatively weak. It clearly becomes more difficult to directly link late childhood experiences to future outcomes over increasingly extended periods of an individual's life course. This will be partly due to the fact that intermediate mediating processes become more important in determining future employment pathways and these may become increasingly influenced by factors other than childhood-related characteristics. Nevertheless, the strong link with teenage employment outcomes is of potential significance, not least given the importance of early employment experiences for future attainment in labour market (Gregg, 1999). In this sense, the disadvantages associated with behavioural problems in late childhood should be seen as a potentially dynamic and cumulative process. Despite evidence of an elevated risk of job instability and failure to gain employment, or to participate in other human capital-enhancing pursuits, greater severity of antisocial conduct as rated by teachers during late childhood was not found to be linked to a higher average risk of adult poverty at age 30 within the 1970 cohort.

Increasing antisocial tendencies in late childhood within the 1970 cohort were strongly linked to higher male adult earnings at age 30. There was generally no evidence of a corresponding earnings premium for women, though, interestingly, women in managerial jobs who had more severe conduct problems at age 10 were estimated to earn close to 10% more than their peers - this compares to a corresponding premium of 7% for men when looking at male earnings across the full occupational range. While no formal test of the statistical significance of female earning differentials across occupational categories was carried out, this finding is intriguing to the extent that it points to possible differences in the way that certain characteristics among female workers (those relating to childhood antisocial conduct) are rewarded within higher status jobs.

While these findings are somewhat at odds with those reported in other studies where adult pay has been found to be negatively related to earlier behavioural problems (Bowles et al., 2001a; Burgess & Propper, 1998; Cawley et al., 2001), there are good reasons for not viewing the positive relationship between childhood antisocial conduct and earnings as entirely counter-intuitive. It is plausible that those individuals from the BCS70 who selected into stable paid employment at age 30, and who were relatively badly behaved at age 10, may possess latent characteristics that attract a higher wage. Children who are naturally aggressive may, for example, possess greater leadership skills - a sustainable personal characteristic for which for which certain types of employer may be prepared to pay a significant premium. Kuhn & Weinberger (2002), using US longitudinal data (the NLSY) found a significant and positive effect of leadership skills identified during the high school years on adult wages. This finding is to some extent consistent with studies that have found a small but positive wage premium associated with participation in sporting activity at school, a potential correlate of leadership ability (Anderson, 2000; Barron et al., 2000).

Beyond the possible importance of leadership skills as an explanation for the findings reported in chapter 3, a review of the importance of personality in determining adult pay carried out by Bowles et al. (2001a) also provides some additional clues as to why childhood antisocial behaviour may promote higher future attainment for certain individuals. They pay considerable attention to a psychological construct known as "Machiavellian intelligence" - the propensity to manipulate others in the pursuit of self-interest - and cite a number of studies demonstrating a link between this type of psychological trait and higher labour market rewards within certain types of occupation (e.g. Turner & Martinez, 1977; Schultz, 1993). As with leadership skills, Bowles et al suggest that certain types of jobs will value these types of personal "qualities" which, if in relatively scarce supply, will command a premium in the labour market. The concept of Machiavellian intelligence is of relevance to the findings of chapter 3 because it has also been shown to be correlated with measures of childhood aggression. Sutton & Keogh (2000), for example, found that a group of children prone to bullying behaviour had significantly higher "Mach" scores compared to a non-bullying control group. Moreover, pro-bullying attitudes were correlated with an increasing 'desire for social success' within the context of the school environment. Sutton, (2001) has suggested that aggressive tendencies at school may simply be, for many children, an expression of other underlying personal characteristics that find their expression in various externalising behaviours. It therefore seems plausible that, on maturation into adulthood, the persistence of underlying motivations that promote less socially desirable behaviour in childhood could also actively promote social progression and work place performance later on in life.

Childhood attention deficit problems and hyperactivity significantly limit future attainment in the labour market.

Attention deficit problems at age 10 were associated with a lower probability of being economically active and a higher likelihood of living in a low income household at age 30 within the BCS70. However, model estimations only translate into small differences in the predicted likelihood of experiencing these outcomes when comparing individuals who were located at the median and 90th percentiles on the relevant age 10 index. Contrary to these findings, there was no link between teenage or adult employment participation and restlessness/poor concentration at age 8-9 within the Cambridge cohort.

An analysis of occupational status in the 1970 cohort found that inattentiveness at age 10 was significantly related to selection into lower skilled occupations at age 30 and lower earnings. This finding was consistent with the negative effect on earnings at age 32 associated with poor concentration/restlessness in late childhood within the Cambridge cohort. In terms of average effect on weekly pay, women who were significantly more inattentive at age 10 appeared to fare significantly worse than males with similar problems in the 1970 cohort. Point estimates suggest that the negative effect on income is over twice as large for females (12% - versus 5% for males). These also add to the gender differences found in relation to antisocial conduct (see below). These findings have some resonance with those reported by Cawley et al. (2001) who supply evidence of a gender difference with respect to the effect of cognitive ability on adult wages in the US. Why might these gender differences exist? They could reflect cross-gender differentials in occupational selectivity: females may on balance select into jobs in which productivity is more severely impaired by attention deficits that have persisted from childhood. A more cynical interpretation of the difference is that men and women with similar levels of ability (cognitive or non-cognitive) are rewarded/penalised differentially. Finally, gender discrepancies in relation to childhood attentiveness might relate to discrepancies in the educational achievements of girls and boys affected by attention deficit problems. This could result from differences in the way that attention deficits affect learning and educational development across the genders, or it may indicate differences in the way that parents or the education system responded to inattentive behaviour among girls compared to boys within the 1970 cohort. This issue warrants further exploration.

The findings from chapter 4 offered some suggestion that the impact on earnings associated with attention deficit problems may be largely transmitted through occupational selectivity rather than through damaged productivity resulting from the persistence of inattentiveness from childhood into the work place. Firstly, ordered probit estimations revealed that those workers with greater childhood inattentiveness were less likely to select into higher status jobs. Secondly, no statistically significant effect on earnings was found *within* specific levels of occupational categories (with the possible exception of males employed in skilled manual work) suggesting no residual negative impact on earnings over and above that related to the lower likelihood of selection into more skilled occupations. It should again be stressed that these findings need to be tempered somewhat given the limited sample size upon which some of the occupational specific regressions were based.

There was less convincing evidence that emotional problems in childhood have a long-standing influence on future economic attainment.

The evidence reviewed in chapter 1 provides no consistent indication as to whether emotional difficulties experienced in childhood and adolescence will have any substantive long-lasting effect on future economic status. In the current thesis late "emotional wellbeing" was measured using an indicator neurotic tendencies (within the Cambridge cohort) and an index of anxiety and related symptoms (in the BCS70). In the 1970 cohort, there was some descriptive evidence of a relationship between lower occupational status and childhood anxiety: twenty-three percent of males in a professional job were located within the highest quartile of the age 10 index of anxiety compared to 32% of employed in unskilled occupations at age 30. However, this association does not hold for either males or females after conditioning on other variables measured in late childhood.

There was also evidence that increasing levels of childhood anxiety negatively affected earnings at age 30: the effect is stronger for males but less convincing statistically and of a lesser magnitude compared to the earnings effect associated with attention deficit problems. There was also no association between neuroticism at age 10 and future earnings within the Cambridge cohort, nor was it significantly related to other teenage or adult employment outcomes. However, for males in the 1970 cohort, increasing childhood anxiety was a statistically significant correlate of the likelihood of exposure to low income at age 30, though again, the predicted probability differentials between subjects located at the 90th and 50th percentiles on the age 10 anxiety score distribution are small in absolute terms.

Mental health problems observed later on during the adolescent years may turn out to be stronger predictors of future attainment, particularly given evidence of a continuity between adolescent mental health problems and psychiatric illness adulthood - the latter has itself been shown to affect both earnings and employment participation (see evidence reviewed in chapter 1). Hofstra et al. (2001), for example, use Dutch longitudinal data for a general population sample of 11-19 year olds to examine developmental continuities in psychopathology over a 10 year follow-up period. They found that the correlation between mental health problems in the 11-19 age group and the presence of a psychiatric disorder 10 years later decreased among those of a younger age - a finding that has some consistency with the results derived from the BCS70. More generally, depression and anxiety during adolescence were found to be associated with similar problems arising in early adulthood - though the predictive power of the models used to examine these relationships are somewhat limited. The authors note that their findings are consistent with other longitudinal evidence.

6.1.2 Summary of main study limitations

Most of the limitations associated with the longitudinal findings reported in chapters 2 and 3 have already been discussed. This section is restricted to a summary of the main limitations that are generic to both studies.

Cohort-specific effects

Both the Cambridge and the 1970 birth cohorts were born and brought-up during specific periods. The developmental trajectories of adults exposed to periods with different economic, social and policy environments could, in principle, vary. It would therefore be prudent to observe some caution when appraising the significance of the findings reported here if the long-term outcomes associated with child and adolescent development are indeed sensitive to these kinds of period specific effects. This would be of some importance, for example, when attempting to assess the potential long-term benefits of interventions that seek to prevent or limit psychosocial impairments within current generations of children and adolescents.

Selective drop-out over time

This is an easy criticism to lay at the door of longitudinal studies conducted over extensive periods of time, though without access to extensive follow-up data of the type utilised in this thesis it would not be feasible to look at associations that are essentially longitudinal in nature, except when relying on less reliable retrospective reporting within cross-sectional surveys. Nevertheless, it is important to be aware of the problems that can arise from the failure to successfully trace and interview cohort members through time, not least if the process of losing information turns out to be non-random. Numerically speaking, loss to follow-up was not a major problem with the Cambridge cohort (93% of those alive were traced at age 32) though a more substantial proportion of eligible subjects were not included in the age 30 wave of interviewing in the 1970 cohort. It seems plausible that more socially problematic individuals (who would have been more likely to have had psychosocial problems at a younger age) will be more difficult to trace. While there is evidence, for example, that this was the case within the National Child Development Study (the 1958 birth cohort), there was, in fact, little to choose to between those who were successfully followed-up and those who had dropped out on the basis of observable characteristics measured at previous waves of data collection (Hawkes & Plewis, 2004). It therefore remains to be seen as to how serious selective loss of data is in terms of its effect on the reliability of the types of longitudinal associations reported here.

Inter-dependence between explanatory variables

The analysis of adult attainment with the Cambridge and 1970 Birth cohorts may underestimate the true level of importance of psychosocial development for future attainment. This would occur in instances where behavioural or emotional difficulties are damaging to other aspects of personal development observed in late childhood - motivational factors (including self-esteem) and cognitive skills development maybe good examples. These additional factors that will contribute to future attainment independently of psychosocial development were conditioned upon in the econometric estimations reported in chapters 2 and 3. As such the findings presented here, in essence, quantify the relationship between the between behavioural and emotional difficulties in late childhood and economic outcomes at around age 30, net of any other indirect influence they may have via their impact on other relevant childhood factors.

Measurement error

A final issue of generic relevance concerns the problem of measurement error. Multivariate estimation procedures of the type used in this thesis assume that variables are non-stochastic in nature - i.e. that they are measured without any error (Dougherty, 2002). This is unlikely to be a realistic assumption, particularly when relying on external ratings of children's behavioural and emotional development. Teachers, for example, may fail to accurately recall problems, or may have difficulties in making more reliable assessments of classroom behaviour if they have only taught a child for a limited period. Certain types of behaviour may be also be difficult to accurately assess - bullying other children, stealing or property damage can only be meaningfully attributed to an individual if reported to a teacher or directly observed. Moreover, it may be more difficult to accurately record or rate emotional difficulties (e.g. anxieties or depressed mood) because of their more "internalised" nature, at least when compared to problems that are more externalised and easily observable due to the disruption they can cause (e.g. hyperactivity in the classroom). Both the Cambridge and the 1970 cohort used external ratings of the behaviour and emotional wellbeing of children. The former relied on a series of ratings by teachers, peers and psychiatric social workers when constructing dichotomous indicators of the presence or otherwise of specified problems. In line with previous studies, a decision was made to rely on the teacher ratings when analysing the 1970 cohort data in the belief that they would provide a more a more independent and therefore more accurate assessment of the behavioural and psychological characteristics of specific child.

Accepting that it is impossible to completely eradicate measurement error from the types of analyses conducted here, irrespective of the source of ratings eventually used, it remains important to be aware of its potential effects. Within a linear regression framework it can be shown that random error in the measurement of key explanatory variables will bias downwards estimated parameters of interest. It is therefore plausible that many of the effects relating to the main indices of interest are conservative. Moreover, the bias will worsen if the variance of the measurement error is large compared to the true value of the explanatory variable of interest.[1] If, for example, the error variance associated with the teacher ratings of anxiety-related problems are comparatively large, then this may explain the comparative lack of significance of emotional problems in the reported estimations: with BCS70 males, for example, age 10 anxiety is negatively associated with age 30 earnings but the effect is comparatively weak and only significant at the 10% level.

6.2 *The costs of intervention*

6.2.1 *Main conclusions*

Frontline education services are by far the most costly of the resource inputs targeted at behavioural and emotional disorders.

The opportunity costs arising from the allocation of mainstream school inputs towards problem children and adolescents by far outweigh any other of the service-related costs associated with problem children. These "frontline" costs include the cost of teacher time and other-related resources diverted into extra help provided at school, as well as

[1] For a proof of this result, see Dougherty (2002).

meetings with parents. It also includes the allocation of school resources for use in the assessment of any special educational needs arising directly from behavioural and emotional problems. Teachers are likely to be the first source of professional response to behavioural and emotional difficulties for most school children. The educational needs of a relatively small number of children and adolescents are also considered by special needs tribunals which, though used comparatively infrequently, are costly to deliver. Special education resources were the second most costly type of service followed by the costs of delivering child and mental health services. The latter represent only around 8% of the costs associated with frontline education resource use.

Chapter 5 provided an estimate of the total cost of frontline education and other services attributable to child and adolescent psychopathology in Great Britain as a whole. Scaling these estimates down to cover England only, the mean total costs for all disordered children reported in chapter 5 suggests that the overall cost of the response of English frontline education services to childhood mental disorders is equivalent to around 2% of total spending on primary and secondary school education in England during 2001 (around £24.5 billion; Department for Education and Skills, 2004a). These are costs that are seen to be additional to the "regular" costs of school provision for children with a psychiatric disorder.

Child and adolescent mental health service costs account for a relative small proportion of overall costs attributable to child and adolescent psychopathology, though they significantly exceed those relating to the primary care and children's health service provision. The mean cost of mental health services was estimated to be less than £60 per child over 12 months for all children with a disorder, including contacts made with child psychiatrists, psychologists, family therapists and other specialist services. In overall terms, the costs of child and adolescent mental health services at a national level, using the estimated means from chapter 5, amount to around 1% of recently published estimates of total spending on adult mental health services within the National Health Service in 2002 (£6.5 billion; Sainsbury Centre for Mental Health, 2003).

Variations in mental health service and educational resource costs are not random and children with increasing levels of "need" attract a greater level of cost.

Multivariate analysis of cost variability at the individual level revealed that resource costs associated with mental health and education services are not random, though the models of cost variability fall well short of explaining all observed variation in the sample of children examined. While the data did allow costs to be conditioned on range of explanatory variables, including those relating to the severity of psychosocial problems experienced and various family and parental characteristics, the impact of other factors, particularly those relating to the supply of services (e.g. resource availability, professional characteristics) could not be examined.

Despite these limitations, there was evidence that resource use and costs are responsive to differences in the severity of problems experienced as measured using a summary index of the impact psychosocial problems on learning, leisure, friendships, home life and levels of distress, and a separate index of reading attainment at school. This is partially reassuring, at least to the extent that it indicates a targeting of resources on those children with a greater *potential* capacity to benefit from intervention.

However, the multivariate models that were fitted to the cost data are unlikely to fully capture the complexity behind those factors that drive unequal levels of resource use across children who make contact with services. This is particularly evident when more extreme cost values were retained with the estimation samples: compared to the use of "trimmed" samples, explanatory power is impaired and the importance of the problem impact score and reading attainment variables were significantly diminished. It is also important to note that the estimations reported here deal entirely with the targeting of resources among children who actually utilise services. Other analyses of the same survey data employed in this chapter show that 75% of children with a recognised psychopathology do not engage with mental health services (Ford, 2004). Targeting in these terms could therefore be regarded as being poor, though the influence of demand-side factors (e.g. parental awareness and motivation) as well as local resource availability and service capacity, as opposed to service responsiveness *per se*, are likely to be more important reasons as to why service involvement appears to be so low.

6.2.2 *Summary of main study limitations*

Selective drop-out

The follow-up surveys of the British Child and Adolescent Mental Health Surveys were subject to a systematic loss of study participants who were included in the original baseline epidemiological survey: children and adolescents from poorer backgrounds were generally under-represented at follow-up. There is published evidence (cited in chapter 4) that selective loss of information of this nature could downward bias resource use and cost estimates.

Limited breadth of service coverage

Missing data and issues of confidentially prevented the comprehensive costing all types of services that children and parents were reported to have contacted over a three year period. Noteworthy exclusions were the costs of police and youth justice services contacts - these are likely to be of greater importance when assessing the costs associated with behavioural disorders. Costs of social services contacts were not included. Other UK studies put these types of cost at no more than 3% of the overall total. The costs of psychotropic medication were also excluded, though again, these will only make a up a relative small proportion of overall health and education service costs. The costs to families arising from child and adolescent psychopathology were also omitted. The costs of parental time inputs and general disruption to family life have the potential to be highly significant (Romeo et al., 2005). There amelioration could, in fact, represent an important source of social benefit from interventions that can effectively limit or prevent behavioural problems or emotional difficulties.

Cost variations: data and econometric limitations.

Cost variations were examined for mental health and education services using a rather limited number of cases - this was partly due to restricting the estimations to children and adolescents who had a positive level of service-related cost. Data observations with more extreme cost values subsequently had an important influence on the findings, with improvements in predictive power and in the strength of association between severity of problem measures and cost increasing when these outliers were excluded. In most instances, outliers appeared to be genuinely costly individuals, though in one instance there was some concern as to the reliability of measured costs. Specification tests revealed some evidence of functional form misspecification: all the models assume that raw scale costs are an exponential function of the explanatory variables included in the multivariate estimations - otherwise referred to as a log-link function when using the terminology of generalised linear modelling. This is a conventionally adopted specification in studies of health care utilisation and costs in the economics and related literatures. However, it need not adequately explain all heterogeneity among children and adolescents who receive help from education and mental health services.

6.3 Policy implications

The findings presented in this thesis should be viewed as a contribution to our understanding of the long-term economic and social implications of behavioural and emotional development during childhood, and the cost consequences of public intervention. While the findings are subject to a number of limitations and caveats, they do raise some important issues that are of potential significance for public policy.

Attention deficit problems in late childhood

Recognising problems at the point of transition from primary into secondary school could enable the planning of an effective package of interventions preventing failure at school and improving opportunities for accessing better paid jobs.

The expectation is that children more severely affected by inattentiveness during late childhood will, on average, go on to earn less over their working lives. The empirical investigations described in chapter 3 offered some tentative evidence that employees in the 1970 birth cohort who had significant attention deficit problems at age 10 ended up earnings less because they did not progress into more skilled and better paid jobs. It would seem fair to conclude that lower educational achievement at school is likely to have a significant role to play in limiting opportunities for gaining access to more economically rewarding occupations. This in turn would tend to reinforce the importance of intervention, either by the education system or mental health services, prior to the completion of formal schooling.

The findings - which relate to problems observed at age 10 - would imply that an improved awareness of significant deficits in attentiveness among pupils of that age could offer an important opportunity for the prospective planning of interventions that seek to improve learning trajectories during the secondary school years. Chapter 5 has shown that, in resource terms, schools and special education services already offer a significant level of input in targeting the educational needs associated with those children who have problems that are serious and pervasive enough to warrant a psychiatric diagnosis. Much of this input revolves around providing additional help to pupils within a mainstream school environment, as well as teaching provided within a more specialist educational environment.

However, as recognised in recent policy statements (HM Treasury, 2003b), child and adolescent mental health services may also have a vital role to play in dealing with the root cause of learning problems experienced by children who are inattentive and hyperactive, as well those with other pervasive psycho-developmental problems. Drug therapy is a common treatment strategy for children with attention deficit and hyperactivity (Lord & Paisley, 2000). In the United States around 2.5% of school children are prescribed a medication for hyperactive behaviour - the majority are given the psycho-stimulant drug methylphenidate (Ritalin) (Cooper, 2001). While psychotropic medication for children and adolescents has proved controversial (there are concerns around the lack of knowledge concerning whether it has any long-term harmful effects), the UK has seen a 68% increase in the use of antidepressants, stimulants and other kinds of medication over the period 2000-2002 (Wong et al., 2004). Moreover, there is evidence that, with an appropriate dosage, this kind of treatment can be effective in improving attentiveness and reducing problem behaviour (Farmer et al., 2002; Greenhill, 1998; Lord & Paisley, 2000).

Evidence on the cost and cost-effectiveness of psycho-stimulant medication - an increasingly important consideration within NHS resource allocation - is less plentiful. The current annual cost of prescribing methylphenidate at a standard dosage is around £200 per child (Lord & Paisley, 2000). This is in fact a modest amount compared to the costs to the British NHS of prescribing other types of psychotropic medication, particularly those still under patent, including, for example, a-typical antipsychotic medication for adults with schizophrenia (around £1220 per patient annually; (National Institute for Clinical Excellence, 2002)). The National Institute for Health and Clinical Excellence (NICE)[2] has recently reviewed the cost-effectiveness relating to drug treatments for attention deficit/hyperactivity disorder (Lord & Paisley, 2000). A submission of evidence to this review - using a decision modelling approach - compared the cost and effects of drug treatment to a "no treatment" strategy. It was concluded than an additional Quality Adjusted Life Year (QALY)[3] could be bought at a cost

[2] A quasi-regulatory body offering guidance for health service commissioning agencies on the effectiveness and cost-effectiveness of medical technologies.

[3] QALYs provide a summary index of the impact of a medical treatment on a patient's quality of life and life expectancy (Drummond et al., 1996). The quality adjustment factors are derived from "utility"

significantly below the maximum threshold for what is normally considered to be a cost-effective treatment option by NICE (£30,000 per additional QALY gained).

Medication is only recommended for use within a multimodal modal approach to dealing with attention deficit and hyperactivity disorders within UK practice settings (Cooper, 2001). This will normally include a course of behavioural therapy involving trained therapists combined with psycho-stimulant treatment. The behavioural therapies themselves can vary quite significantly and may include one-to-one sessions with child and parent, group sessions including other children and parents as well as programmes that directly involve teachers (Best Treatments, 2005). Whereas the prescribing of medication has an obvious biological focus in its approach to controlling problem symptoms, behavioural therapies target behavioural management and the interaction between parent and child. While it is yet to be established whether behavioural interventions are effective *per se* (Lord & Paisley, 2000), recent experimental trial evidence suggests that a multimodal approach is more effective than behavioural therapy alone (MTA & Group, 1999). The effective management of attention deficit and hyperactivity may also be made complicated by their co-existence with other types of behavioural problem - particularly conduct disorders (Goodman, 2005). There is growing evidence suggesting that the latter could be effectively dealt with using parent-training techniques or other community-based programmes (Farmer et al., 2002; Scott Spender et al., 2001). Evidence relating to parenting programmes are outlined in more detail below.

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weighting applied to various states of health-related quality of life either by the public, patients or health service professionals. It is questionable whether these measures are completely appropriate in terms of identifying treatment outcomes relating to childhood mental disorders.

Antisocial conduct in late childhood

Identifying troublesome children who are at much greater risk of developing persistent life-course antisocial tendencies would promote the effective and efficient targeting of resources on problems that are more individually and socially damaging in the long-term. However, many badly behaved children will not develop into adult sociopaths and may in fact possess underlying characteristics that promote future success in the labour market. Policy and practice within schools might seek to limit the immediate social harm that these characteristics engender within a school environment (e.g. bullying, fighting), perhaps by channelling aggression and other antisocial behaviour into more individually and socially productive pursuits.

There is now plenty of evidence (cited in chapter 1) showing that conduct problems in late childhood are an added risk factor for life-course persistent antisocial behaviour. Unstable employment patterns and periodic spells of unemployment are an integral feature of this type of developmental trajectory. However, it would be misleading to imply that all children with conduct problems face a lifetime of social deviancy and unemployment. Many will probably experience a relatively normal pattern of social development and will maintain a stable employment record. Moreover, the evidence presented in this thesis showed that antisocial 10-year- old boys born in 1970 who were working at age 30 tended to get paid more than their peers, other things equal, as did antisocial girls who selected into managerial occupations. There are some important policy issues that fall out of these findings.

Public agencies could potentially improve the social productivity of resource allocations if they were in a position to successfully identify which troublesome individuals in late childhood are the more likely to become more socially problematic over the longer-term, and more prone to significantly diminished opportunities in terms of their own personal development and future wellbeing. Child and adolescent mental health services already seek to target children who meet the requisite psychiatric criteria for a diagnosis of conduct disorder. It may be that these psychiatric classifications already serve as an effective screening device for selecting out those children whose problems are serious and pervasive enough to imply that they are likely to be more problematic over the longer-term.

There are in fact a number of pointers as to the seriousness of late childhood conduct problems in terms of their longer-term prognosis without corrective action. Without corrective action, a 10-year-old whose behavioural problems began during the pre-school years will face a significantly elevated risk of developing persistent antisocial tendencies through adolescence and into adulthood (Moffitt, 1993). Moreover, all the evidence shows that a high hereditary component, early age neuropsychological deficits, co-morbid problems (including hyperactivity and emotional difficulties), language disorders and low IQ are all characteristic features of individuals whose behavioural problems become life-course persistent from an early age (Moffitt, 1993; Moffitt et al., 1994; Silberg et al., 1996). There may also be other indicators regarding long-term prognosis. A sub-group of children with conduct problems also experience peer unpopularity resulting from major deficits in social skills. Group unpopularity has itself been shown to be a major determinant of whether antisocial children become delinquent, fail at school and experience poor employment outcomes (Hinshaw, 1992;

Kokko & Pulkkinen, 2000; Loeber & Hay, 1997; Rutter et al., 1998). The long-term prognosis for aggressive children may also crucially depend on the quality of their home environment and particularly the quality of relationship they have with their parents and the nature of the parenting regime to which they are exposed to (Kokko & Pulkkinen, 2000).

Publicly funded parenting programmes provided within child and adolescent mental health service settings are now gaining popularity in the UK as a means of targeting children viewed as being at high risk of developing life-course persistent behavioural problems. Review evidence does support the view that they are an effective means of behavioural management (Farmer et al., 2002). Scott et al. (2001), for example, report the findings from a multi-centred randomised experiment of a specific type of parenting programme developed in the US and tested within health service settings within the UK. All children included in the evaluation were aged 3-8 years. Those in the control group (a no treatment exposure waiting list) showed no change in behaviour 5-7 months after entering the trial. However the children of parents who were randomly assigned to the experimental intervention showed, on average, marked improvements in behaviour: mean conduct problem scores fell to within a range of normal behaviour at follow-up, though a third of the treatment group did show resistance to change.

The preceding discussion is not meant to imply that any antisocial behaviour in late childhood that does not fit a life-course persistent characterisation should be considered a public policy irrelevance. Behaviourally problematic 10-year-olds who are more likely to be "non-persistent" will generally cease any socially deviant behaviour by the time they are 18 (Moffitt, 1993). Nevertheless, bullying, fighting, disruptiveness in the classroom, property damage and theft are all socially harmful behaviours. There may therefore still be a justifiable case for schools and other agencies to intervene in limiting this type of behaviour, even where the types of interventions required may be quite distinct from those targeted at children who come into contact with specialist psychiatric services. Evidence cited earlier in this chapter showed that many children showing aggressive tendencies share underlying characteristics that may in fact be individually beneficial in the longer-term. Bullying and other socially undesirable behaviours may therefore simply be a conduit through which some children express an underlying social competitiveness or "Machiavellian" tendency within their immediate environment (Sutton, 2001). Bad behaviour may also be indicative of underlying leadership skills which may also attract a future wage premium. In summary, the challenge for policy and practice may ultimately be to offer a means minimizing the wider social harm linked to developmental characteristics that are more likely to be individually beneficial in the longer-term.

Mental health services and costs to the education system

Behavioural and emotional disorders in childhood and adolescence result in significant opportunity costs rèlating educational resource use - particularly within a mainstream school environment. Expanding the provision of effective child and adolescent mental health service provision could lead to more socially productive resource allocations.

Emotional and behavioural problems in childhood and adolescence can often demand a multi-agency response. While historically this has been rather uncoordinated in terms of service provision within a British context, the effect of decisions made in one sector or by one specific agency, may have important repercussions, in resource terms, for other "stakeholders". The recently published Green Paper *Every Child Matters* and the new National Services Framework for children make an explicit commitment to further investment of public resources in child and adolescent services as well introducing measures to improve the coordination, planning and communication across different agencies. Assuming that these plans are followed through, and that there are effective services and treatment regimes that can be put in place, then this type of initiative could have wide reaching resource implications, particularly within the education system.

Chapter 5 showed that the opportunity costs associated with the allocation of teacher time and other mainstream school resources represent a significant proportion of the overall health and education system costs linked to children and adolescents identified with a psychopathology. Evidence from parental interviews within the British Child and Adolescent Mental Health Surveys show that many of the service contacts with mainstream schools were parent-teacher discussions regarding children's difficulties as well as teacher time allocated to offering additional advice to parents about mental health and behavioural issues. If behavioural difficulties can be ameliorated or emotional states improved via the delivery of effective services within the National Health Service, then there may be important opportunities available for freeing up education and other resources (including parental time) towards other socially productive uses. Ford et al. (2003) provide an anecdotal example of how these inter-agency processes might actually work. Their example relates to 15- year old boy with a hyperkinetic disorder:

"A 15-year-old with hyperkinetic disorder, whose behaviour and educational progress had improved markedly on methylphenidate at the time of the first survey continued to do well during the follow-up period. His child psychiatrist saw him with his parents four-monthly to monitor his height and blood pressure, and to discuss his academic progress and any other concerns. The psychiatrist had been instrumental in ensuring that that he would be allowed extra time in his GCSE exams. However, he was doing so well at school that his mother had required no contact with his teachers outside ordinary parents evenings. She reported that both the medication and the support from the child psychiatrist had been extremely beneficial" (taken from: Ford et al., 2003; page 50).

Investment in mental health services for children and adolescents will in itself have opportunity costs. These, of course, need to be balanced against the resource impacts for other agencies and the broader welfare impacts for children and their families when making a more complete appraisal of new investments in services.

6.4 Future research

6.4.1 Childhood antisocial conduct and earnings: reconciling discrepancies in the evidence

The previous discussion of the policy issues arising from the main findings concerning antisocial conduct in childhood is largely predicated on the assumption that the nature the relationships reported in chapters 2 and 3 hold more generally. However, there are some discrepancies between the findings that have been described here and the few studies that have looked at childhood behavioural problems and future earnings. Feinstein (2000), using an earlier wave of the BCS70 adult data, reported a positive association antisocial behaviour at age 10 and female wages (the corresponding effect reported in chapter 3 is non-significant though positive and significant for women in managerial jobs), and a non-significant wage effect for male antisocial conduct at age 10 (chapter 3 reported a positive effect on male earnings). Based on estimations using data from the National Child Development Study Bowles et al. (2001b) report a negative association between childhood aggression (instrumenting for adult aggressiveness) and male and female earnings, though male earnings were reported to be positively associated with childhood aggression for those employed in "high status" jobs. These discrepancies point to the need for further exploratory investigations in order to gain more understanding as to why these inconsistencies arise. One possibility, for example, concerns the choice of control variables: in the study reported by Bowles and colleagues, earnings were also conditioned on IQ, years of schooling, qualifications achieved at school, childhood "withdrawal" and socio-economic status in childhood. Their model did not include other background variables, though whether this can explain the opposite direction of effect observed in the work reported is open to question. It is also worth emphasising that chapters 2 and 3 looked specifically at weekly pay (as opposed to wage rates). As such, it is possible that the differences between the findings reported here and those of other studies in relation to childhood antisocial conduct could be accounted for by labour supply-effects rather differentials in market rewards per unit of labour time supplied.

6.4.2 Economic attainment at different stages of the life cycle and cross-cohort comparisons

Chapters 2 and 3 considered economic outcomes in relation to childhood psychosocial development within specific cohorts. A more extensive test of whether the same findings hold within other British birth cohorts, namely those born in 1948 and 1958 would be of added value. This would enable further examination of the extent to which the evidence derived from the types of analyses reported here are sensitive to the choice of cohort examined.

Chapters 2 and 3 also looked at outcomes at a particular stage of the working life cycle. This raises questions as to whether the same magnitude and direction of effect associated with psychosocial characteristics in late childhood will be observed at more advanced ages. An investigation of the association between behavioural and emotional development in childhood and adult attainment at middle age and beyond would help to address this issue and enable better projections to be made regarding the impact of these kinds of developmental problems over an individual's life-course. Research along these lines should be possible within the previously mentioned older birth cohorts.

6.4.3 Age of onset

Chapters 2 and 3 both considered the relationship between adult economic attainment and psychosocial outcomes in late childhood. While both investigations observed some important associations between the main psychosocial indicators of concern and future attainment, it is important to be aware that the strength of the longitudinal relationships of interest are unlikely to be independent of the age at which behavioural and emotional difficulties are observed. Signs of significant psychological and behavioural problems at an early pre-school age are known to be strongly correlated with adult antisocial personality and delinquency (Moffitt, 1993). It therefore seems plausible, for example, that behavioural problems observed at a very early age might serve as a much stronger childhood predictor of future employment participation later on in life compared to behaviour observed at more advanced stages of childhood and adolescence. This chapter has already cited evidence, for example, suggesting that the importance of emotional development for future attainment may depend on whether problems are experienced during childhood or later in the adolescent years.

6.4.4 Developmental dynamics

A related issue concerns the importance of studying the dynamic aspects of psychosocial development. The long-term damage associated with child and adolescent behavioural and emotional problems may heavily depend on whether problems observed at a given age persist or desist over the course of time. Transitional states across different ages were not explored in the current thesis, though the major British birth cohort data sets and data from other longitudinal studies, such as the Cambridge cohort, provide opportunities for pursuing this line of enquiry. Feinstein & Bynner (2004), for example, have looked at this issue in relation to cognitive development within the BCS70 data. Healey et al. (2004), in a related study to that reported in chapter 2, have examined the relative impact on future economic status of different developmental pathways, with a particular focus on childhood conduct problems and the transition or otherwise into adolescent delinquent behaviour. Troublesome boys who became juvenile delinquents were significantly more likely to experience poor employment outcomes compared to those whose troublesome behaviour at age 10 did not extend into adolescent delinquency and for those whose delinquency was not preceded by troublesome behaviour during late childhood.

6.4.5 Informing the evaluation and appraisal of policies and programmes of intervention

Part of the value of conducting longitudinal investigations of the type described here is that they might begin to inform policy makers as to the potential long-term benefits of policies and programmes that target psychosocial problems prior to entry into the labour market. If interventions that seek to alter developmental trajectories are to be viewed as investments in human potential then evidence needs to be provided on their likely impacts far into the future in order that their social value can be considered along side the costs involved with implementation.

Many evaluations of new school-based interventions or trials of drug treatments and programmes delivered by child and adolescent mental health services can only feasibly observe the outcomes of these initiatives over a very limited span of time. For example, the evaluation of the parenting programme cited earlier only followed up children and parents over a period of 5-7 months after entering the trial. To follow-up children who participate in an experimental evaluation over a significant portion of their life course is likely to be difficult practically (loss to follow-up would be a more obvious problem) as well as prohibitively costly in research terms. Moreover, policy makers usually require answers to questions on the costs and outcomes of interventions within a short time frame. Exploring ways of explicitly linking up evidence from experimental studies of child and adolescent interventions with evidence on long-term outcomes derived from the analysis of birth cohort data could be a fruitful avenue of pursuit. For example, can any observed changes in indices of emotional states or behaviour attributable to an intervention with an experimental evaluation be feasibly mapped on to the kinds of psychosocial measures used within existing longitudinal data sets? If so, this could in principle offer a means of assessing the potential effect of the these types of intervention in terms of, for example, future earnings potential or the likelihood of employment participation.

6.4.6 Developing and improving model specifications when exploring cost variability

The modelling of public service cost data is becoming increasingly common within applied economic research (Knapp, 1998; Lipscomb, 1998; Manning & Mullahy, 2001). Estimation methods for studying cost variations are also becoming increasingly more sophisticated with a growing emphasis placed applying statistical procedures that suit the data at hand, particularly where there are concerns regarding its underlying distributional properties: non-normality is the rule rather than the exception (Manning & Mullahy, 2001). However, there is generally less guidance on the types of functional specifications that are likely to best describe the underlying relationships between cost and individual characteristics. The multivariate investigations described in chapter 5 adopted a conventional "log-link" specification of the relationship between costs and a linear combination of explanatory variables (akin to the semi-log models estimated using OLS). In future, more detailed testing of other types of functional forms might yield better fitting models, while the inclusion of a non-linear specification of important explanatory variables (e.g. indicators of need) might lead to a greater understanding of how resources are allocated at the micro level: each of the models reported in chapter 5 assumed that changes in cost are proportionately linear as SDQ impact scores or measures of academic attainment increase, which may be an unnecessarily restrictive assumption. However, there are pitfalls involved with seeking out better fitting models, not least the fact that there is little theoretical guidance on what might be the most appropriate specification to adopt.

The estimations reported in chapter 5 were also unable to look in detail at the importance of supply-side factors on cost differences across children and adolescents in need of help. Local resource availability, as recently reported in an Audit Commission report on the state of child and adolescent mental health services, are one potential supply-side influence - though given recent policy commitments to improve services nationally this may become less important over time (HM Treasury, 2003b). Professional judgements, motivations and preferences over the ways in which psychosocial problems should be tackled could also, in principle, vary quite considerably. The importance of the "agency" role of clinicians and other professionals may be important, not just because of its impact on costs *per se,* but also because differences in the way professionals respond to different children who are similar in terms of the problems they present with may be indicative of inefficiencies and inequities in the way the health and education system as a whole responds to children and adolescents with behavioural or emotional difficulties. A more in depth empirical examination of these issues will inevitably require more extensive data relating to the types of supply-side factors discussed.

6.4.7 Efficiency and resource allocation

Multivariate models of cost variability do not, on their own, deliver any indication of whether public services currently respond in an *efficient* manner to psychosocial problems in childhood and adolescence. This requires some measure of the *productivity* of health and educational resource inputs with respect to their impact on the wellbeing of problem children, their families and the wider society. So, for example, do behavioural therapies or drug treatments delivered by mental health professionals effectively manage or improve emotional wellbeing, poor attentiveness or disruptive behaviour? Similarly, are teachers effective at managing the disruptive effects of conduct problems or hyperactive behaviour in the classroom? Will allocating additional teacher time to problem children promote a better learning trajectory and levels of educational attainment than might otherwise have been expected? Moreover, to what extent are different types of services inputs either complimentary to one another or effective substitutes? This latter issue has recently been raised in the context of the policy debate concerning the most appropriate educational settings within which to locate disruptive pupils (Curtis, 2004).

Issues of effectiveness/productivity and cost-effectiveness are traditionally explored in health care settings using randomised controlled experiments of specific types of interventions and service arrangements (Drummond et al., 1997). However, the use of non-experimental data can also yield important insights into the effect of service inputs on outcomes (however measured) so-long as confounding sources of heterogeneity can be adequately controlled for. This "production function" approach is an established technique within the economics of education literature (Hanushek, 1986), and has also recently been applied to the evaluation of the productivity and efficiency of community care arrangements for elderly people (Davies & Fernández, 2000). To date the British Child and Adolescent Mental Health Surveys have provided a unique opportunity to investigate the magnitude of the costs of health service and educational resource use linked to psychosocial problems within a national epidemiological sample of British children. The surveys are, however, ongoing and are continuing to collect information at follow-up on the severity and impact of emotional difficulties for those children who were initially surveyed. Combined with the evidence generated on service use and costs, the longitudinal nature of this data could, in principle, begin to enable input allocations and costs to be linked, using appropriate econometric procedures, to any measured changes in problem severity and impact scores (e.g. using the strengths and difficulties questionnaire or other available measures). This type of exercise would provide a starting point for addressing some of the more searching questions concerning resource allocation and efficiency within public services targeting psychosocial problems in the child and adolescent population.

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Appendices

Appendix: chapter 2

Models estimated on each multiply imputed data set

Variable label definitions

Label	Definition
logpay	Log of weekly earnings (age 32)
untim18	> 18 weeks of unemployment since school leaving (age 18-19)
unlfy12m	> 1 year of unemployment over 5 years (age 32)
jobs_318	> 3 jobs since school leaving (age 18-19)
Jobs_332	> 3 jobs over 5 years (age 32)
tbc8	Troublesome/antisocial (1= yes;0=no)
trlc80	Restless/Poor concentration (1=yes; 0=no)
njn10d	Neurotic (1=yes;0=no)
iq8c	Low non-verbal IQ (1=yes;0=no)
if8	Low family income (1=yes;0=no)
sp10	Poor parental supervision (1=yes;0=no)
afmc10	Harsh discipline by parents (1=yes;0=no)
fs8	Large family (1=yes;0=no)
mp8	Parental conflict (1=yes;0=no)
snp10	Disrupted family (1=yes;0=no)

Data set 1

OLS: log of weekly earnings (age 32)

```
Source |       SS       df       MS                  Number of obs =     326
-------------+------------------------------            F( 10,   315) =    1.66
       Model |  3.34599955    10  .334599955            Prob > F      =  0.0894
    Residual |  63.5230842   315  .201660585            R-squared     =  0.0500
-------------+------------------------------            Adj R-squared =  0.0199
       Total |  66.8690837   325  .205751027            Root MSE      =  .44907

------------------------------------------------------------------------------
      logpay |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        tbc8 |   .0669844   .0724468     0.92   0.356    -.0755563    .2095251
      trlc80 |  -.1327619   .0695723    -1.91   0.057    -.2696471    .0041233
      njn10d |  -.0433291    .054543    -0.79   0.428    -.1506437    .0639856
        iq8c |   -.074901   .0619372    -1.21   0.227     -.196764     .046962
         if8 |  -.1626868   .0742282    -2.19   0.029    -.3087325   -.0166411
        sp10 |   .0292099    .076305     0.38   0.702    -.1209221    .1793418
      afmc10 |  -.0061995   .0610002    -0.10   0.919    -.1262188    .1138197
         fs8 |  -.0557331   .0657271    -0.85   0.397    -.1850527    .0735865
         mp8 |  -.0070752   .0664084    -0.11   0.915    -.1377353    .1235849
       snp10 |   .0370465   .0649877     0.57   0.569    -.0908184    .1649115
       _cons |   5.110967   .0376723   135.67   0.000     5.036846    5.185089
------------------------------------------------------------------------------
```

Probit: > 18 weeks of unemployment (age 18-19)

```
Probit estimates                                   Number of obs   =        368
                                                   LR chi2(10)     =      42.42
                                                   Prob > chi2     =     0.0000
```

Log likelihood = -105.30324 Pseudo R2 = 0.1676

untim_18	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.6966087	.2301522	3.03	0.002	.2455187	1.147699
trlc80	-.2695621	.2524641	-1.07	0.286	-.7643826	.2252584
njnl0d	-.0184644	.207306	-0.09	0.929	-.4247767	.3878479
iq8c	.4324669	.209749	2.06	0.039	.0213664	.8435674
if8	.6030001	.248928	2.42	0.015	.1151102	1.09089
sp10	-.4206665	.2640302	-1.59	0.111	-.9381562	.0968232
afmc10	.1583292	.2214082	0.72	0.475	-.2756229	.5922813
fs8	-.2039214	.2586665	-0.79	0.430	-.7108983	.3030555
mp8	.3599352	.2234241	1.61	0.107	-.0779681	.7978385
snp10	.4737671	.2075138	2.28	0.022	.0670475	.8804867
_cons	-1.882755	.1746638	-10.78	0.000	-2.22509	-1.540421

Probit: > 1 year unemployment over 5 years (age 32)

Probit estimates Number of obs = 376
LR chi2(10) = 20.13
Prob > chi2 = 0.0281
Log likelihood = -154.98656 Pseudo R2 = 0.0610

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3265148	.2096764	1.56	0.119	-.0844433	.7374729
trlc80	.1323383	.2105346	0.63	0.530	-.280302	.5449785
njnl0d	.2439382	.16974	1.44	0.151	-.0887461	.5766224
iq8c	.2680016	.184303	1.45	0.146	-.0932257	.6292288
if8	.3861346	.2172038	1.78	0.075	-.039577	.8118462
sp10	-.0717914	.2278209	-0.32	0.753	-.5183121	.3747293
afmc10	-.0721408	.2017693	-0.36	0.721	-.4676014	.3233198
fs8	.0646196	.2040593	0.32	0.751	-.3353293	.4645686
mp8	-.0571399	.2115866	-0.27	0.787	-.4718419	.3575621
snp10	-.0977014	.2045464	-0.48	0.633	-.4986049	.3032021
_cons	-1.323804	.1300653	-10.18	0.000	-1.578728	-1.068881

Probit: unstable employment (age 18-19)

Probit estimates Number of obs = 361
LR chi2(10) = 56.13
Prob > chi2 = 0.0000
Log likelihood = -222.15739 Pseudo R2 = 0.1122

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3966709	.1906709	2.08	0.037	.0229629	.7703789
trlc80	.0541704	.1876823	0.29	0.773	-.3136801	.422021
njnl0d	-.0439547	.1534645	-0.29	0.775	-.3447395	.2568301
iq8c	.4027918	.1649087	2.44	0.015	.0795768	.7260069
if8	.1074741	.1959149	0.55	0.583	-.2765121	.4914603
sp10	.0952748	.1897255	0.50	0.616	-.2765803	.4671298
afmc10	.2103606	.1651266	1.27	0.203	-.1132816	.5340028
fs8	.5850147	.183799	3.18	0.001	.2247753	.945254
mp8	.2641108	.1793238	1.47	0.141	-.0873573	.615579
snp10	.2086394	.1725824	1.21	0.227	-.1296159	.5468947
_cons	-.5271546	.1098996	-4.80	0.000	-.742554	-.3117553

Probit: unstable employment (age 32)

Probit estimates Number of obs = 369
LR chi2(10) = 3.60
Prob > chi2 = 0.9635
Log likelihood = -191.12297 Pseudo R2 = 0.0093

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.0160234	.2112069	0.08	0.940	-.3979346	.4299814
trlc80	.2041913	.2028238	1.01	0.314	-.193336	.6017186
njn10d	-.1025676	.1628814	-0.63	0.529	-.4218092	.216674
iq8c	-.1449644	.1829018	-0.79	0.428	-.5034453	.2135165
if8	.0625859	.214365	0.29	0.770	-.3575618	.4827336
sp10	-.1421021	.2183808	-0.65	0.515	-.5701205	.2859164
afmc10	-.0048432	.182165	-0.03	0.979	-.3618801	.3521937
fs8	-.0467876	.1951918	-0.24	0.811	-.4293566	.3357813
mp8	-.1378288	.1912756	-0.72	0.471	-.5127221	.2370646
snp10	.0375058	.1872963	0.20	0.841	-.3295882	.4045998
_cons	-.7185363	.1113416	-6.45	0.000	-.9367619	-.5003107

Data set 2

OLS: log of weekly earnings (age 32)

Source	SS	df	MS
Model	3.24270273	10	.324270273
Residual	63.626381	315	.201988511
Total	66.8690837	325	.205751027

Number of obs	= 326
F(10, 315)	= 1.61
Prob > F	= 0.1038
R-squared	= 0.0485
Adj R-squared	= 0.0183
Root MSE	= .44943

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tbc8	.0632431	.0722123	0.88	0.382	-.0788364	.2053226
trlc80	-.1297896	.069541	-1.87	0.063	-.2666131	.007034
njn10d	-.0228058	.0553237	-0.41	0.680	-.1316565	.0860449
iq8c	-.0742339	.0619801	-1.20	0.232	-.1961813	.0477134
if8	-.1643732	.0742451	-2.21	0.028	-.3104522	-.0182942
sp10	.0129332	.0769934	0.17	0.867	-.138553	.1644195
afmc10	-.0068449	.0610671	-0.11	0.911	-.1269959	.1133061
fs8	-.0549263	.0658442	-0.83	0.405	-.1844764	.0746238
mp8	.0123804	.0683518	0.18	0.856	-.1221034	.1468642
snp10	.0352928	.065291	0.54	0.589	-.0931687	.1637543
_cons	5.104767	.0382535	133.45	0.000	5.029502	5.180032

Probit: > 18 weeks of unemployment (age 18-19)

Probit estimates

Log likelihood = -105.82198

Number of obs	= 368
LR chi2(10)	= 41.38
Prob > chi2	= 0.0000
Pseudo R2	= 0.1635

untim_18	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.6799306	.2270012	3.00	0.003	.2350164	1.124845
trlc80	-.2826134	.2527996	-1.12	0.264	-.7780914	.2128647
njn10d	.0056553	.2125994	0.03	0.979	-.4110318	.4223424
iq8c	.4302099	.2099347	2.05	0.040	.0187453	.8416744
if8	.5917705	.2461299	2.40	0.016	.1093647	1.074176
sp10	-.4083872	.284926	-1.43	0.152	-.966832	.1500575
afmc10	.2357192	.2166873	1.09	0.277	-.18898	.6604184
fs8	-.1957127	.2593518	-0.75	0.450	-.7040328	.3126074
mp8	.2800276	.2255364	1.24	0.214	-.1620156	.7220708
snp10	.4643142	.2091448	2.22	0.026	.0543978	.8742305
_cons	-1.885424	.1764439	-10.69	0.000	-2.231247	-1.5396

Probit: > 1 year unemployment over 5 years (age 32)

```
Probit estimates                                  Number of obs   =        376
                                                  LR chi2(10)     =      19.06
                                                  Prob > chi2     =     0.0395
Log likelihood = -155.51813                       Pseudo R2       =     0.0578
```

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3613469	.2074095	1.74	0.081	-.0451683	.7678621
trlc80	.1160587	.2097196	0.55	0.580	-.2949843	.5271016
njn10d	.1636857	.173101	0.95	0.344	-.175586	.5029574
iq8c	.2813757	.1845834	1.52	0.127	-.0804011	.6431526
if8	.3826866	.214229	1.79	0.074	-.0371944	.8025677
sp10	-.115405	.2339111	-0.49	0.622	-.5738623	.3430524
afmc10	-.0819578	.2001722	-0.41	0.682	-.4742881	.3103724
fs8	.0820887	.2037616	0.40	0.687	-.3172767	.4814541
mp8	-.0080498	.2143976	-0.04	0.970	-.4282612	.4121617
snp10	-.09431	.2054139	-0.46	0.646	-.4969139	.308294
_cons	-1.308089	.1310302	-9.98	0.000	-1.564904	-1.051275

Probit: unstable employment (age 18-19)

```
Probit estimates                                  Number of obs   =        361
                                                  LR chi2(10)     =      56.34
                                                  Prob > chi2     =     0.0000
Log likelihood = -222.05653                       Pseudo R2       =     0.1126
```

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.4053045	.1894027	2.14	0.032	.034082	.7765271
trlc80	.0467872	.187852	0.25	0.803	-.3213959	.4149702
njn10d	.0520101	.154545	0.34	0.736	-.2508925	.3549127
iq8c	.4051952	.1653123	2.45	0.014	.081189	.7292014
if8	.1302738	.194967	0.67	0.504	-.2518545	.5124022
sp10	-.0166248	.2003899	-0.08	0.934	-.4093818	.3761323
afmc10	.2327357	.164195	1.42	0.156	-.0890805	.5545519
fs8	.5952935	.1842298	3.23	0.001	.2342096	.9563774
mp8	.2923162	.1801227	1.62	0.105	-.0607178	.6453501
snp10	.2021338	.1739539	1.16	0.245	-.1388096	.5430772
_cons	-.5577312	.1115715	-5.00	0.000	-.7764073	-.339055

Probit: unstable employment (age 32)

```
Probit estimates                                  Number of obs   =        369
                                                  LR chi2(10)     =       3.30
                                                  Prob > chi2     =     0.9734
Log likelihood = -191.27308                       Pseudo R2       =     0.0086
```

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.0105881	.210607	0.05	0.960	-.4021939	.4233702
trlc80	.201014	.2026007	0.99	0.321	-.196076	.5981039
njn10d	-.1463237	.1652766	-0.89	0.376	-.4702598	.1776125
iq8c	-.1286231	.1833547	-0.70	0.483	-.4879917	.2307456
if8	.0368359	.2137928	0.17	0.863	-.3821903	.4558622
sp10	-.0788205	.2221157	-0.35	0.723	-.5141593	.3565183
afmc10	-.1199446	.1829988	-0.66	0.512	-.4786156	.2387265
fs8	-.0478674	.1947633	-0.25	0.806	-.4295964	.3338616
mp8	-.0021931	.1984697	-0.01	0.991	-.3911866	.3868004
snp10	.0226916	.1879428	0.12	0.904	-.3456696	.3910528
_cons	-.7067586	.1127283	-6.27	0.000	-.9277021	-.4858152

Data set 3

OLS: log of weekly earnings (age 32)

Source	SS	df	MS
Model	3.34461327	10	.334461327
Residual	63.5244705	315	.201664986
Total	66.8690837	325	.205751027

Number of obs	=	326
F(10, 315)	=	1.66
Prob > F	=	0.0896
R-squared	=	0.0500
Adj R-squared	=	0.0199
Root MSE	=	.44907

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tbc8	.0661056	.0722171	0.92	0.361	-.0759833	.2081945
trlc80	-.131478	.0694834	-1.89	0.059	-.2681882	.0052322
njn10d	-.0447257	.0559176	-0.80	0.424	-.1547449	.0652936
iq8c	-.0716207	.0619086	-1.16	0.248	-.1934274	.050186
if8	-.1613153	.0744307	-2.17	0.031	-.3077595	-.0148712
sp10	.0013509	.0729776	0.02	0.985	-.1422342	.1449361
afmc10	.0024902	.0607212	0.04	0.967	-.1169802	.1219607
fs8	-.0525984	.0655832	-0.80	0.423	-.181635	.0764381
mp8	.0190281	.0659232	0.29	0.773	-.1106774	.1487335
snp10	.0327371	.0653612	0.50	0.617	-.0958626	.1613368
_cons	5.107409	.0382868	133.40	0.000	5.032079	5.182739

Probit: > 18 weeks of unemployment (age 18-19)

Probit estimates

Log likelihood = -104.55315

Number of obs	=	368
LR chi2(10)	=	43.92
Prob > chi2	=	0.0000
Pseudo R2	=	0.1736

untim_18	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.6968872	.2291788	3.04	0.002	.247705	1.146069
trlc80	-.3071753	.2538849	-1.21	0.226	-.8047805	.1904298
njn10d	.0139411	.2160631	0.06	0.949	-.4095348	.4374171
iq8c	.4225363	.2100857	2.01	0.044	.0107759	.8342966
if8	.6013368	.2479057	2.43	0.015	.1154506	1.087223
sp10	-.4469398	.2776114	-1.61	0.107	-.9910482	.0971685
afmc10	.2185843	.2165713	1.01	0.313	-.2058878	.6430563
fs8	-.190937	.2591176	-0.74	0.461	-.698798	.3169241
mp8	.3937791	.2155053	1.83	0.068	-.0286034	.8161617
snp10	.450013	.2101781	2.14	0.032	.0380716	.8619545
_cons	-1.910506	.180126	-10.61	0.000	-2.263547	-1.557466

Probit: > 1 year unemployment over 5 years (age 32)

Probit estimates

Log likelihood = -155.6203

Number of obs	=	376
LR chi2(10)	=	18.86
Prob > chi2	=	0.0421
Pseudo R2	=	0.0571

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3690821	.2077541	1.78	0.076	-.0381084	.7762726
trlc80	.108013	.2100203	0.51	0.607	-.3036193	.5196452
njn10d	.1264556	.1751117	0.72	0.470	-.2167571	.4696682
iq8c	.293844	.1835655	1.60	0.109	-.0659378	.6536257
if8	.3887692	.2144606	1.81	0.070	-.0315659	.8091042
sp10	-.1744642	.2279346	-0.77	0.444	-.6212079	.2722795
afmc10	-.04303	.1979144	-0.22	0.828	-.4309351	.3448752
fs8	.093394	.2025458	0.46	0.645	-.3035884	.4903765
mp8	-.0010593	.205403	-0.01	0.996	-.4036417	.4015231

snp10	-.0883178	.204872	-0.43	0.666	-.4898596	.3132239
_cons	-1.302722	.1316502	-9.90	0.000	-1.560751	-1.044692

Probit: unstable employment (age 18-19)

```
probit jobs_318 tbc8 trlc80 njn10d iq8c if8 sp10 afmc10 fs8 mp8 snp10

Iteration 0:   log likelihood = -250.22475
Iteration 1:   log likelihood = -223.11788
Iteration 2:   log likelihood = -222.68408
Iteration 3:   log likelihood = -222.68361

Probit estimates                                  Number of obs   =        361
                                                  LR chi2(10)     =      55.08
                                                  Prob > chi2     =     0.0000
Log likelihood = -222.68361                       Pseudo R2       =     0.1101
```

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.4095784	.1894573	2.16	0.031	.0382489	.7809079
trlc80	.0278251	.18613	0.15	0.881	-.3369829	.3926331
njn10d	.0277838	.155804	0.18	0.858	-.2775864	.3331541
iq8c	.3933549	.1647949	2.39	0.017	.0703629	.7163469
if8	.1290108	.1946349	0.66	0.507	-.2524665	.5104881
sp10	.0830449	.1883089	0.44	0.659	-.2860339	.4521236
afmc10	.2285237	.1640737	1.39	0.164	-.0930549	.5501024
fs8	.5873654	.1832484	3.21	0.001	.2282052	.9465256
mp8	.2135397	.1745065	1.22	0.221	-.1284866	.5555661
snp10	.2027429	.1736329	1.17	0.243	-.1375713	.5430571
_cons	-.5419952	.1115117	-4.86	0.000	-.7605541	-.3234362

Probit: unstable employment (age 32)

```
probit jobs_332 tbc8 trlc80 njn10d iq8c if8 sp10 afmc10 fs8 mp8 snp10

Iteration 0:   log likelihood = -192.92452
Iteration 1:   log likelihood = -190.96943
Iteration 2:   log likelihood = -190.96548
Iteration 3:   log likelihood = -190.96548

Probit estimates                                  Number of obs   =        369
                                                  LR chi2(10)     =       3.92
                                                  Prob > chi2     =     0.9510
Log likelihood = -190.96548                       Pseudo R2       =     0.0102
```

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.0117398	.2109518	0.06	0.956	-.4017182	.4251978
trlc80	.185734	.2030437	0.91	0.360	-.2122244	.5836924
njn10d	-.2048295	.1682277	-1.22	0.223	-.5345496	.1248907
iq8c	-.1243381	.1831848	-0.68	0.497	-.4833737	.2346975
if8	.0252227	.2141199	0.12	0.906	-.3944446	.4448899
sp10	-.0662235	.2116	-0.31	0.754	-.4809519	.3485049
afmc10	-.1235861	.1810544	-0.68	0.495	-.4784462	.2312741
fs8	-.0457776	.1944886	-0.24	0.814	-.4269683	.3354131
mp8	.0519203	.1874926	0.28	0.782	-.3155585	.4193991
snp10	.0085318	.1885597	0.05	0.964	-.3610385	.3781021
_cons	-.6993334	.1133755	-6.17	0.000	-.9215452	-.4771215

Data set 4

OLS: log of weekly earnings (age 32)

```
regress logpay tbc8 trlc80 njn10d iq8c if8 sp10 afmc10 fs8 mp8 snp10

      Source |       SS       df       MS              Number of obs =     326
-------------+------------------------------           F( 10,   315) =    1.61
       Model |  3.26062769    10  .326062769           Prob > F      =  0.1012
    Residual |   63.608456   315  .201931606           R-squared     =  0.0488
-------------+------------------------------           Adj R-squared =  0.0186
       Total |  66.8690837   325  .205751027           Root MSE      =  .44937
```

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tbc8	.064377	.0723792	0.89	0.374	-.0780307	.2067848
trlc80	-.1301836	.0695085	-1.87	0.062	-.2669432	.006576
njn10d	-.0237003	.0546674	-0.43	0.665	-.1312597	.083859
iq8c	-.0775993	.0624454	-1.24	0.215	-.200462	.0452634
if8	-.1635026	.0730938	-2.24	0.026	-.3073164	-.0196888
sp10	.0289646	.0739371	0.39	0.696	-.1165085	.1744376
afmc10	-.0051531	.0596216	-0.09	0.931	-.1224601	.1121538
fs8	-.0575427	.0660388	-0.87	0.384	-.1874756	.0723901
mp8	-.0042064	.0662268	-0.06	0.949	-.1345092	.1260963
snp10	.0364551	.065225	0.56	0.577	-.0918765	.1647868
_cons	5.106124	.0379898	134.41	0.000	5.031378	5.180869

Probit: > 18 weeks of unemployment (age 18-19)

```
Probit estimates                                  Number of obs   =        368
                                                  LR chi2(10)     =      44.03
                                                  Prob > chi2     =     0.0000
Log likelihood = -104.49627                       Pseudo R2       =     0.1740
```

untim_18	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.7073262	.2298982	3.08	0.002	.256734	1.157918
trlc80	-.302332	.2547168	-1.19	0.235	-.8015677	.1969037
njn10d	-.0921247	.209242	-0.44	0.660	-.5022314	.3179821
iq8c	.4671892	.2118771	2.21	0.027	.0519177	.8824607
if8	.5627541	.2442165	2.30	0.021	.0840986	1.04141
sp10	-.4980309	.2825476	-1.76	0.078	-1.051814	.0557523
afmc10	.2212506	.215144	1.03	0.304	-.2004238	.6429251
fs8	-.148841	.2598763	-0.57	0.567	-.6581891	.360507
mp8	.3459391	.2243419	1.54	0.123	-.093763	.7856413
snp10	.4712856	.2105863	2.24	0.025	.058544	.8840272
_cons	-1.87624	.1743969	-10.76	0.000	-2.218051	-1.534428

Probit: > 1 year unemployment over 5 years (age 32)

```
Probit estimates                                  Number of obs   =        376
                                                  LR chi2(10)     =      20.58
                                                  Prob > chi2     =     0.0242
Log likelihood = -154.75789                       Pseudo R2       =     0.0624
```

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3398223	.2091695	1.62	0.104	-.0701424	.749787
trlc80	.1043209	.2097184	0.50	0.619	-.3067195	.5153614
njn10d	.2570329	.1675829	1.53	0.125	-.0714235	.5854893
iq8c	.2909229	.1857962	1.57	0.117	-.073231	.6550767
if8	.3736279	.2142472	1.74	0.081	-.0462889	.7935447
sp10	-.1490512	.232966	-0.64	0.522	-.6056561	.3075536
afmc10	-.1120065	.1977767	-0.57	0.571	-.4996417	.2756288
fs8	.0822297	.2049302	0.40	0.688	-.319426	.4838854
mp8	.0510533	.2094799	0.24	0.807	-.3595198	.4616264

snp10	-.0914161	.2066223	-0.44	0.658	-.4963883	.3135561
_cons	-1.335902	.1304607	-10.24	0.000	-1.5916	-1.080203

Probit: unstable employment (age 18-19)

Probit estimates	Number of obs	=	361
	LR chi2(10)	=	53.31
	Prob > chi2	=	0.0000
Log likelihood = -223.5703	Pseudo R2	=	0.1065

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.4121855	.1907506	2.16	0.031	.0383212	.7860498
trlc80	.0636658	.1876664	0.34	0.734	-.3041536	.4314853
njnl0d	-.0120871	.1517922	-0.08	0.937	-.3095944	.2854201
iq8c	.3954816	.1657135	2.39	0.017	.0706892	.7202741
if8	.1547906	.193235	0.80	0.423	-.223943	.5335241
sp10	-.0081742	.195252	-0.04	0.967	-.3908611	.3745126
afmc10	.2473271	.164045	1.51	0.132	-.0741951	.5688493
fs8	.6006989	.1835663	3.27	0.001	.2409157	.9604822
mp8	.0982556	.172618	0.57	0.569	-.2400695	.4365807
snp10	.2331229	.1730096	1.35	0.178	-.1059698	.5722156
_cons	-.5160408	.1095722	-4.71	0.000	-.7307983	-.3012833

Probit: unstable employment (age 32)

Probit estimates	Number of obs	=	369
	LR chi2(10)	=	3.17
	Prob > chi2	=	0.9770
Log likelihood = -191.33783	Pseudo R2	=	0.0082

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.0171112	.2109438	0.08	0.935	-.3963311	.4305535
trlc80	.1939126	.2020068	0.96	0.337	-.2020134	.5898386
njnl0d	-.1288401	.1604603	-0.80	0.422	-.4433365	.1856564
iq8c	-.1225621	.1839856	-0.67	0.505	-.4831673	.2380431
if8	.018788	.2108211	0.09	0.929	-.3944137	.4319897
sp10	-.0865066	.2162606	-0.40	0.689	-.5103696	.3373564
afmc10	-.1177992	.1797439	-0.66	0.512	-.4700907	.2344923
fs8	-.0440234	.1952798	-0.23	0.822	-.4267648	.338718
mp8	.0551045	.1909628	0.29	0.773	-.3191756	.4293847
snp10	.0153791	.1880168	0.08	0.935	-.3531272	.3838853
_cons	-.7191362	.111751	-6.44	0.000	-.9381641	-.5001083

Data set 5

OLS: log of weekly earnings (age 32)

Source	SS	df	MS			
Model	3.30314881	10	.330314881	Number of obs	=	326
Residual	63.5659349	315	.201796619	F(10, 315)	=	1.64
				Prob > F	=	0.0952
				R-squared	=	0.0494
				Adj R-squared	=	0.0192
Total	66.8690837	325	.205751027	Root MSE	=	.44922

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tbc8	.064183	.0726811	0.88	0.378	-.0788188	.2071848
trlc80	-.1299011	.0694908	-1.87	0.063	-.2666258	.0068236
njnl0d	-.0353229	.0554298	-0.64	0.524	-.1443823	.0737365
iq8c	-.0730754	.062135	-1.18	0.240	-.1953274	.0491766
if8	-.1660265	.0740514	-2.24	0.026	-.3117244	-.0203286
sp10	.0261059	.0724498	0.36	0.719	-.1164408	.1686525
afmc10	-.0061906	.0602509	-0.10	0.918	-.1247356	.1123544
fs8	-.0567859	.0659733	-0.86	0.390	-.18659	.0730182

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
mp8	.0056685	.0687459	0.08	0.934	-.1295908	.1409277
snp10	.034552	.0656483	0.53	0.599	-.0946126	.1637166
_cons	5.107988	.0383033	133.36	0.000	5.032625	5.183351

Probit: > 18 weeks of unemployment (age 18-19)

```
Probit estimates                                  Number of obs   =        361
                                                  LR chi2(10)     =      55.16
                                                  Prob > chi2     =     0.0000
Log likelihood = -222.64669                       Pseudo R2       =     0.1102
```

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3754103	.1906573	1.97	0.049	.0017288	.7490918
trlc80	.0584699	.1874631	0.31	0.755	-.3089509	.4258908
njn10d	.0340966	.1547431	0.22	0.826	-.2691943	.3373875
iq8c	.4188036	.1650451	2.54	0.011	.0953211	.7422861
if8	.1124893	.1960676	0.57	0.566	-.2717962	.4967748
sp10	.050602	.190601	0.27	0.791	-.3229691	.424173
afmc10	.1929068	.1595507	1.21	0.227	-.1198068	.5056204
fs8	.5910084	.1841848	3.21	0.001	.2300128	.952004
mp8	.2502136	.1811109	1.38	0.167	-.1047573	.6051845
snp10	.2080278	.1736802	1.20	0.231	-.1323792	.5484348
_cons	-.5440641	.1109996	-4.90	0.000	-.7616194	-.3265088

Probit: > 1 year unemployment over 5 years (age 32)

```
Probit estimates                                  Number of obs   =        376
                                                  LR chi2(10)     =      19.28
                                                  Prob > chi2     =     0.0368
Log likelihood = -155.40802                       Pseudo R2       =     0.0584
```

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3480267	.2086997	1.67	0.095	-.0610173	.7570707
trlc80	.1144497	.2097448	0.55	0.585	-.2966426	.5255421
njn10d	.1949163	.17346	1.12	0.261	-.1450591	.5348917
iq8c	.2692982	.1845384	1.46	0.144	-.0923905	.6309868
if8	.3808874	.2150178	1.77	0.076	-.0405397	.8023145
sp10	-.1083231	.2231422	-0.49	0.627	-.5456737	.3290274
afmc10	-.064221	.1974229	-0.33	0.745	-.4511628	.3227208
fs8	.0830535	.203968	0.41	0.684	-.3167164	.4828233
mp8	-.0107646	.2128046	-0.05	0.960	-.4278539	.4063247
snp10	-.0920395	.2058026	-0.45	0.655	-.4954052	.3113263
_cons	-1.319247	.1309533	-10.07	0.000	-1.575911	-1.062583

Probit: unstable employment (age 18-19)

```
Probit estimates                                  Number of obs   =        361
                                                  LR chi2(10)     =      55.16
                                                  Prob > chi2     =     0.0000
Log likelihood = -222.64669                       Pseudo R2       =     0.1102
```

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.3754103	.1906573	1.97	0.049	.0017288	.7490918
trlc80	.0584699	.1874631	0.31	0.755	-.3089509	.4258908
njn10d	.0340966	.1547431	0.22	0.826	-.2691943	.3373875
iq8c	.4188036	.1650451	2.54	0.011	.0953211	.7422861
if8	.1124893	.1960676	0.57	0.566	-.2717962	.4967748
sp10	.050602	.190601	0.27	0.791	-.3229691	.424173
afmc10	.1929068	.1595507	1.21	0.227	-.1198068	.5056204
fs8	.5910084	.1841848	3.21	0.001	.2300128	.952004
mp8	.2502136	.1811109	1.38	0.167	-.1047573	.6051845

snp10	.2080278	.1736802	1.20	0.231	-.1323792	.5484348
_cons	-.5440641	.1109996	-4.90	0.000	-.7616194	-.3265088

Probit: unstable employment (age 32)

```
Probit estimates                                  Number of obs   =        369
                                                  LR chi2(10)     =       3.08
                                                  Prob > chi2     =     0.9796
Log likelihood = -191.38622                       Pseudo R2       =     0.0080
```

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	-.0078293	.2112313	-0.04	0.970	-.421835	.4061765
trlc80	.1980323	.2021718	0.98	0.327	-.1982172	.5942818
njnl0d	-.1657151	.1658229	-1.00	0.318	-.490722	.1592918
iq8c	-.1343406	.1831533	-0.73	0.463	-.4933146	.2246333
if8	-.0129349	.2137968	-0.06	0.952	-.4319689	.406099
sp10	.0833943	.2043851	0.41	0.683	-.3171931	.4839816
afmc10	-.0932124	.1778573	-0.52	0.600	-.4418063	.2553814
fs8	-.0582953	.1950553	-0.30	0.765	-.4405968	.3240061
mp8	.0047932	.1953947	0.02	0.980	-.3781733	.3877598
snp10	.0037558	.1884618	0.02	0.984	-.3656226	.3731341
_cons	-.7156042	.1126185	-6.35	0.000	-.9363325	-.4948759

Diagnostic tests

For each test 5 sets of results are reported based on each of the multiply imputed data sets:

Park test

Data set 1

OLS regression: lnvar are the log scaled residuals and lnyhat are the log scaled predictions derived from a generalised linear model of weekly earnings.

Source	SS	df	MS
Model	28.5105998	1	28.5105998
Residual	1581.49618	324	4.88116105
Total	1610.00678	325	4.95386701

```
Number of obs =    326
F(  1,   324) =   5.84
Prob > F      = 0.0162
R-squared     = 0.0177
Adj R-squared = 0.0147
Root MSE      = 2.2093
```

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.625668	1.086421	2.42	0.016	.4883378	4.762998
_cons	-6.310507	5.583778	-1.13	0.259	-17.29555	4.674532

Descriptives

	Percentiles	Smallest
1%	-1.297089	-1.651584

```
 5%    -.6444502      -1.438282
10%    -.4105349      -1.298002       Obs                 326
25%    -.1165509      -1.297089       Sum of Wgt.         326

50%     .1362293                      Mean           .1051686
                        Largest       Std. Dev.      .4429476
75%      .357945        1.30146
90%      .568429        1.30146       Variance       .1962026
95%     .7136731       1.805149       Skewness      -.2506577
99%      1.30146       1.812285       Kurtosis       5.391831
```

The important statistic is the coefficient of kurtosis. If the log scaled residuals are heavy tailed (coefficient of kurtosis >3) then OLS with a log transformed dependent variable is recommended.

Data set 2

```
      Source |       SS       df       MS              Number of obs =     326
-------------+------------------------------           F(  1,   324) =    4.28
       Model |  23.0301032     1  23.0301032           Prob > F      =  0.0394
    Residual |  1743.50721   324  5.38119511           R-squared     =  0.0130
-------------+------------------------------           Adj R-squared =  0.0100
       Total |  1766.53732   325  5.43549944           Root MSE      =  2.3197

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|      [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnyhat |   2.382031   1.151434     2.07   0.039     .1168013    4.647261
       _cons |  -5.073651    5.91808    -0.86   0.392    -16.71637    6.569063
------------------------------------------------------------------------------
```

```
Descriptives
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.285192      -1.656302
 5%    -.6386619      -1.425482
10%    -.4176049      -1.318253       Obs                 326
25%    -.1135321      -1.285192       Sum of Wgt.         326

50%      .131239                      Mean           .1053333
                        Largest       Std. Dev.      .4433345
75%     .3578591        1.29439
90%      .571002        1.29439       Variance       .1965455
95%     .7066031       1.805215       Skewness      -.2481091
99%      1.29439       1.824933       Kurtosis       5.402284
```

Data set 3

```
      Source |       SS       df       MS              Number of obs =     326
-------------+------------------------------           F(  1,   324) =    5.88
       Model |  28.9709219     1  28.9709219           Prob > F      =  0.0159
    Residual |    1596.066   324  4.92612963           R-squared     =  0.0178
-------------+------------------------------           Adj R-squared =  0.0148
       Total |  1625.03692   325  5.00011361           Root MSE      =  2.2195

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|      [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
     lnyhat |  2.649243    1.09243     2.43   0.016     .5000919    4.798395
      _cons |  -6.42689    5.61474    -1.14   0.253    -17.47284     4.61906
------------------------------------------------------------------------------
```

```
Descriptives
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.285948      -1.653424
 5%    -.6187873      -1.435314
10%    -.4145079      -1.322942       Obs                 326
25%    -.1161456      -1.285948       Sum of Wgt.         326

50%     .1387625                      Mean           .1052426
                        Largest       Std. Dev.      .4430444
75%      .362711       1.297487
90%     .5598269       1.297487       Variance       .1962884
95%     .7116642       1.808302       Skewness      -.2517835
99%     1.297487       1.808312       Kurtosis       5.397803
```

Data set 4

```
      Source |       SS       df       MS                  Number of obs =     326
-------------+------------------------------               F(  1,   324) =    4.69
       Model |  23.6311279     1  23.6311279               Prob > F      =  0.0312
    Residual |  1634.11847   324  5.04357552               R-squared     =  0.0143
-------------+------------------------------               Adj R-squared =  0.0112
       Total |   1657.7496   325  5.10076799               Root MSE      =  2.2458

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.409326   1.113071     2.16   0.031     .2195686    4.599084
       _cons |  -5.205672   5.720834    -0.91   0.364    -16.46034    6.048998
------------------------------------------------------------------------------
```

```
Descriptives
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.298137      -1.654624
 5%    -.6420817       -1.42935
10%    -.4145699      -1.302323       Obs                 326
25%    -.1176576      -1.298137       Sum of Wgt.         326

50%     .1341544                      Mean            .105267
                        Largest       Std. Dev.      .4432329
75%     .3589106       1.297425
90%     .5709715       1.297425       Variance       .1964554
95%     .7096381        1.80825       Skewness      -.2477038
99%     1.297425       1.818683       Kurtosis       5.394142
```

Data set 5

```
      Source |       SS       df       MS                  Number of obs =     326
-------------+------------------------------               F(  1,   324) =    4.36
       Model |  22.2833816     1  22.2833816               Prob > F      =  0.0375
    Residual |  1655.43524   324  5.10936803               R-squared     =  0.0133
-------------+------------------------------               Adj R-squared =  0.0102
       Total |  1677.71862   325  5.16221115               Root MSE      =  2.2604

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.334501   1.117859     2.09   0.038     .1353223     4.53368
       _cons |  -4.824879    5.74544    -0.84   0.402    -16.12796    6.478198
------------------------------------------------------------------------------
```

```
Descriptives

      Percentiles      Smallest
```

1%	-1.291964	-1.653296		
5%	-.6462183	-1.437363		
10%	-.412303	-1.30015	Obs	326
25%	-.1108689	-1.291964	Sum of Wgt.	326
50%	.1354013		Mean	.1052554
		Largest	Std. Dev.	.4430962
75%	.3622456	1.299692		
90%	.5698776	1.299692	Variance	.1963343
95%	.711905	1.810517	Skewness	-.251247
99%	1.299692	1.811915	Kurtosis	5.396597

Link test

Data set 1

OLS: log of weekly earnings (age 32)

OLS regression

Source	SS	df	MS
Model	3.34664982	2	1.67332491
Residual	63.5224339	323	.196663882
Total	66.8690837	325	.205751027

Number of obs	= 326
F(2, 323)	= 8.51
Prob > F	= 0.0003
R-squared	= 0.0500
Adj R-squared	= 0.0442
Root MSE	= .44347

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	2.142004	19.84371	0.11	0.914	-36.89724	41.18125
_hatsq	-.1146056	1.991263	-0.06	0.954	-4.032089	3.802877
_cons	-2.843442	49.41968	-0.06	0.954	-100.0685	94.38166

_hat and _hatsq are, respectively, the predicted values of the dependent variable and the predicted values squared. Statistical significance of the latter would imply functional form mis-specification.

Probit: > 18 weeks of unemployment (age 18-19)

Probit estimates

Log likelihood = -105.044

Number of obs	= 368
LR chi2(2)	= 42.93
Prob > chi2	= 0.0000
Pseudo R2	= 0.1697

untim_18	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.372353	.5456822	2.51	0.012	.3028356	2.441871
_hatsq	.1754433	.242695	0.72	0.470	-.3002302	.6511167
_cons	.136148	.2849718	0.48	0.633	-.4223865	.6946824

Probit: > 1 year unemployment over 5 years (age 32)

Probit estimates

Log likelihood = -154.56451

Number of obs	= 376
LR chi2(2)	= 20.97
Prob > chi2	= 0.0000
Pseudo R2	= 0.0635

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.225999	.8725404	0.26	0.796	-1.484149	1.936147
_hatsq	-.4715257	.5149396	-0.92	0.360	-1.480789	.5377375
_cons	-.2479613	.3561503	-0.70	0.486	-.946003	.4500805

Probit: unstable employment (age 18-19)

Probit estimates		Number of obs	=	361
		LR chi2(2)	=	57.70
		Prob > chi2	=	0.0000
Log likelihood = -221.37524		Pseudo R2	=	0.1153

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.131427	.176521	6.41	0.000	.7854525	1.477402
_hatsq	-.2768845	.2175689	-1.27	0.203	-.7033118	.1495427
_cons	.0693892	.088687	0.78	0.434	-.1044342	.2432126

Probit: unstable employment (age 32)

Probit estimates		Number of obs	=	369
		LR chi2(2)	=	3.61
		Prob > chi2	=	0.1644
Log likelihood = -191.11919		Pseudo R2	=	0.0094

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.357087	4.138819	0.33	0.743	-6.754849	9.469024
_hatsq	.2236362	2.569678	0.09	0.931	-4.812841	5.260113
_cons	.1382024	1.643736	0.08	0.933	-3.083462	3.359867

Data set 2

OLS: log of weekly earnings (age 32)

OLS regression

Source	SS	df	MS		
				Number of obs =	326
				F(2, 323) =	8.23
Model	3.24406931	2	1.62203465	Prob > F =	0.0003
Residual	63.6250144	323	.196981469	R-squared =	0.0485
				Adj R-squared =	0.0426
Total	66.8690837	325	.205751027	Root MSE =	.44383

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	2.670478	20.05105	0.13	0.894	-36.77666	42.11762
_hatsq	-.1677774	2.01371	-0.08	0.934	-4.129421	3.793866
_cons	-4.155858	49.89519	-0.08	0.934	-102.3164	94.00472

Probit: > 18 weeks of unemployment (age 18-19)

Probit estimates		Number of obs	=	368
		LR chi2(2)	=	42.01
		Prob > chi2	=	0.0000
Log likelihood = -105.50603		Pseudo R2	=	0.1660

untim_18	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.421327	.5591256	2.54	0.011	.3254614	2.517193
_hatsq	.197839	.2479473	0.80	0.425	-.2881288	.6838067
_cons	.156824	.2927238	0.54	0.592	-.4169041	.7305521

Probit: > 1 year unemployment over 5 years (age 32)

Probit estimates

Number of obs	=	376
LR chi2(2)	=	20.15
Prob > chi2	=	0.0000
Pseudo R2	=	0.0610

Log likelihood = -154.97687

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.0389177	.9535546	0.04	0.967	-1.830015	1.90785
_hatsq	-.5816883	.5612357	-1.04	0.300	-1.68169	.5183134
_cons	-.3156325	.3859767	-0.82	0.413	-1.072133	.440868

Probit: unstable employment (age 18-19)

Probit estimates

Number of obs	=	361
LR chi2(2)	=	57.88
Prob > chi2	=	0.0000
Pseudo R2	=	0.1156

Log likelihood = -221.28671

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.125148	.1738408	6.47	0.000	.7844267	1.46587
_hatsq	-.2729954	.2156891	-1.27	0.206	-.6957383	.1497474
_cons	.0684945	.0884973	0.77	0.439	-.104957	.241946

Probit: unstable employment (age 32)

Probit estimates

Number of obs	=	369
LR chi2(2)	=	4.20
Prob > chi2	=	0.1223
Pseudo R2	=	0.0109

Log likelihood = -190.82323

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	-3.202049	4.541076	-0.71	0.481	-12.1024	5.698296
_hatsq	-2.649258	2.850598	-0.93	0.353	-8.236328	2.937812
_cons	-1.62085	1.790382	-0.91	0.365	-5.129934	1.888234

Data set 3

OLS: log of weekly earnings (age 32)

OLS regression

Source	SS	df	MS
Model	3.34989527	2	1.67494764
Residual	63.5191885	323	.196653834
Total	66.8690837	325	.205751027

Number of obs	=	326
F(2, 323)	=	8.52
Prob > F	=	0.0002
R-squared	=	0.0501
Adj R-squared	=	0.0442
Root MSE	=	.44346

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	4.114487	19.00588	0.22	0.829	-33.27646	41.50543
_hatsq	-.3127915	1.908627	-0.16	0.870	-4.067701	3.442118
_cons	-7.748649	47.29735	-0.16	0.870	-100.7984	85.3011

Probit: > 18 weeks of unemployment (age 18-19)

```
Probit estimates                                  Number of obs   =        368
                                                  LR chi2(2)      =      44.11
                                                  Prob > chi2     =     0.0000
Log likelihood = -104.45364                       Pseudo R2       =     0.1744

------------------------------------------------------------------------------
    untim_18 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.221175   .5233293     2.33   0.020      .1954687    2.246882
      _hatsq |   .1044768   .2333748     0.45   0.654     -.3529294    .5618831
       _cons |   .0796212   .2744112     0.29   0.772     -.4582148    .6174572
------------------------------------------------------------------------------
```

Probit: > 1 year unemployment over 5 years (age 32)

```
Probit estimates                                  Number of obs   =        376
                                                  LR chi2(2)      =      19.84
                                                  Prob > chi2     =     0.0000
Log likelihood = -155.12811                       Pseudo R2       =     0.0601

------------------------------------------------------------------------------
    unlfy12m |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .0465517   .9915127     0.05   0.963     -1.896778    1.989881
      _hatsq |  -.5732228   .5806109    -0.99   0.324     -1.711199    .5647536
       _cons |  -.3180113   .4009671    -0.79   0.428     -1.103892    .4678698
------------------------------------------------------------------------------
```

Probit: unstable employment (age 18-19)

```
Probit estimates                                  Number of obs   =        368
                                                  LR chi2(2)      =      44.11
                                                  Prob > chi2     =     0.0000
Log likelihood = -104.45364                       Pseudo R2       =     0.1744

------------------------------------------------------------------------------
    untim_18 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.221175   .5233293     2.33   0.020      .1954687    2.246882
      _hatsq |   .1044768   .2333748     0.45   0.654     -.3529294    .5618831
       _cons |   .0796212   .2744112     0.29   0.772     -.4582148    .6174572
------------------------------------------------------------------------------
```

Probit: unstable employment (age 32)

```
Probit estimates                                  Number of obs   =        369
                                                  LR chi2(2)      =       5.16
                                                  Prob > chi2     =     0.0759
Log likelihood = -190.34554                       Pseudo R2       =     0.0134

------------------------------------------------------------------------------
    jobs_332 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -3.636895   4.283918    -0.85   0.396     -12.03322    4.759429
      _hatsq |  -2.887229   2.656526    -1.09   0.277     -8.093925    2.319467
       _cons |  -1.802178   1.700111    -1.06   0.289     -5.134334    1.529978
------------------------------------------------------------------------------
```

Data set 4

OLS: log of weekly earnings (age 32)

```
OLS regression

      Source |       SS       df       MS              Number of obs =     326
-------------+------------------------------           F(  2,   323) =    8.28
       Model |  3.26063392     2  1.63031696           Prob > F      =  0.0003
```

	SS	df	MS		
Residual	63.6084498	323	.196930185	R-squared =	0.0488
				Adj R-squared =	0.0429
Total	66.8690837	325	.205751027	Root MSE =	.44377

logpay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	1.104203	20.02349	0.06	0.956	-38.28872	40.49713
_hatsq	-.0104615	2.01012	-0.01	0.996	-3.965042	3.944118
_cons	-.259349	49.84732	-0.01	0.996	-98.32575	97.80705

Probit: > 18 weeks of unemployment (age 18-19)

Probit estimates	Number of obs	=	368
	LR chi2(10)	=	44.03
	Prob > chi2	=	0.0000
Log likelihood = -104.49627	Pseudo R2	=	0.1740

untim_18	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tbc8	.7073262	.2298982	3.08	0.002	.256734	1.157918
trlc80	-.302332	.2547168	-1.19	0.235	-.8015677	.1969037
njnl0d	-.0921247	.209242	-0.44	0.660	-.5022314	.3179821
iq8c	.4671892	.2118771	2.21	0.027	.0519177	.8824607
if8	.5627541	.2442165	2.30	0.021	.0840986	1.04141
sp10	-.4980309	.2825476	-1.76	0.078	-1.051814	.0557523
afmc10	.2212506	.215144	1.03	0.304	-.2004238	.6429251
fs8	-.148841	.2598763	-0.57	0.567	-.6581891	.360507
mp8	.3459391	.2243419	1.54	0.123	-.093763	.7856413
snp10	.4712856	.2105863	2.24	0.025	.058544	.8840272
_cons	-1.87624	.1743969	-10.76	0.000	-2.218051	-1.534428

Probit: > 1 year unemployment over 5 years (age 32)

Probit estimates	Number of obs	=	376
	LR chi2(2)	=	21.62
	Prob > chi2	=	0.0000
Log likelihood = -154.24155	Pseudo R2	=	0.0655

unlfy12m	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.1367234	.8809591	0.16	0.877	-1.589925	1.863372
_hatsq	-.521667	.5164698	-1.01	0.312	-1.533929	.4905952
_cons	-.2800389	.3599571	-0.78	0.437	-.9855419	.4254641

Probit: unstable employment (age 18-19)

Probit estimates	Number of obs	=	361
	LR chi2(2)	=	53.94
	Prob > chi2	=	0.0000
Log likelihood = -223.25459	Pseudo R2	=	0.1078

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.085184	.1806624	6.01	0.000	.731092	1.439276
_hatsq	-.1852385	.2305389	-0.80	0.422	-.6370865	.2666094
_cons	.0437845	.0883566	0.50	0.620	-.1293911	.2169602

Probit: unstable employment (age 32)

```
Probit estimates                                  Number of obs   =        369
                                                  LR chi2(2)      =       4.66
                                                  Prob > chi2     =     0.0974
Log likelihood = -190.59563                       Pseudo R2       =     0.0121

------------------------------------------------------------------------------
    jobs_332 |      Coef.   Std. Err.       z     P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -4.756175   4.869748    -0.98   0.329     -14.30071    4.788356
      _hatsq |  -3.660149   3.084293    -1.19   0.235     -9.705252    2.384953
       _cons |  -2.203644   1.903309    -1.16   0.247      -5.93406    1.526772
------------------------------------------------------------------------------
```

Data set 5

OLS: log of weekly earnings (age 32)

```
OLS regression

Source |       SS       df       MS              Number of obs =      326
-------------+------------------------------           F(  2,    323) =    8.39
       Model |  3.30330705     2  1.65165353           Prob > F      =  0.0003
    Residual |  63.5657767   323  .19679807            R-squared     =  0.0494
-------------+------------------------------           Adj R-squared =  0.0435
       Total |  66.8690837   325  .205751027           Root MSE      =  .44362

------------------------------------------------------------------------------
      logpay |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .4403263   19.64827     0.02   0.982     -38.21441    39.09506
      _hatsq |   .0561897   1.972482     0.03   0.977     -3.824344    3.936724
       _cons |    1.39292   48.91239     0.03   0.977     -94.83417    97.62001
------------------------------------------------------------------------------
```

Probit: > 18 weeks of unemployment (age 18-19)

```
Probit estimates                                  Number of obs   =        368
                                                  LR chi2(2)      =      38.55
                                                  Prob > chi2     =     0.0000
Log likelihood =  -107.2343                       Pseudo R2       =     0.1524

------------------------------------------------------------------------------
    untim_18 |      Coef.   Std. Err.       z     P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.400325   .6232684     2.25   0.025      .1787411    2.621908
      _hatsq |   .1892988   .2817969     0.67   0.502     -.3630129    .7416105
       _cons |    .150751   .3142514     0.48   0.631     -.4651704    .7666724
------------------------------------------------------------------------------
```

Probit: > 1 year unemployment over 5 years (age 32)

```
Probit estimates                                  Number of obs   =        376
                                                  LR chi2(2)      =      20.48
                                                  Prob > chi2     =     0.0000
Log likelihood = -154.81081                       Pseudo R2       =     0.0620

------------------------------------------------------------------------------
    unlfy12m |      Coef.   Std. Err.       z     P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -.0184848   .9622671    -0.02   0.985     -1.904494    1.867524
      _hatsq |  -.6138214   .5643085    -1.09   0.277     -1.719846    .4922029
       _cons |  -.3365512   .3894905    -0.86   0.388     -1.099939    .4268362
------------------------------------------------------------------------------
```

Probit: unstable employment (age 18-19)

```
Probit estimates                                  Number of obs   =        361
                                                  LR chi2(2)      =      56.45
                                                  Prob > chi2     =     0.0000
Log likelihood = -221.99871                       Pseudo R2       =     0.1128
```

jobs_318	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.119981	.1775557	6.31	0.000	.7719783	1.467984
_hatsq	-.2595386	.2243978	-1.16	0.247	-.6993501	.1802729
_cons	.063792	.0890009	0.72	0.474	-.1106466	.2382305

Probit: unstable employment (age 32)

```
Probit estimates                                  Number of obs   =        369
                                                  LR chi2(2)      =       4.21
                                                  Prob > chi2     =     0.1217
Log likelihood = -190.81854                       Pseudo R2       =     0.0109
```

jobs_332	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	-4.461525	5.248281	-0.85	0.395	-14.74797	5.824916
_hatsq	-3.472413	3.322717	-1.05	0.296	-9.984819	3.039993
_cons	-2.092272	2.048601	-1.02	0.307	-6.107456	1.922911

Breusch-Pagan test (OLS only)

Data set 1

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logpay

         chi2(1)      =     1.32
         Prob > chi2  =   0.2509
```

Data set 2

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logpay

         chi2(1)      =     1.42
         Prob > chi2  =   0.2327
```

Data set 3

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logpay

         chi2(1)      =     1.13
         Prob > chi2  =   0.2869
```

Data set 4

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logpay

         chi2(1)      =     1.47
         Prob > chi2  =   0.2247
```

Data set 5

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logpay

         chi2(1)      =     1.30
         Prob > chi2  =   0.2537
```

Appendix: chapter 3

Principle components analysis

Principle components analysis using teacher ratings: rotated component matrix containing extracted psychosocial components and factor loadings (correlations)

	Antisocial conduct	Attention deficit problems	Anxiety	Poor coordination
Daydreaming	4.725E-02	.677	.174	.174
Afraid of new situations	-9.312E-02	.358	.648	6.719E-02
Cannot concentrate on tasks	.173	.636	.136	9.527E-02
Wets pants in class	3.676E-02	1.690E-02	7.454E-02	.102
Complains	.687	.200	.196	.167
Trips, falls, bumps into things	.266	.115	9.508E-02	.666
Works deftly with hands	-7.424E-02	-.334	-5.803E-02	-.197
Temper outbursts	.804	.108	8.070E-02	6.367E-02
Teases others	.786	.162	-9.551E-02	5.950E-02
Clumsy at games	.134	.231	.164	.725
Cries for little cause	.361	8.828E-02	.448	.269
Bored during class	.384	.694	5.211E-02	.146
Shows perseverance	-.280	-.748	-5.730E-02	-1.818E-02
Difficulty kicking ball	2.371E-02	.116	.189	.680
Dresses/undresses competently	-8.647E-02	-6.307E-02	-3.866E-02	-5.249E-02
Interferes with others	.725	.360	-5.321E-02	.141
Confused or hesitant	7.936E-02	.643	.438	.142
Difficulty picking up small objects	.127	.126	.130	.571
Behaves nervously	-2.081E-02	.242	.723	.174
Fussy or over-particular	.313	1.448E-03	.642	.214
Changes mood quickly	.747	.150	.300	8.224E-02
Excitable-impulsive	.632	.145	.228	6.691E-02
Worried-anxious	.101	.167	.815	9.515E-02
Restless-overactive	.627	.272	.227	9.139E-02
Squirmy-fidgety	.521	.501	.139	.161
Easily distracted	.397	.764	.106	.123
Manipulates small objects with hands	-2.764E-02	-.116	-7.253E-02	-.189
Drops things	.208	.198	.157	.562
Pays attention	-.285	-.739	-1.798E-02	-7.092E-02
Relations with others tearful/unhappy	.369	.146	.445	.200
Obsessed about unimportant tasks	.386	.102	.487	.250
Forgetful on complex tasks	.152	.716	.269	.183
Rather solitary	6.028E-02	6.791E-02	.327	.157
Quarrels with other kids	.802	.234	7.032E-02	.103
Can use manipulative equipment	-7.234E-02	-.231	-6.745E-02	-.233
Lethargic/listless	.126	.517	.168	.261
Destroys belongings	.607	.172	-5.862E-02	9.459E-02
Hums or makes odd sounds	.429	.220	4.960E-03	.115
Rhythmic tapping	.416	.226	1.163E-02	.115
Inadequate control of pencil/paintbrush	.117	.239	5.859E-02	.309
Soils pants	4.219E-02	1.501E-02	4.052E-02	.106
Accident prone	.295	.147	8.523E-02	.474
Bullies others	.759	.143	-.122	2.982E-02

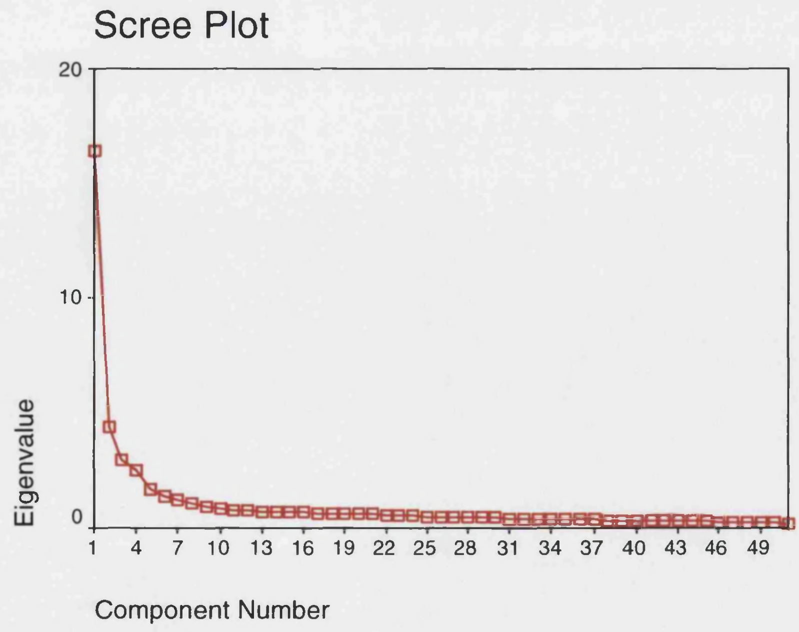
Sullen or sulky	.674	.208	.161	8.148E-02
Twitches/mannerisms/tics	.179	5.467E-02	.179	.194
Truants	.155	.137	-2.898E-02	2.605E-02
Fearful in movement	-4.659E-02	.190	.283	.557
Forgetful with complex tasks	-.203	-.722	-3.558E-02	-5.787E-02
Easily frustrated	.624	.236	.233	7.830E-02
Holds instruments appropriately	-9.278E-02	-.232	-8.232E-02	-.103
Fails to finish tasks	.219	.739	3.831E-02	.101

Notes

1. First four extracted components reported.

2. Varimax rotation used to extract components

“Scree plots” can be used as a visual guidance as to which components contribute to most of the variance in teacher ratings. The components extracted are shown on the horizontal axis with a measure of the variance associated each component on the vertical (the Eigenvalues). All components beyond the point at which the scree plot “kinks” - generally where the Eigenvalue are below 1 - contribute little to the total variance in the ratings. The first four components shown below correspond to those described in the table above.



Principle components analysis using maternal ratings: rotated component matrix containing extracted psychosocial components and factor loadings (correlations)

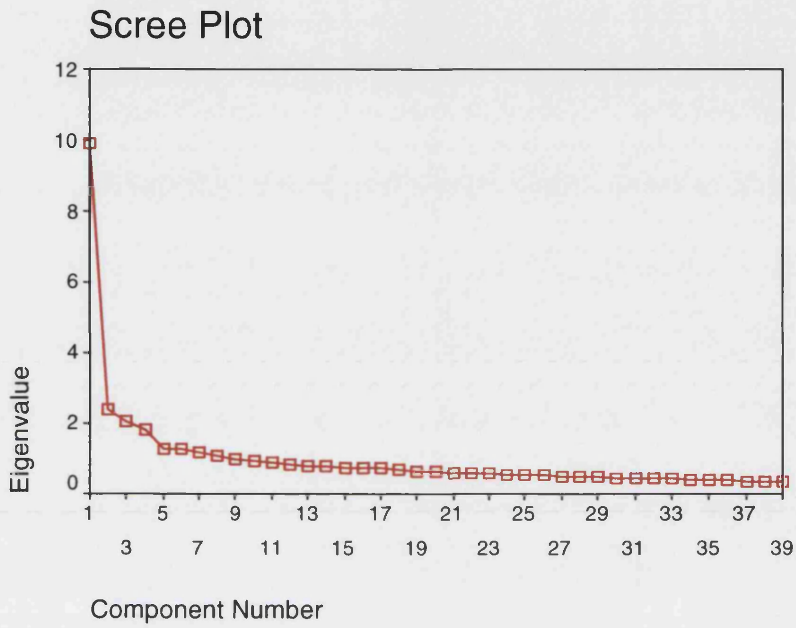
	Emotional problems	Antisocial conduct	Restlessness-impulsiveness	Attention deficit problems	Poor coordination
Child's behaviour: very restless	9.443E-02	.121	.748	.165	5.817E-02
Squirmy or fidgety	8.814E-02	.140	.674	.185	.196
Destroys belongings	.113	.644	8.904E-02	.160	.109
Fights with other children	.235	.621	.176	2.263E-02	4.253E-02
Not much liked by other children	1.154E-02	.467	9.955E-02	5.304E-02	.149
Worried	.217	-3.158E-02	.101	.101	3.356E-03
Does things on own-rather solitary	5.443E-02	.194	9.743E-02	-4.840E-02	.113
Irritable	.675	.189	.240	5.017E-02	-2.303E-02
Appears miserable or distressed	.507	.248	-4.543E-02	.121	.184
Takes others' belongings	7.413E-02	.669	5.225E-02	.132	6.438E-02
Has twitches, mannerisms or ticks	6.011E-03	.223	.146	2.143E-02	6.541E-02
Sucks thumb or finger	1.929E-02	6.025E-02	-4.403E-02	4.633E-02	3.520E-02
Bites nails or fingers	9.336E-02	6.749E-02	.161	2.724E-02	2.364E-02
Often disobedient	.431	.455	.266	.196	6.490E-03
Cannot settle to do anything	.119	.221	.318	.664	5.668E-02
Afraid of new things/situations	.132	-8.165E-02	-1.156E-02	.185	1.999E-02
Fussy of over-particular	.253	-3.117E-02	.189	-.119	-.162
Often tells lies	.247	.627	.115	.187	8.515E-02
Bullies other children	.249	.609	9.104E-02	2.328E-02	4.528E-02
Noticeably clumsy	.106	9.003E-02	.174	.149	.801
Trips or falls easily	.146	.108	.163	9.187E-02	.785
Inattentive/difficulty concentrating	.172	.167	.282	.677	.118
Hums or makes odd noises	.108	.192	.476	.135	.143
Difficulty picking up small objects	3.964E-02	.266	-2.152E-02	8.265E-02	.338
Drops things being carried	.109	.160	.117	7.945E-02	.652
Obsessional	.385	3.791E-02	.197	5.409E-02	3.713E-02
Requests must be met immediately	.595	7.578E-02	.347	.151	-3.038E-02
Restless or over-active behaviour	.259	.158	.682	.250	3.898E-02
Impulsive-excitable	.372	7.876E-02	.569	.205	4.370E-02
Interferes with other children	.264	.497	.252	.191	7.679E-02
Sullen or sulky	.620	.215	-8.596E-03	8.855E-02	.179
Fails to finish things	.172	.129	.187	.792	.108
Given to rhythmic tapping/kicking	.125	.178	.416	.102	.153
Cries for little cause	.566	.125	-2.430E-02	.135	.195
Changes mood quickly/drastically	.713	.182	.211	.145	8.819E-02
Outbursts of temper/ unpredictable	.688	.250	.226	9.847E-02	3.236E-02

Difficulty using scissors	1.749E-02	.170	-3.934E-02	.212	.269
Difficulty concentrating on task	.145	.142	.150	.747	9.904E-02

Notes

1. First five extracted components reported.

2. Varimax rotation used to extract components



The first five components shown in the above scree plot correspond to the five components described in the previous table.

Multivariate models and diagnostic tests for each multiply imputed data set

Variable label definitions

Label	Description
logern	Log of weekly earnings
empact	Economically active(0=no; 1=yes)
Low_inc	Low income status(0=no; 1=yes)
oclass	Occupational status (1-5 scale)
Fac1_1	Antisocial conduct (PCA standardised score: teacher ratings)
Fac2_1	Attention deficit problems (PCA standardised score: teacher ratings)
Fac3_1	Anxiety (PCA standardised score: teacher ratings)
Fac4_1	Poor coordination (PCA standardised score: teacher ratings)
Fac1_m	Emotional problems (PCA standardised score: maternal ratings)
Fac2_m	Antisocial conduct (PCA standardised score: maternal ratings)
Fac3_m	Restlessness-impulsiveness (PCA standardised score: maternal ratings)
Fac4_m	Attention deficit problems (PCA standardised score: maternal ratings)
Fac5_m	Poor coordination (PCA standardised score: maternal ratings)
mothhlth	Health problems from child's 5th birthday: mother (0=no; 1=yes)
fathhlth	Health problems from child's 5th birthday: father (0=no; 1=yes)
fath_ed	Father has formal qualifications (0=no; 1=yes)
moth_ed	Mother has formal qualifications (0=no; 1=yes)
Inc_10	Family income (scale 1-7)
num_chld	Number of children living in household
iq_nverb	Cognitive attainment (BAS combined scores)
mothhr	Hours of work: mother
fathhr	Hours of work: father
urban	Residence in relatively disadvantaged neighbourhood (0=no; 1=yes)
lawseq	Self esteem (LAWSEQ score)
caraloc	Locus of control (CARALOC score)
samepar	Lived with same parents (0=no; 1=yes)
incare	Taken into care (0=no; 1=yes)
mea7_1	Health problems up to age 10 (=-no; 1=yes)
j255	Attended independent sector primary school (0=no; 1=yes)
ratio	Staff-pupil ratio at school

OLS: log of weekly earnings (age 30)

Data set 1

Males

Source	SS	df	MS
Model	157.202541	21	7.48583527
Residual	2090.85766	4445	.470384176
Total	2248.0602	4466	.50337219

Number of obs =	4467
F(21, 4445) =	15.91
Prob > F =	0.0000
R-squared =	0.0699
Adj R-squared =	0.0655
Root MSE =	.68585

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fac1_1	.0402825	.0108709	3.71	0.000	.0189702	.0615948
fac2_1	-.0334432	.0117215	-2.85	0.004	-.0564231	-.0104632
fac3_1	-.0390269	.0104838	-3.72	0.000	-.0595804	-.0184734
fac4_1	-.0167267	.0105346	-1.59	0.112	-.0373799	.0039264
mothhlth	-.0026501	.0311276	-0.09	0.932	-.0636757	.0583756
fathhlth	-.050153	.0326662	-1.54	0.125	-.1141949	.0138889
fath_ed	.0242331	.0241646	1.00	0.316	-.0231416	.0716078
moth_ed	.0747323	.0236386	3.16	0.002	.0283889	.1210756
inc_10	.0489397	.0093393	5.24	0.000	.0306299	.0672494
num_chld	.0029375	.0104703	0.28	0.779	-.0175896	.0234646
iq_nverb	.003595	.0009396	3.83	0.000	.0017528	.0054372
mothhr	-.0008748	.0007259	-1.21	0.228	-.002298	.0005484
fathhr	.0002907	.0008522	0.34	0.733	-.0013799	.0019614
urban	-.0710822	.024485	-2.90	0.004	-.119085	-.0230794
lawseq	.0063392	.0027122	2.34	0.019	.001022	.0116564
caraloc	.0073152	.0025541	2.86	0.004	.0023079	.0123224
samepar	-.0040994	.0337168	-0.12	0.903	-.0702011	.0620023
incare	-.2956564	.0965218	-3.06	0.002	-.4848871	-.1064256
mea7_1	.0080127	.0231	0.35	0.729	-.0372749	.0533003
j255	.1364265	.0731456	1.87	0.062	-.0069754	.2798283
ratio	-.0008282	.0011128	-0.74	0.457	-.0030098	.0013535
_cons	5.193711	.1016569	51.09	0.000	4.994412	5.393009

. linktest

Source	SS	df	MS
Model	157.397708	2	78.6988538
Residual	2090.66249	4464	.468338373
Total	2248.0602	4466	.50337219

Number of obs =	4467
F(2, 4464) =	168.04
Prob > F =	0.0000
R-squared =	0.0700
Adj R-squared =	0.0696
Root MSE =	.68435

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	2.529106	2.369466	1.07	0.286	-2.116222	7.174434
_hatsq	-.1290739	.1999567	-0.65	0.519	-.5210882	.2629404
_cons	-4.524185	7.016188	-0.64	0.519	-18.27939	9.23102

_hat and _hatsq are, respectively, the predicted values of the dependent variable and the predicted values squared. Statistical significance of the latter would imply functional form mis-specification.

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =    10.75
         Prob > chi2  =   0.0010
```

Park test

Source	SS	df	MS		
Model	3082.69622	1	3082.69622	Number of obs =	4467
Residual	22179.7637	4465	4.96747227	F(1, 4465) =	620.58
Total	25262.4599	4466	5.65661887	Prob > F =	0.0000
				R-squared =	0.1220
				Adj R-squared =	0.1218
				Root MSE =	2.2288

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.998454	.1203649	24.91	0.000	2.76248	3.234429
_cons	-8.744499	.7516337	-11.63	0.000	-10.21807	-7.270924

	Percentiles	Smallest		
1%	-1.734529	-4.272695		
5%	-.6240048	-4.167057		
10%	-.3555212	-4.153571	Obs	4467
25%	-.0099559	-3.950221	Sum of Wgt.	4467
50%	.2969027		Mean	.3068501
		Largest	Std. Dev.	.6967706
75%	.6134224	5.046589		
90%	.9171452	5.229254	Variance	.4854893
95%	1.198351	6.257677	Skewness	.5847735
99%	2.768722	6.533124	Kurtosis	12.60749

The important statistic is the coefficient of kurtosis. If the log scaled residuals are heavy tailed (coefficient of kurtosis >3) then OLS with a log transformed dependent variable is recommended.

Data set 2

Source	SS	df	MS		
Model	152.643601	21	7.26874289	Number of obs =	4467
Residual	2095.4166	4445	.471409809	F(21, 4445) =	15.42
Total	2248.0602	4466	.50337219	Prob > F =	0.0000
				R-squared =	0.0679
				Adj R-squared =	0.0635
				Root MSE =	.68659

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fac1_1	.0513795	.0109491	4.69	0.000	.0299138	.0728452
fac2_1	-.0251975	.0117783	-2.14	0.032	-.0482887	-.0021062
fac3_1	-.0280686	.0106624	-2.63	0.009	-.0489722	-.0071649
fac4_1	-.0188818	.0104376	-1.81	0.071	-.0393447	.0015811
mothhlth	-.0035232	.0312041	-0.11	0.910	-.0646987	.0576523
fathhlth	-.0563527	.0326455	-1.73	0.084	-.1203542	.0076488
fath_ed	.0059557	.0240106	0.25	0.804	-.041117	.0530285
moth_ed	.1077953	.0236344	4.56	0.000	.0614602	.1541305
inc_10	.0436905	.009274	4.71	0.000	.0255088	.0618722
num_chld	.0003091	.0106053	0.03	0.977	-.0204825	.0211008
iq_nverb	.0034422	.0009301	3.70	0.000	.0016188	.0052656
mothhr	-.0008035	.000728	-1.10	0.270	-.0022308	.0006238
fathhr	.000086	.0008578	0.10	0.920	-.0015958	.0017678
urban	-.060885	.024578	-2.48	0.013	-.1090702	-.0126998
lawseq	.0037866	.0027112	1.40	0.163	-.0015286	.0091019
caraloc	.0096241	.0026123	3.68	0.000	.0045028	.0147454

```
    samepar |  -.0186763    .033849    -0.55   0.581    -.0850371    .0476845
     incare |  -.3018672   .0964798    -3.13   0.002    -.4910155   -.1127188
     mea7_1 |  -.0097438   .0232359    -0.42   0.675    -.0552977    .0358101
       j255 |    .132433   .0715571     1.85   0.064    -.0078545    .2727205
      ratio |  -.0001546   .0011218    -0.14   0.890     -.002354    .0020448
      _cons |   5.233113   .1017201    51.45   0.000     5.033691    5.432535
------------------------------------------------------------------------------

. linktest

      Source |       SS       df       MS              Number of obs =    4467
-------------+------------------------------           F(  2,  4464) =  163.15
       Model |  153.133339     2  76.5666694           Prob > F      =  0.0000
    Residual |  2094.92686  4464  .469293652           R-squared     =  0.0681
-------------+------------------------------           Adj R-squared =  0.0677
       Total |   2248.0602  4466   .50337219           Root MSE      =  .68505

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   3.548425   2.495272     1.42   0.155    -1.343545    8.440395
      _hatsq |  -.2151418   .2106025    -1.02   0.307    -.6280271    .1977436
       _cons |  -7.539363   7.387623    -1.02   0.308    -22.02277     6.94404
------------------------------------------------------------------------------

hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =    29.28
         Prob > chi2  =   0.0000


Park test

      Source |       SS       df       MS              Number of obs =    4467
-------------+------------------------------           F(  1,  4465) =  749.39
       Model |  3772.65508     1  3772.65508           Prob > F      =  0.0000
    Residual |  22478.0295  4465  5.03427313           R-squared     =  0.1437
-------------+------------------------------           Adj R-squared =  0.1435
       Total |  26250.6846  4466  5.87789624           Root MSE      =  2.2437

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   3.163372   .1155567    27.38   0.000     2.936823     3.38992
       _cons |  -9.782461   .7211306   -13.57   0.000    -11.19623   -8.368687
------------------------------------------------------------------------------


-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.679114      -4.325078
 5%    -.6351824      -4.011372
10%    -.3609104      -3.905119       Obs                4467
25%    -.0214409      -3.825397       Sum of Wgt.        4467

50%     .2981864                      Mean           .3020999
                        Largest       Std. Dev.      .7015278
75%     .6007872       5.202676
90%     .9232282       5.262613       Variance       .4921413
95%     1.225939       6.460965       Skewness       .6775379
99%     2.748427       6.655374       Kurtosis       12.82295
```

Data set 3

```
      Source |       SS       df       MS              Number of obs =    4467
-------------+------------------------------           F( 21,  4445) =   16.64
```

```
       Model |  163.877187    21  7.80367558           Prob > F      =  0.0000
    Residual |  2084.18302  4445  .468882568           R-squared     =  0.0729
-------------+------------------------------           Adj R-squared =  0.0685
       Total |   2248.0602  4466   .50337219           Root MSE      =  .68475

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |   .0452301   .0105459     4.29   0.000     .0245549    .0659052
      fac2_1 |  -.0347715   .0116292    -2.99   0.003    -.0575705   -.0119725
      fac3_1 |  -.0183435   .0105674    -1.74   0.083    -.0390609    .0023739
      fac4_1 |  -.0341176     .01043    -3.27   0.001    -.0545655   -.0136697
    mothhlth |  -.0298275   .0315414    -0.95   0.344    -.0916643    .0320093
    fathhlth |  -.0422365   .0322396    -1.31   0.190    -.1054422    .0209693
     fath_ed |   .0495087   .0239731     2.07   0.039     .0025095    .0965078
     moth_ed |   .0884557   .0236051     3.75   0.000     .0421779    .1347335
      inc_10 |    .049033   .0092482     5.30   0.000      .030902    .0671641
    num_chld |  -.0086808   .0104917    -0.83   0.408    -.0292498    .0118881
    iq_nverb |   .0035626   .0009293     3.83   0.000     .0017407    .0053845
      mothhr |  -.0011126   .0007266    -1.53   0.126    -.0025371     .000312
      fathhr |   .0008065   .0008485     0.95   0.342    -.0008569    .0024699
       urban |  -.0278556   .0245951    -1.13   0.257    -.0760743    .0203631
      lawseq |    .005167   .0026714     1.93   0.053    -.0000703    .0104043
     caraloc |   .0084054   .0025987     3.23   0.001     .0033106    .0135002
     samepar |   .0027313   .0335252     0.08   0.935    -.0629949    .0684574
      incare |  -.2899173   .0962838    -3.01   0.003    -.4786814   -.1011531
      mea7_1 |   .0030054   .0232018     0.13   0.897    -.0424816    .0484925
        j255 |   .1292132     .07289     1.77   0.076    -.0136875    .2721139
       ratio |  -.0011457   .0011203    -1.02   0.307    -.0033422    .0010507
       _cons |   5.173786   .1015782    50.93   0.000     4.974643     5.37293
------------------------------------------------------------------------------

. linktest

      Source |       SS       df       MS              Number of obs =    4467
-------------+------------------------------           F(  2,  4464) =  175.51
       Model |  163.888115     2  81.9440574           Prob > F      =  0.0000
    Residual |  2084.17209  4464  .466884428           R-squared     =  0.0729
-------------+------------------------------           Adj R-squared =  0.0725
       Total |   2248.0602  4466   .50337219           Root MSE      =  .68329

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .6492579   2.291804     0.28   0.777    -3.843814     5.14233
      _hatsq |   .0296023   .1933737     0.15   0.878    -.3495059    .4087105
       _cons |   1.037852   6.787045     0.15   0.878    -12.26812    14.34382
------------------------------------------------------------------------------


Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =    37.58
         Prob > chi2  =   0.0000


Park test

      Source |       SS       df       MS              Number of obs =    4467
-------------+------------------------------           F(  1,  4465) =  780.20
       Model |  3749.72181     1  3749.72181           Prob > F      =  0.0000
    Residual |  21459.3273  4465  4.80612034           R-squared     =  0.1487
-------------+------------------------------           Adj R-squared =  0.1486
       Total |  25209.0491  4466  5.64465946           Root MSE      =  2.1923

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   3.010173   .1077679    27.93   0.000     2.798895    3.221452
       _cons |  -8.797333   .6721974   -13.09   0.000    -10.11517   -7.479493
------------------------------------------------------------------------------

                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
```

```
 1%    -1.702352      -4.331774
 5%    -.6371713      -4.060833
10%    -.3854389      -3.897103       Obs                4467
25%    -.0301895      -3.862235       Sum of Wgt.        4467

50%     .2935224                      Mean           .2983991
                        Largest       Std. Dev.      .6982343
75%     .5930381       5.152606
90%     .9167123       5.302885       Variance       .4875311
95%     1.216899       6.496291       Skewness       .6783802
99%      2.70385       6.498583       Kurtosis        12.6708
```

Data set 4

```
     Source |       SS       df       MS              Number of obs =    4466
-------------+------------------------------           F( 21,  4444) =   15.51
      Model |  153.53715     21  7.31129286           Prob > F      =  0.0000
   Residual | 2094.45085   4444  .471298572           R-squared     =  0.0683
-------------+------------------------------           Adj R-squared =  0.0639
      Total |   2247.988   4465  .503468758           Root MSE      =  .68651

------------------------------------------------------------------------------
     logern |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |   .0385407   .0107514      3.58   0.000      .0174626    .0596187
      fac2_1 |  -.0446807   .0117163     -3.81   0.000     -.0676504   -.0217109
      fac3_1 |  -.0321158   .0106378     -3.02   0.003     -.0529712   -.0112604
      fac4_1 |  -.0066954   .0104126     -0.64   0.520     -.0271092    .0137185
    mothhlth |  -.0112187   .0311466     -0.36   0.719     -.0722817    .0498442
    fathhlth |  -.0583894   .0330667     -1.77   0.077     -.1232167    .0064378
     fath_ed |   .0348823   .0240619      1.45   0.147      -.012291    .0820557
     moth_ed |   .0865801   .0236134      3.67   0.000      .0402861    .1328741
      inc_10 |   .0387554    .009236      4.20   0.000      .0206483    .0568625
    num_chld |  -.0047639   .0105048     -0.45   0.650     -.0253586    .0158309
    iq_nverb |    .003048   .0009399      3.24   0.001      .0012053    .0048907
      mothhr |  -.0005828   .0007278     -0.80   0.423     -.0020097    .0008441
      fathhr |   .0006395   .0008499      0.75   0.452     -.0010266    .0023057
       urban |  -.0601545   .0245711     -2.45   0.014      -.108326    -.011983
      lawseq |   .0081044   .0026848      3.02   0.003      .0028407     .013368
     caraloc |   .0061082   .0025927      2.36   0.019      .0010252    .0111911
     samepar |   .0129608   .0334661      0.39   0.699     -.0526494    .0785709
      incare |  -.2918032    .096482     -3.02   0.003      -.480956   -.1026504
      mea7_1 |  -.0102258   .0232183     -0.44   0.660     -.0557452    .0352935
        j255 |   .1515732    .073286      2.07   0.039      .0078961    .2952503
       ratio |  -.0010002   .0011165     -0.90   0.370     -.0031891    .0011887
       _cons |   5.252298   .1009501     52.03   0.000      5.054385    5.450211
------------------------------------------------------------------------------

. linktest

     Source |       SS       df       MS              Number of obs =    4466
-------------+------------------------------           F(  2,  4463) =  163.85
      Model |  153.771746     2  76.8858732           Prob > F      =  0.0000
   Residual |  2094.21626  4463  .469239583           R-squared     =  0.0684
-------------+------------------------------           Adj R-squared =  0.0680
      Total |    2247.988  4465  .503468758           Root MSE      =  .68501

------------------------------------------------------------------------------
     logern |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -.7244814    2.43951     -0.30   0.766      -5.50713    4.058168
      _hatsq |   .1456102   .2059322      0.71   0.480      -.258119    .5493393
       _cons |   5.100798   7.221366      0.71   0.480     -9.056658    19.25825
------------------------------------------------------------------------------

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =    26.58
         Prob > chi2  =   0.0000
```

Park test

Source	SS	df	MS
Model	3032.19931	1	3032.19931
Residual	20356.4798	4464	4.56014332
Total	23388.6791	4465	5.238226

Number of obs	=	4466
F(1, 4464)	=	664.94
Prob > F	=	0.0000
R-squared	=	0.1296
Adj R-squared	=	0.1294
Root MSE	=	2.1354

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.938712	.1139639	25.79	0.000	2.715286	3.162138
_cons	-8.362537	.7118013	-11.75	0.000	-9.75802	-6.967054

	Percentiles	Smallest		
1%	-1.706108	-4.296503		
5%	-.6218419	-4.220949		
10%	-.3436322	-4.087031	Obs	4466
25%	-.0133137	-3.912617	Sum of Wgt.	4466
50%	.3005378		Mean	.3078631
		Largest	Std. Dev.	.6980316
75%	.5990023	5.244084		
90%	.9223341	5.258055	Variance	.4872481
95%	1.20282	6.546132	Skewness	.6623134
99%	2.746469	6.55062	Kurtosis	13.18693

Data set 5

Source	SS	df	MS
Model	155.082239	21	7.38486854
Residual	2092.96352	4444	.470963888
Total	2248.04576	4465	.503481692

Number of obs	=	4466
F(21, 4444)	=	15.68
Prob > F	=	0.0000
R-squared	=	0.0690
Adj R-squared	=	0.0646
Root MSE	=	.68627

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fac1_1	.0542959	.0108641	5.00	0.000	.0329968	.075595
fac2_1	-.0384189	.011619	-3.31	0.001	-.061198	-.0156398
fac3_1	-.0158197	.0106041	-1.49	0.136	-.0366089	.0049695
fac4_1	-.039801	.0105196	-3.78	0.000	-.0604247	-.0191774
mothhlth	-.0305707	.0313163	-0.98	0.329	-.0919661	.0308248
fathhlth	-.0498279	.0331068	-1.51	0.132	-.1147338	.0150779
fath_ed	.0256299	.0240797	1.06	0.287	-.0215783	.0728382
moth_ed	.0836961	.023624	3.54	0.000	.0373812	.1300109
inc_10	.0473687	.0093215	5.08	0.000	.029094	.0656435
num_chld	-.0011028	.010529	-0.10	0.917	-.0217449	.0195392
iq_nverb	.0030006	.0009353	3.21	0.001	.001167	.0048342
mothhr	-.0014825	.0007249	-2.05	0.041	-.0029037	-.0000613
fathhr	.0004686	.0008471	0.55	0.580	-.0011922	.0021294
urban	-.0561815	.0246201	-2.28	0.023	-.104449	-.0079139
lawseq	.0052338	.0027045	1.94	0.053	-.0000683	.010536
caraloc	.0081386	.0025729	3.16	0.002	.0030945	.0131827
samepar	-.0341177	.0329808	-1.03	0.301	-.0987765	.0305411
incare	-.3043182	.0964439	-3.16	0.002	-.4933963	-.1152401
mea7_1	.0037491	.0232715	0.16	0.872	-.0418746	.0493729
j255	.1599918	.0720848	2.22	0.027	.0186697	.3013138
ratio	.0001507	.001123	0.13	0.893	-.002051	.0023525
_cons	5.264488	.1019157	51.66	0.000	5.064682	5.464294

. linktest

Source	SS	df	MS
Model	155.114378	2	77.5571888

Number of obs	=	4466
F(2, 4463)	=	165.38
Prob > F	=	0.0000

```
    Residual |  2092.93138  4463  .468951687           R-squared     =  0.0690
-------------+------------------------------           Adj R-squared =  0.0686
       Total |  2248.04576  4465  .503481692           Root MSE      =   .6848

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.631132    2.41122     0.68   0.499    -3.096054    6.358318
      _hatsq |    -.05328   .2035013    -0.26   0.793    -.4522434    .3456835
       _cons |  -1.867179   7.139102    -0.26   0.794    -15.86336      12.129
------------------------------------------------------------------------------


Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =    24.16
         Prob > chi2  =   0.0000

Park test

      Source |       SS       df       MS              Number of obs =    4466
-------------+------------------------------           F(  1,  4464) =  760.23
       Model |  3639.75628     1  3639.75628           Prob > F      =  0.0000
    Residual |  21372.4125  4464  4.78772681           R-squared     =  0.1455
-------------+------------------------------           Adj R-squared =  0.1453
       Total |  25012.1688  4465  5.60182951           Root MSE      =  2.1881

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   3.046731   .1105001    27.57   0.000     2.830096    3.263366
       _cons |  -9.032108   .6895463   -13.10   0.000    -10.38396   -7.680255
------------------------------------------------------------------------------

                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.720869      -4.265748
 5%    -.6387153      -4.014287
10%    -.3702106      -3.956023       Obs                4466
25%    -.0262986      -3.921551       Sum of Wgt.        4466

50%     .2907186                      Mean           .3015395
                        Largest       Std. Dev.      .7011018
75%     .6020761       5.264667
90%     .9293919       5.308009       Variance       .4915438
95%     1.209121       6.376514       Skewness       .6564457
99%     2.733944         6.3906       Kurtosis        12.4084
```

Females

Data set 1

```
      Source |       SS       df       MS              Number of obs =    3856
-------------+------------------------------           F( 21,  3834) =   20.12
       Model |  337.722743    21  16.0820354           Prob > F      =  0.0000
    Residual |  3064.38732  3834  .799266384           R-squared     =  0.0993
-------------+------------------------------           Adj R-squared =  0.0943
       Total |  3402.11006  3855  .882518822           Root MSE      =  .89402

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |   .0021146   .0160737     0.13   0.895    -.0293993    .0336284
      fac2_1 |  -.0677132      .0175    -3.87   0.000    -.1020234    -.033403
      fac3_1 |   -.027217   .0153965    -1.77   0.077    -.0574032    .0029692
      fac4_1 |  -.0009274   .0156344    -0.06   0.953      -.03158    .0297251
    mothhlth |   .0528988   .0430287     1.23   0.219    -.0314626    .1372602
    fathhlth |   -.009473   .0441749    -0.21   0.830    -.0960817    .0771356
```

fath_ed	.0011648	.0333562	0.03	0.972	-.0642329	.0665624
moth_ed	.037127	.0330482	1.12	0.261	-.0276667	.1019208
inc_10	.0782055	.0130769	5.98	0.000	.0525671	.1038438
num_chld	-.0096874	.0148135	-0.65	0.513	-.0387305	.0193557
iq_nverb	.0104415	.0013773	7.58	0.000	.0077412	.0131418
mothhr	-.0005553	.0010311	-0.54	0.590	-.0025768	.0014663
fathhr	-.0019063	.0011979	-1.59	0.112	-.004255	.0004423
urban	-.1159925	.0350826	-3.31	0.001	-.1847749	-.0472102
lawseq	.0092421	.0036128	2.56	0.011	.002159	.0163252
caraloc	.0090761	.0037308	2.43	0.015	.0017616	.0163906
samepar	.0525298	.0459922	1.14	0.253	-.0376416	.1427013
incare	.0570789	.1337965	0.43	0.670	-.2052402	.3193981
mea7_1	.0245166	.0334022	0.73	0.463	-.0409712	.0900044
j255	.1061197	.1026769	1.03	0.301	-.0951869	.3074264
ratio	-.0043949	.0015673	-2.80	0.005	-.0074676	-.0013221
_cons	4.068911	.1430959	28.43	0.000	3.78836	4.349463

. linktest

Source	SS	df	MS
Model	338.149699	2	169.074849
Residual	3063.96036	3853	.795214213
Total	3402.11006	3855	.882518822

Number of obs	= 3856
F(2, 3853)	= 212.62
Prob > F	= 0.0000
R-squared	= 0.0994
Adj R-squared	= 0.0989
Root MSE	= .89175

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	1.973116	1.32891	1.48	0.138	-.6323193	4.578551
_hatsq	-.0906669	.1237344	-0.73	0.464	-.333258	.1519242
_cons	-2.603139	3.562098	-0.73	0.465	-9.586916	4.380638

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of logern

chi2(1) = 0.01
Prob > chi2 = 0.9151

Park test

Source	SS	df	MS
Model	1988.43426	1	1988.43426
Residual	20519.6676	3854	5.32425211
Total	22508.1019	3855	5.83867753

Number of obs	= 3856
F(1, 3854)	= 373.47
Prob > F	= 0.0000
R-squared	= 0.0883
Adj R-squared	= 0.0881
Root MSE	= 2.3074

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	1.904353	.0985419	19.33	0.000	1.711153	2.097552
_cons	-1.697759	.5704536	-2.98	0.003	-2.816178	-.5793387

	Percentiles	Smallest		
1%	-2.023783	-4.072379		
5%	-.6655884	-4.033744		
10%	-.4581966	-3.708332	Obs	3856
25%	-.1242084	-3.707553	Sum of Wgt.	3856
50%	.2695682		Mean	.4105552
		Largest	Std. Dev.	.9051869
75%	.8067033	5.103036		
90%	1.516568	5.780548	Variance	.8193634
95%	2.089403	5.817151	Skewness	.8625672
99%	3.304965	7.216298	Kurtosis	7.111701

Data set 2

```
      Source |       SS       df       MS              Number of obs =    3856
-------------+------------------------------           F( 21,  3834) =   20.87
       Model |  349.036751    21  16.6207977           Prob > F      =  0.0000
    Residual |  3053.07331  3834  .796315417           R-squared     =  0.1026
-------------+------------------------------           Adj R-squared =  0.0977
       Total |  3402.11006  3855  .882518822           Root MSE      =  .89237

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |   .0289696   .0161919     1.79   0.074     -.002776    .0607153
      fac2_1 |  -.0989919   .0179218    -5.52   0.000    -.1341291   -.0638547
      fac3_1 |  -.0224309    .015381    -1.46   0.145    -.0525867    .0077249
      fac4_1 |  -.0127047   .0154933    -0.82   0.412    -.0430806    .0176711
    mothhlth |    .041609   .0431762     0.96   0.335    -.0430416    .1262596
    fathhlth |   .0293175   .0438757     0.67   0.504    -.0567045    .1153394
     fath_ed |   .0114083    .033388     0.34   0.733    -.0540515    .0768682
     moth_ed |   .0721389   .0328537     2.20   0.028     .0077264    .1365514
      inc_10 |   .0747426   .0129783     5.76   0.000     .0492976    .1001875
    num_chld |  -.0166596    .014733    -1.13   0.258    -.0455448    .0122256
    iq_nverb |   .0090098   .0013652     6.60   0.000     .0063331    .0116865
      mothhr |  -.0019896   .0010353    -1.92   0.055    -.0040193    .0000401
      fathhr |  -.0012643   .0011935    -1.06   0.290    -.0036042    .0010756
       urban |  -.1169328   .0351905    -3.32   0.001    -.1859268   -.0479388
      lawseq |   .0091089   .0036034     2.53   0.012     .0020441    .0161737
     caraloc |   .0071908   .0037248     1.93   0.054     -.000112    .0144936
     samepar |   .0397047   .0452954     0.88   0.381    -.0491007    .1285101
      incare |    .053308   .1334725     0.40   0.690     -.208376    .3149919
      mea7_1 |   .0041224   .0335132     0.12   0.902    -.0615831    .0698278
        j255 |   .1258133   .1027986     1.22   0.221     -.075732    .3273585
       ratio |  -.0035489   .0015598    -2.28   0.023    -.0066069   -.0004909
       _cons |    4.22336   .1400877    30.15   0.000     3.948707    4.498014
------------------------------------------------------------------------------

. linktest

      Source |       SS       df       MS              Number of obs =    3856
-------------+------------------------------           F(  2,  3853) =  220.35
       Model |  349.193507     2  174.596753           Prob > F      =  0.0000
    Residual |  3052.91655  3853  .792347925           R-squared     =  0.1026
-------------+------------------------------           Adj R-squared =  0.1022
       Total |  3402.11006  3855  .882518822           Root MSE      =  .89014

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |    1.55918   1.258085     1.24   0.215    -.9073964    4.025756
      _hatsq |  -.0521237   .1171877    -0.44   0.656    -.2818796    .1776322
       _cons |  -1.494993   3.370876    -0.44   0.657    -8.103865    5.113879
------------------------------------------------------------------------------


Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =     1.15
         Prob > chi2  =   0.2842


Park test

      Source |       SS       df       MS              Number of obs =    3856
-------------+------------------------------           F(  1,  3854) =  332.71
       Model |   1708.0562     1   1708.0562           Prob > F      =  0.0000
    Residual |  19785.7228  3854  5.13381493           R-squared     =  0.0795
-------------+------------------------------           Adj R-squared =  0.0792
       Total |   21493.779  3855  5.57555874           Root MSE      =  2.2658

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   1.791484   .0982159    18.24   0.000     1.598924    1.984044
```

```
       _cons |  -1.026141   .5691786    -1.80   0.071    -2.142061    .0897792
------------------------------------------------------------------------------
```

```
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.960265      -4.241524
 5%    -.6977358       -4.13705
10%    -.4565248      -3.960518       Obs                3856
25%    -.1089354      -3.744523       Sum of Wgt.        3856

50%     .2761586                      Mean           .4171611
                        Largest       Std. Dev.      .9078866
75%     .8124273        5.13242
90%     1.544013       5.739849       Variance       .8242581
95%     2.086778       5.934168       Skewness       .8552189
99%     3.307838       6.921857       Kurtosis       7.069599
```

Data set 3

```
      Source |       SS       df       MS              Number of obs =    3856
-------------+------------------------------           F( 21,  3834) =   20.57
       Model |  344.432853    21  16.4015644           Prob > F      =  0.0000
    Residual |  3057.67721  3834  .797516225           R-squared     =  0.1012
-------------+------------------------------           Adj R-squared =  0.0963
       Total |  3402.11006  3855  .882518822           Root MSE      =  .89304

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |   .0099863   .0160672     0.62   0.534    -.0215146    .0414873
      fac2_1 |  -.0935356   .0176227    -5.31   0.000    -.1280864   -.0589848
      fac3_1 |  -.0346406   .0152853    -2.27   0.023    -.0646087   -.0046725
      fac4_1 |  -.0089788   .0156921    -0.57   0.567    -.0397445    .0217868
    mothhlth |    .025316   .0428935     0.59   0.555    -.0587802    .1094122
    fathhlth |   .0305214   .0435781     0.70   0.484    -.0549171    .1159599
     fath_ed |  -.0149382   .0334197    -0.45   0.655    -.0804603    .0505838
     moth_ed |   .0473273   .0330007     1.43   0.152    -.0173733    .1120278
      inc_10 |    .080835   .0130521     6.19   0.000     .0552453    .1064247
    num_chld |  -.0257008   .0147013    -1.75   0.081     -.054524    .0031224
    iq_nverb |   .0096506   .0013685     7.05   0.000     .0069676    .0123336
      mothhr |  -.0014907    .001048    -1.42   0.155    -.0035454    .0005639
      fathhr |  -.0004133    .001205    -0.34   0.732    -.0027758    .0019491
       urban |  -.1084126    .034807    -3.11   0.002    -.1766547   -.0401705
      lawseq |   .0083138   .0036105     2.30   0.021      .001235    .0153925
     caraloc |   .0068856   .0037696     1.83   0.068     -.000505    .0142762
     samepar |   .0629664   .0456213     1.38   0.168    -.0264779    .1524106
      incare |   .0859845    .133661     0.64   0.520     -.176069    .3480381
      mea7_1 |   .0487428   .0333889     1.46   0.144    -.0167189    .1142044
        j255 |   .1196755   .1010848     1.18   0.237    -.0785097    .3178607
       ratio |   -.003032   .0015445    -1.96   0.050    -.0060602   -3.88e-06
       _cons |   4.120736   .1427133    28.87   0.000     3.840935    4.400537
------------------------------------------------------------------------------

. linktest

      Source |       SS       df       MS              Number of obs =    3856
-------------+------------------------------           F(  2,  3853) =  217.38
       Model |  344.952974     2  172.476487           Prob > F      =  0.0000
    Residual |  3057.15709  3853  .793448504           R-squared     =  0.1014
-------------+------------------------------           Adj R-squared =  0.1009
       Total |  3402.11006  3855  .882518822           Root MSE      =  .89076

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   2.028569   1.271288     1.60   0.111     -.463894    4.521031
      _hatsq |  -.0957768   .1182936    -0.81   0.418    -.3277008    .1361473
       _cons |  -2.752952   3.409934    -0.81   0.420    -9.438399    3.932496
------------------------------------------------------------------------------
```

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =     1.73
         Prob > chi2  =   0.1890
```

Park test

```
      Source |       SS       df       MS              Number of obs =    3856
-------------+------------------------------           F(  1,  3854) =  312.59
       Model |  1765.72103     1  1765.72103           Prob > F      =  0.0000
    Residual |  21770.1978  3854  5.64872803           R-squared     =  0.0750
-------------+------------------------------           Adj R-squared =  0.0748
       Total |  23535.9189  3855  6.10529672           Root MSE      =  2.3767

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   1.846065   .1044146    17.68   0.000     1.641352    2.050778
       _cons |  -1.436514   .6051111    -2.37   0.018    -2.622883   -.2501453
------------------------------------------------------------------------------
```

```
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.960332      -4.207345
 5%    -.6816645      -4.145939
10%    -.4390211      -4.074819       Obs                3856
25%     -.102772      -3.553133       Sum of Wgt.        3856

50%     .2699854                      Mean            .417576
                        Largest       Std. Dev.      .9052651
75%     .8056071       5.158467
90%     1.533568       5.514184       Variance       .8195048
95%     2.088815       5.984333       Skewness       .8386304
99%     3.252755       6.751332       Kurtosis       6.989476
```

Data set 4

```
      Source |       SS       df       MS              Number of obs =    3855
-------------+------------------------------           F( 21,  3833) =   21.52
       Model |  358.823273    21  17.0868225           Prob > F      =  0.0000
    Residual |  3043.27891  3833  .793967887           R-squared     =  0.1055
-------------+------------------------------           Adj R-squared =  0.1006
       Total |  3402.10219  3854  .882745767           Root MSE      =  .89105

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |   .0358601   .0157643     2.27   0.023     .0049528    .0667673
      fac2_1 |  -.0963634   .0177739    -5.42   0.000    -.1312107   -.0615161
      fac3_1 |    -.07052   .0150318    -4.69   0.000    -.0999912   -.0410489
      fac4_1 |    -.00241   .0150528    -0.16   0.873    -.0319222    .0271022
    mothhlth |    .038782   .0427507     0.91   0.364    -.0450344    .1225984
    fathhlth |   .0247679   .0430059     0.58   0.565    -.0595488    .1090846
     fath_ed |   .0052493   .0335414     0.16   0.876    -.0605114      .07101
     moth_ed |   .0389484    .032996     1.18   0.238     -.025743    .1036398
      inc_10 |   .0775674   .0128437     6.04   0.000     .0523864    .1027485
    num_chld |  -.0215024   .0145475    -1.48   0.139    -.0500239    .0070192
    iq_nverb |   .0089335   .0013667     6.54   0.000      .006254     .011613
      mothhr |  -.0012604   .0010348    -1.22   0.223    -.0032892    .0007684
      fathhr |   -.001542    .001195    -1.29   0.197    -.0038849    .0008008
       urban |  -.1378051   .0348224    -3.96   0.000    -.2060774   -.0695328
      lawseq |   .0103458   .0035906     2.88   0.004     .0033061    .0173856
     caraloc |   .0055215   .0037858     1.46   0.145    -.0019009    .0129439
     samepar |   .0366211    .045599     0.80   0.422    -.0527796    .1260217
      incare |   .0581801   .1331009     0.44   0.662    -.2027753    .3191356
      mea7_1 |   .0422848   .0335388     1.26   0.207    -.0234708    .1080405
        j255 |   .1112675   .1021609     1.09   0.276    -.0890274    .3115624
       ratio |  -.0049065   .0015543    -3.16   0.002    -.0079538   -.0018591
       _cons |   4.290212     .14123    30.38   0.000     4.013319    4.567105
```

```
------------------------------------------------------------------------------

. linktest

      Source |       SS       df       MS              Number of obs =    3855
-------------+------------------------------           F(  2,  3852) =  227.58
       Model |  359.517334     2  179.758667           Prob > F      =  0.0000
    Residual |  3042.58485  3852  .789871457           R-squared     =  0.1057
-------------+------------------------------           Adj R-squared =  0.1052
       Total |  3402.10219  3854  .882745767           Root MSE      =  .88875

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   2.152331   1.230194     1.75   0.080    -.2595624    4.564225
      _hatsq |  -.1073691   .1145406    -0.94   0.349     -.331935    .1171969
       _cons |  -3.081835   3.297337    -0.93   0.350    -9.546528    3.382858
------------------------------------------------------------------------------


Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =     4.75
         Prob > chi2  =   0.0293

Park test

      Source |       SS       df       MS              Number of obs =    3855
-------------+------------------------------           F(  1,  3853) =  385.15
       Model |  1914.13264     1  1914.13264           Prob > F      =  0.0000
    Residual |  19148.8997  3853  4.96986756           R-squared     =  0.0909
-------------+------------------------------           Adj R-squared =  0.0906
       Total |  21063.0323  3854  5.46523932           Root MSE      =  2.2293

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |    1.91191   .0974213    19.63   0.000     1.720908    2.102913
       _cons |  -1.720075   .5646006    -3.05   0.002     -2.82702   -.6131306
------------------------------------------------------------------------------


-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.954792       -4.15749
 5%    -.6698413      -4.148396
10%    -.4439968      -3.910066       Obs                3855
25%    -.1145134      -3.815684       Sum of Wgt.        3855

50%     .2758198                      Mean           .4176065
                        Largest       Std. Dev.      .9034661
75%     .8300151       5.240058
90%     1.526632       5.623985       Variance        .816251
95%     2.081925        5.80567       Skewness       .8234751
99%     3.201376       6.992463       Kurtosis       7.062027
```

Data set 5

```
      Source |       SS       df       MS              Number of obs =    3855
-------------+------------------------------           F( 21,  3833) =   18.79
       Model |  317.614034    21  15.1244778           Prob > F      =  0.0000
    Residual |  3084.49087  3833  .804719768           R-squared     =  0.0934
-------------+------------------------------           Adj R-squared =  0.0884
       Total |  3402.10491  3854  .882746473           Root MSE      =  .89706

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |   .0338888   .0159318     2.13   0.033     .0026532    .0651245
      fac2_1 |  -.0787939   .0173701    -4.54   0.000    -.1128495   -.0447383
      fac3_1 |  -.0330087   .0154276    -2.14   0.032    -.0632558   -.0027616
      fac4_1 |  -.0002777    .015514    -0.02   0.986    -.0306941    .0301387
```

```
    mothhlth |   .020288   .0429176     0.47   0.636    -.0638554    .1044314
    fathhlth |  .0011453   .0441208     0.03   0.979    -.0853573    .0876479
     fath_ed |   .000917   .0334001     0.03   0.978    -.0645667    .0664007
     moth_ed |  .0633895   .0331168     1.91   0.056    -.0015387    .1283177
      inc_10 |  .0736902   .0130719     5.64   0.000     .0480618    .0993187
    num_chld | -.0163382   .0146828    -1.11   0.266    -.0451251    .0124488
    iq_nverb |  .0090477   .0013798     6.56   0.000     .0063424    .0117529
      mothhr | -.0011091   .0010427    -1.06   0.288    -.0031534    .0009351
      fathhr | -.0010625   .0011991    -0.89   0.376    -.0034135    .0012885
       urban | -.0975176   .0350154    -2.78   0.005    -.1661683   -.028867
      lawseq |  .0087011   .0036488     2.38   0.017     .0015473    .0158549
     caraloc |  .0099549   .0037651     2.64   0.008     .0025732    .0173366
     samepar |  .0372669   .0461134     0.81   0.419    -.0531424    .1276761
      incare |  .0422528    .134177     0.31   0.753    -.2208124     .305318
      mea7_1 |  .0243783   .0337551     0.72   0.470    -.0418013    .0905579
        j255 |  .1649312   .1032964     1.60   0.110      -.03759    .3674524
       ratio | -.0016585   .0015811    -1.05   0.294    -.0047585    .0014415
       _cons |  4.114251   .1423225    28.91   0.000     3.835216    4.393286
------------------------------------------------------------------------------
```

```
. linktest

      Source |       SS       df       MS              Number of obs =    3855
-------------+------------------------------           F(  2,  3852) =  198.51
       Model |  317.879875     2  158.939938           Prob > F      =  0.0000
    Residual |  3084.22503  3852  .800681472           R-squared     =  0.0934
-------------+------------------------------           Adj R-squared =  0.0930
       Total |  3402.10491  3854  .882746473           Root MSE      =  .89481

------------------------------------------------------------------------------
      logern |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.809014   1.404886     1.29   0.198    -.9453768    4.563405
      _hatsq |   -.075262   .1306121    -0.58   0.564    -.3313374    .1808134
       _cons |  -2.167877   3.771864    -0.57   0.565    -9.562919    5.227165
------------------------------------------------------------------------------
```

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of logern

         chi2(1)      =     1.32
         Prob > chi2  =   0.2510
```

```
Park test

      Source |       SS       df       MS              Number of obs =    3855
-------------+------------------------------           F(  1,  3853) =  317.65
       Model |  1597.91778     1  1597.91778           Prob > F      =  0.0000
    Residual |  19382.5542  3853  5.03050978           R-squared     =  0.0762
-------------+------------------------------           Adj R-squared =  0.0759
       Total |   20980.472  3854  5.44381732           Root MSE      =  2.2429

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   1.903093   .1067797    17.82   0.000     1.693743    2.112443
       _cons |  -1.700498    .620268    -2.74   0.006    -2.916583   -.4844129
------------------------------------------------------------------------------
```

```
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.938066      -4.594726
 5%    -.6346946      -4.178158
10%    -.4145723      -4.109613       Obs                3855
25%    -.1070685       -3.78968       Sum of Wgt.        3855

50%      .284298                      Mean           .4329208
                        Largest       Std. Dev.      .9102598
75%     .8229184       5.213667
90%     1.562028       5.810974       Variance       .8285729
95%      2.10637       5.947811       Skewness       .8558021
99%     3.285153         7.3367       Kurtosis       7.343569
```

Probit: economically active (age 30)

Data set 1

Males

```
Probit estimates                                  Number of obs   =       5429
                                                  Wald chi2(21)   =     238.10
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -1417.9199                 Pseudo R2       =     0.0818

------------------------------------------------------------------------------
             |               Robust
      empact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |  -.1037552   .0250006    -4.15   0.000    -.1527555    -.054755
      fac2_1 |  -.1037335   .0286511    -3.62   0.000    -.1598887   -.0475783
      fac3_1 |   -.001991   .0254854    -0.08   0.938    -.0519414    .0479594
      fac4_1 |   .0159935   .0259477     0.62   0.538    -.0348631    .0668501
    mothhlth |  -.0971621    .072395    -1.34   0.180    -.2390537    .0447294
    fathhlth |  -.1196686   .0761027    -1.57   0.116    -.2688272      .02949
     fath_ed |   .1428787   .0586272     2.44   0.015     .0279715    .2577859
     moth_ed |   .0063041   .0600429     0.10   0.916    -.1113778     .123986
      inc_10 |   .0747353   .0245851     3.04   0.002     .0265493    .1229213
    num_chld |  -.0448913   .0236981    -1.89   0.058    -.0913387    .0015561
    iq_nverb |   .0073034   .0023279     3.14   0.002     .0027409    .0118659
      mothhr |   .0006396    .001798     0.36   0.722    -.0028845    .0041637
      fathhr |   .0028544   .0021365     1.34   0.182     -.001333    .0070419
       urban |  -.2394732   .0555085    -4.31   0.000    -.3482678   -.1306786
      lawseq |  -.0074228   .0066846    -1.11   0.267    -.0205243    .0056787
     caraloc |   .0093042   .0062744     1.48   0.138    -.0029935    .0216018
     samepar |   .1594606   .0731068     2.18   0.029      .016174    .3027473
      incare |  -.4124054   .1853368    -2.23   0.026    -.7756588   -.0491519
      mea7_1 |  -.2118508   .0545133    -3.89   0.000    -.3186948   -.1050067
        j255 |  -.2833723   .1984875    -1.43   0.153    -.6724007     .105656
       ratio |   .0050389   .0027936     1.80   0.071    -.0004364    .0105142
       _cons |   .3944144   .2454441     1.61   0.108    -.0866472    .8754759
------------------------------------------------------------------------------

. linktest

Probit estimates                                  Number of obs   =       5429
                                                  LR chi2(2)      =     252.59
                                                  Prob > chi2     =     0.0000
Log likelihood =  -1417.914                       Pseudo R2       =     0.0818

------------------------------------------------------------------------------
      empact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.034707   .3263318     3.17   0.002     .3951083    1.674306
      _hatsq |  -.0134693    .124053    -0.11   0.914    -.2566086    .2296701
       _cons |  -.0202434   .2072891    -0.10   0.922    -.4265225    .3860358
------------------------------------------------------------------------------
```

Data set 2

```
Probit estimates                                  Number of obs   =       5430
                                                  Wald chi2(21)   =     222.42
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -1427.8849                 Pseudo R2       =     0.0768

------------------------------------------------------------------------------
             |               Robust
      empact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |  -.0975623   .0257618    -3.79   0.000    -.1480545     -.04707
      fac2_1 |  -.1464076   .0286155    -5.12   0.000     -.202493   -.0903223
      fac3_1 |  -.0142912   .0260357    -0.55   0.583    -.0653202    .0367378
      fac4_1 |  -.0220646   .0249081    -0.89   0.376    -.0708835    .0267543
    mothhlth |  -.0768926   .0744401    -1.03   0.302    -.2227925    .0690072
    fathhlth |  -.0363483   .0769917    -0.47   0.637    -.1872493    .1145527
```

fath_ed	.0976326	.0573138	1.70	0.088	-.0147004	.2099656
moth_ed	.0247786	.0589161	0.42	0.674	-.0906949	.1402521
inc_10	.0749874	.0244892	3.06	0.002	.0269893	.1229854
num_chld	-.040414	.0244668	-1.65	0.099	-.0883681	.0075402
iq_nverb	.0049065	.0023005	2.13	0.033	.0003976	.0094153
mothhr	.0007641	.0017832	0.43	0.668	-.0027309	.0042591
fathhr	.0024704	.0020602	1.20	0.230	-.0015675	.0065083
urban	-.2522732	.0558056	-4.52	0.000	-.3616502	-.1428962
lawseq	-.0030461	.0066584	-0.46	0.647	-.0160963	.010004
caraloc	.0077398	.0063783	1.21	0.225	-.0047614	.020241
samepar	.1121457	.074738	1.50	0.133	-.0343382	.2586296
incare	-.4119047	.1866483	-2.21	0.027	-.7777287	-.0460807
mea7_1	-.1476358	.0549714	-2.69	0.007	-.2553779	-.0398938
j255	-.2312737	.199315	-1.16	0.246	-.6219239	.1593764
ratio	.006969	.0027971	2.49	0.013	.0014867	.0124513
_cons	.5236118	.2504256	2.09	0.037	.0327868	1.014437

. linktest

Probit estimates

Number of obs = 5430
LR chi2(2) = 237.72
Prob > chi2 = 0.0000
Log likelihood = -1427.842
Pseudo R2 = 0.0768

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.9023714	.3402383	2.65	0.008	.2355166	1.569226
_hatsq	.037968	.1297783	0.29	0.770	-.2163927	.2923287
_cons	.0571501	.2162346	0.26	0.792	-.3666618	.4809621

Data set 3.

Probit estimates

Number of obs = 5430
Wald chi2(21) = 214.20
Prob > chi2 = 0.0000
Log pseudolikelihood = -1435.681
Pseudo R2 = 0.0718

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0567812	.0253933	-2.24	0.025	-.1065511	-.0070112
fac2_1	-.1019001	.02776	-3.67	0.000	-.1563087	-.0474915
fac3_1	-.0242	.0254995	-0.95	0.343	-.0741781	.0257781
fac4_1	-.0112408	.0252404	-0.45	0.656	-.0607111	.0382294
mothhlth	-.0552237	.0755795	-0.73	0.465	-.2033569	.0929094
fathhlth	-.0291095	.0761995	-0.38	0.702	-.1784578	.1202388
fath_ed	.1481239	.0568071	2.61	0.009	.0367841	.2594638
moth_ed	-.0135917	.0583723	-0.23	0.816	-.1279993	.1008158
inc_10	.065617	.0240393	2.73	0.006	.0185009	.1127331
num_chld	-.0327552	.024551	-1.33	0.182	-.0808743	.015364
iq_nverb	.0057001	.0022801	2.50	0.012	.0012313	.010169
mothhr	.0004299	.0017776	0.24	0.809	-.0030542	.003914
fathhr	.0028045	.002122	1.32	0.186	-.0013545	.0069635
urban	-.2580531	.0552476	-4.67	0.000	-.3663364	-.1497699
lawseq	-.0029888	.0065138	-0.46	0.646	-.0157556	.009778
caraloc	.0147403	.0062398	2.36	0.018	.0025105	.0269702
samepar	.109613	.073546	1.49	0.136	-.0345345	.2537606
incare	-.401857	.1843786	-2.18	0.029	-.7632323	-.0404816
mea7_1	-.2068538	.0544453	-3.80	0.000	-.3135647	-.1001429
j255	-.253457	.1949115	-1.30	0.193	-.6354765	.1285625
ratio	.0049842	.0027968	1.78	0.075	-.0004975	.0104659
_cons	.3683887	.2450701	1.50	0.133	-.1119399	.8487173

. linktest

Probit estimates

Number of obs = 5430
LR chi2(2) = 222.34
Prob > chi2 = 0.0000
Log likelihood = -1435.5322
Pseudo R2 = 0.0719

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.7981164	.3774008	2.11	0.034	.0584244	1.537808
_hatsq	.0778768	.14323	0.54	0.587	-.2028489	.3586025
_cons	.1201683	.2407256	0.50	0.618	-.3516452	.5919818

.

Data set 4.

```
Probit estimates                                  Number of obs   =       5429
                                                  Wald chi2(21)   =     220.60
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood =  -1427.034                 Pseudo R2       =     0.0773
```

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0838078	.0248573	-3.37	0.001	-.1325271	-.0350885
fac2_1	-.1079736	.0288207	-3.75	0.000	-.164461	-.0514861
fac3_1	-.027129	.0258575	-1.05	0.294	-.0778088	.0235507
fac4_1	-.0338813	.0241269	-1.40	0.160	-.0811692	.0134066
mothhlth	-.0928714	.0739129	-1.26	0.209	-.2377381	.0519952
fathhlth	-.0864708	.0764081	-1.13	0.258	-.236228	.0632864
fath_ed	.2001924	.0577572	3.47	0.001	.0869904	.3133944
moth_ed	.0034927	.0601218	0.06	0.954	-.1143439	.1213294
inc_10	.0618075	.0239194	2.58	0.010	.0149264	.1086886
num_chld	-.039803	.0242298	-1.64	0.100	-.0872924	.0076865
iq_nverb	.0083966	.0023278	3.61	0.000	.0038342	.012959
mothhr	-.0001515	.0017423	-0.09	0.931	-.0035664	.0032633
fathhr	.0023512	.0020374	1.15	0.248	-.001642	.0063445
urban	-.1762123	.0559941	-3.15	0.002	-.2859588	-.0664658
lawseq	-.0050751	.0066303	-0.77	0.444	-.0180702	.0079201
caraloc	.0091629	.0062577	1.46	0.143	-.003102	.0214278
samepar	.1617707	.0735185	2.20	0.028	.017677	.3058643
incare	-.3788508	.1847548	-2.05	0.040	-.7409636	-.016738
mea7_1	-.1500279	.0551317	-2.72	0.007	-.258084	-.0419718
j255	-.3360158	.1860557	-1.81	0.071	-.7006782	.0286466
ratio	.0069728	.0028276	2.47	0.014	.0014309	.0125147
_cons	.2236087	.2456578	0.91	0.363	-.2578717	.7050891

. linktest

```
Probit estimates                                  Number of obs   =       5429
                                                  LR chi2(2)      =     239.23
                                                  Prob > chi2     =     0.0000
Log likelihood = -1427.0022                       Pseudo R2       =     0.0773
```

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.086507	.3489265	3.11	0.002	.4026232	1.77039
_hatsq	-.0331874	.1313069	-0.25	0.800	-.2905441	.2241693
_cons	-.0514836	.2239342	-0.23	0.818	-.4903866	.3874193

.

.

Data set 5.

```
Probit estimates                                  Number of obs   =       5429
                                                  Wald chi2(21)   =     238.98
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -1424.7509                 Pseudo R2       =     0.0788
```

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.1019089	.0251997	-4.04	0.000	-.1512995	-.0525184
fac2_1	-.1278951	.028244	-4.53	0.000	-.1832523	-.0725378
fac3_1	-.0390829	.0253518	-1.54	0.123	-.0887715	.0106056

fac4_1	-.0398994	.0245907	-1.62	0.105	-.0880962	.0082975
mothhlth	-.0616014	.0744637	-0.83	0.408	-.2075475	.0843447
fathhlth	.0263416	.0803871	0.33	0.743	-.1312142	.1838974
fath_ed	.0239607	.0585041	0.41	0.682	-.0907051	.1386266
moth_ed	-.0044917	.0588979	-0.08	0.939	-.1199294	.110946
inc_10	.077224	.0243069	3.18	0.001	.0295835	.1248646
num_chld	-.0517407	.0240415	-2.15	0.031	-.0988612	-.0046203
iq_nverb	.006367	.002248	2.83	0.005	.0019611	.010773
mothhr	-.001306	.0017322	-0.75	0.451	-.0047009	.002089
fathhr	.0013477	.0020995	0.64	0.521	-.0027671	.0054626
urban	-.2811785	.0559095	-5.03	0.000	-.3907591	-.1715979
lawseq	-.0027379	.006487	-0.42	0.673	-.0154521	.0099764
caraloc	.0084075	.0062494	1.35	0.179	-.0038411	.0206561
samepar	.1253076	.072999	1.72	0.086	-.0177678	.268383
incare	-.3813238	.1879297	-2.03	0.042	-.7496592	-.0129884
mea7_1	-.2351865	.0547325	-4.30	0.000	-.3424603	-.1279127
j255	-.2514945	.194818	-1.29	0.197	-.6333307	.1303417
ratio	.0051641	.0028258	1.83	0.068	-.0003743	.0107026
_cons	.6167275	.2412997	2.56	0.011	.1437889	1.089666

. linktest

```
Probit estimates                                  Number of obs   =       5429
                                                  LR chi2(2)      =     245.61
                                                  Prob > chi2     =     0.0000
Log likelihood = -1423.8145                       Pseudo R2       =     0.0794
```

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.5572252	.3328176	1.67	0.094	-.0950852	1.209536
_hatsq	.1732283	.1278647	1.35	0.175	-.0773819	.4238384
_cons	.2570047	.2104584	1.22	0.222	-.1554862	.6694955

Females

. Data set 1

```
Probit estimates                                  Number of obs   =       5752
                                                  Wald chi2(21)   =     339.10
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2994.7375                 Pseudo R2       =     0.0592
```

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0154273	.0200111	-0.77	0.441	-.0546483	.0237937
fac2_1	-.0920244	.0216419	-4.25	0.000	-.1344416	-.0496071
fac3_1	-.0355381	.0195579	-1.82	0.069	-.0738708	.0027946
fac4_1	-.0088722	.0191743	-0.46	0.644	-.0464531	.0287087
mothhlth	-.0134179	.0547427	-0.25	0.806	-.1207117	.0938759
fathhlth	-.0499362	.0554037	-0.90	0.367	-.1585254	.058653
fath_ed	.0197277	.0415576	0.47	0.635	-.0617237	.1011792
moth_ed	.0745386	.0425147	1.75	0.080	-.0087887	.157866
inc_10	.0484225	.0174442	2.78	0.006	.0142326	.0826124
num_chld	-.0982802	.0175721	-5.59	0.000	-.1327209	-.0638396
iq_nverb	.0111181	.0017607	6.31	0.000	.0076672	.014569
mothhr	.0001261	.0013209	0.10	0.924	-.0024627	.002715
fathhr	-.0013783	.0015103	-0.91	0.361	-.0043385	.0015819
urban	-.1247452	.0424984	-2.94	0.003	-.2080405	-.0414499
lawseq	.0008302	.0045733	0.18	0.856	-.0081333	.0097936
caraloc	.0103379	.0047294	2.19	0.029	.0010685	.0196074
samepar	.1810538	.0538738	3.36	0.001	.0754632	.2866444
incare	-.1190194	.1447095	-0.82	0.411	-.4026449	.1646061
mea7_1	.0003865	.0425538	0.01	0.993	-.0830173	.0837903
j255	-.1859871	.1442698	-1.29	0.197	-.4687507	.0967766
ratio	.0059478	.0020217	2.94	0.003	.0019853	.0099103
_cons	-.4870461	.1774041	-2.75	0.006	-.8347517	-.1393405

. linktest

```
Probit estimates                                  Number of obs   =       5752
                                                  LR chi2(2)      =     387.80
                                                  Prob > chi2     =     0.0000
Log likelihood = -2989.1287                       Pseudo R2       =     0.0609
```

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_hat	1.481058	.1534703	9.65	0.000	1.180261	1.781854
_hatsq	-.3686328	.1096133	-3.36	0.001	-.5834709	-.1537948
_cons	-.110549	.0525583	-2.10	0.035	-.2135614	-.0075366

.

Data set 2.

```
Probit estimates                                  Number of obs   =       5752
                                                  Wald chi2(21)   =     335.07
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2999.9388                 Pseudo R2       =     0.0575
```

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
fac1_1	-.060128	.019932	-3.02	0.003	-.0991939	-.0210621
fac2_1	-.1075507	.022285	-4.83	0.000	-.1512285	-.0638729
fac3_1	-.0239971	.019585	-1.23	0.220	-.062383	.0143889
fac4_1	-.0410217	.0192006	-2.14	0.033	-.0786542	-.0033893
mothhlth	-.0017879	.0548744	-0.03	0.974	-.1093398	.105764
fathhlth	-.0193846	.0557544	-0.35	0.728	-.1286612	.0898921
fath_ed	-.0011693	.0417998	-0.03	0.978	-.0830954	.0807568
moth_ed	.1046015	.0426479	2.45	0.014	.0210132	.1881898
inc_10	.0500219	.0173549	2.88	0.004	.016007	.0840368
num_chld	-.103425	.0174512	-5.93	0.000	-.1376287	-.0692212
iq_nverb	.0072288	.0017424	4.15	0.000	.0038137	.0106439
mothhr	-.0006901	.0013235	-0.52	0.602	-.0032842	.0019039
fathhr	-.0012194	.0015088	-0.81	0.419	-.0041765	.0017377
urban	-.1636619	.0423966	-3.86	0.000	-.2467578	-.0805661
lawseq	-.0024669	.0046116	-0.53	0.593	-.0115056	.0065717
caraloc	.0142692	.0047384	3.01	0.003	.0049821	.0235564
samepar	.1130862	.0542933	2.08	0.037	.0066733	.219499
incare	-.1386488	.1448982	-0.96	0.339	-.4226441	.1453464
mea7_1	.023749	.0427903	0.56	0.579	-.0601184	.1076164
j255	-.1615064	.1440689	-1.12	0.262	-.4438763	.1208635
ratio	.0060721	.0020236	3.00	0.003	.0021059	.0100383
_cons	-.1551662	.175208	-0.89	0.376	-.4985676	.1882352

```
. linktest

Iteration 0:   log likelihood = -3183.0275
Iteration 1:   log likelihood =  -2997.666
Iteration 2:   log likelihood = -2997.0028
Iteration 3:   log likelihood = -2997.0026

Probit estimates                                  Number of obs   =       5752
                                                  LR chi2(2)      =     372.05
                                                  Prob > chi2     =     0.0000
Log likelihood = -2997.0026                       Pseudo R2       =     0.0584
```

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_hat	1.347839	.1533765	8.79	0.000	1.047227	1.648452
_hatsq	-.2719495	.1118649	-2.43	0.015	-.4912008	-.0526983
_cons	-.0777048	.0521601	-1.49	0.136	-.1799367	.0245272

.

Data set 3.

```
Probit estimates                                  Number of obs   =       5751
                                                  Wald chi2(21)   =     319.77
```

```
                                                  Prob > chi2     =    0.0000
Log pseudolikelihood = -3006.5954                 Pseudo R2       =    0.0550
```

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0044818	.0200831	-0.22	0.823	-.0438441	.0348804
fac2_1	-.104277	.0217592	-4.79	0.000	-.1469243	-.0616298
fac3_1	-.069432	.0193898	-3.58	0.000	-.1074354	-.0314287
fac4_1	-.0125878	.019375	-0.65	0.516	-.0505621	.0253865
mothhlth	.0152082	.0550736	0.28	0.782	-.092734	.1231504
fathhlth	.0070025	.056028	0.12	0.901	-.1028104	.1168154
fath_ed	.0249967	.0414978	0.60	0.547	-.0563375	.1063308
moth_ed	.0664833	.0425357	1.56	0.118	-.0168852	.1498518
inc_10	.0450335	.0173509	2.60	0.009	.0110264	.0790407
num_chld	-.0875873	.0175919	-4.98	0.000	-.1220668	-.0531079
iq_nverb	.0099917	.001752	5.70	0.000	.0065579	.0134255
mothhr	-.002238	.0013314	-1.68	0.093	-.0048475	.0003715
fathhr	-.0004973	.0015323	-0.32	0.746	-.0035005	.0025059
urban	-.121317	.042204	-2.87	0.004	-.2040354	-.0385987
lawseq	-.0015093	.0045986	-0.33	0.743	-.0105225	.0075039
caraloc	.0124471	.004797	2.59	0.009	.0030451	.0218491
samepar	.1317948	.0545218	2.42	0.016	.0249341	.2386556
incare	-.1276461	.1450859	-0.88	0.379	-.4120093	.1567171
mea7_1	.0531969	.0428987	1.24	0.215	-.0308831	.1372769
j255	-.1598191	.1429431	-1.12	0.264	-.4399825	.1203443
ratio	.0042751	.0019976	2.14	0.032	.0003599	.0081903
_cons	-.3553483	.1773141	-2.00	0.045	-.7028774	-.0078191

```
. linktest

Iteration 0:   log likelihood = -3181.6084
Iteration 1:   log likelihood =   -3004.57
Iteration 2:   log likelihood = -3003.8439
Iteration 3:   log likelihood = -3003.8437

Probit estimates                                  Number of obs   =      5751
                                                  LR chi2(2)      =    355.53
                                                  Prob > chi2     =    0.0000
Log likelihood = -3003.8437                       Pseudo R2       =    0.0559
```

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.371298	.1676083	8.18	0.000	1.042791	1.699804
_hatsq	-.2796027	.118729	-2.35	0.019	-.5123072	-.0468982
_cons	-.0908066	.0570386	-1.59	0.111	-.2026002	.020987

Data set 4.

```
Probit estimates                                  Number of obs   =      5751
                                                  Wald chi2(21)   =    345.14
                                                  Prob > chi2     =    0.0000
Log pseudolikelihood =  -2992.135                 Pseudo R2       =    0.0599
```

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0341498	.0196112	-1.74	0.082	-.072587	.0042874
fac2_1	-.0941075	.0222819	-4.22	0.000	-.1377792	-.0504358
fac3_1	-.0091653	.0193011	-0.47	0.635	-.0469947	.0286641
fac4_1	.0059932	.0188443	0.32	0.750	-.0309409	.0429273
mothhlth	.0513509	.0552242	0.93	0.352	-.0568866	.1595884
fathhlth	.0128137	.0553782	0.23	0.817	-.0957255	.1213529
fath_ed	.0331679	.0417424	0.79	0.427	-.0486458	.1149816
moth_ed	.0651089	.0429167	1.52	0.129	-.0190063	.1492241
inc_10	.0549753	.0172315	3.19	0.001	.0212022	.0887485
num_chld	-.1081806	.0173408	-6.24	0.000	-.1421679	-.0741933
iq_nverb	.0100617	.0017605	5.72	0.000	.0066113	.0135121
mothhr	.0000262	.0013323	0.02	0.984	-.0025852	.0026375
fathhr	-.0014735	.0015156	-0.97	0.331	-.004444	.001497

urban	-.1162691	.0422195	-2.75	0.006	-.1990177	-.0335204
lawseq	-.0011751	.0045898	-0.26	0.798	-.0101709	.0078207
caraloc	.0137759	.0048494	2.84	0.005	.0042713	.0232806
samepar	.1708062	.0538894	3.17	0.002	.0651849	.2764274
incare	-.1382812	.1439456	-0.96	0.337	-.4204094	.143847
mea7_1	.0192388	.0430562	0.45	0.655	-.0651498	.1036274
j255	-.177418	.1442203	-1.23	0.219	-.4600846	.1052486
ratio	.0083581	.002023	4.13	0.000	.0043931	.0123231
_cons	-.5160507	.1757717	-2.94	0.003	-.8605568	-.1715446

. linktest

Probit estimates — Number of obs = 5751; LR chi2(2) = 387.08; Prob > chi2 = 0.0000; Pseudo R2 = 0.0608

Log likelihood = -2989.2084

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.327048	.1453293	9.13	0.000	1.042208	1.611888
_hatsq	-.2542574	.1047333	-2.43	0.015	-.4595309	-.048984
_cons	-.0727362	.0505015	-1.44	0.150	-.1717173	.0262448

Data set 5.

Probit estimates — Number of obs = 5751; Wald chi2(21) = 388.14; Prob > chi2 = 0.0000; Pseudo R2 = 0.0668

Log pseudolikelihood = -2970.0598

empact	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0425971	.0197004	-2.16	0.031	-.0812092	-.0039849
fac2_1	-.1549536	.0215173	-7.20	0.000	-.1971266	-.1127805
fac3_1	-.0578618	.0194536	-2.97	0.003	-.0959901	-.0197335
fac4_1	-.0459349	.0188917	-2.43	0.015	-.0829619	-.008908
mothhlth	.0003627	.0549043	0.01	0.995	-.1072477	.1079732
fathhlth	-.0105571	.0562957	-0.19	0.851	-.1208947	.0997805
fath_ed	.0087373	.0418054	0.21	0.834	-.0731997	.0906744
moth_ed	.0899001	.043206	2.08	0.037	.0052178	.1745823
inc_10	.0659086	.0175167	3.76	0.000	.0315765	.1002407
num_chld	-.10512	.0174731	-6.02	0.000	-.1393665	-.0708734
iq_nverb	.0076942	.0017609	4.37	0.000	.0042429	.0111455
mothhr	.0005378	.0013261	0.41	0.685	-.0020612	.0031368
fathhr	-.0008701	.0015091	-0.58	0.564	-.0038279	.0020876
urban	-.1022631	.0425007	-2.41	0.016	-.185563	-.0189633
lawseq	-.0062362	.0046549	-1.34	0.180	-.0153596	.0028872
caraloc	.0160764	.0047942	3.35	0.001	.0066799	.0254729
samepar	.1216944	.054772	2.22	0.026	.0143433	.2290455
incare	-.1389805	.1475583	-0.94	0.346	-.4281894	.1502284
mea7_1	.0474667	.0432122	1.10	0.272	-.0372276	.1321609
j255	-.1946182	.1453254	-1.34	0.181	-.4794508	.0902144
ratio	.0049065	.0020543	2.39	0.017	.0008801	.0089329
_cons	-.2821566	.1774339	-1.59	0.112	-.6299206	.0656075

. linktest

Probit estimates — Number of obs = 5751; LR chi2(2) = 432.10; Prob > chi2 = 0.0000; Pseudo R2 = 0.0679

Log likelihood = -2966.7017

empact	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.331154	.1375672	9.68	0.000	1.061528	1.600781
_hatsq	-.255964	.0984074	-2.60	0.009	-.4488388	-.0630891
_cons	-.0708035	.0475737	-1.49	0.137	-.1640462	.0224392

Probit: low income (age 30)

Data set 1

Males

```
Probit estimates                                  Number of obs   =       4378
                                                  Wald chi2(21)   =     310.14
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2500.1101                 Pseudo R2       =     0.0623
```

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0260211	.0215038	-1.21	0.226	-.0681677	.0161255
fac2_1	.0736456	.0233521	3.15	0.002	.0278763	.1194149
fac3_1	.050876	.0207913	2.45	0.014	.0101258	.0916263
fac4_1	.0525613	.0203813	2.58	0.010	.0126147	.0925079
mothhlth	-.0621659	.0606984	-1.02	0.306	-.1811326	.0568009
fathhlth	.0744549	.0639755	1.16	0.245	-.0509348	.1998446
fath_ed	-.0880986	.0462218	-1.91	0.057	-.1786916	.0024944
moth_ed	-.1975855	.046937	-4.21	0.000	-.2895804	-.1055906
inc_10	-.0944848	.0191911	-4.92	0.000	-.1320987	-.0568709
num_chld	.0543858	.0198784	2.74	0.006	.0154249	.0933467
iq_nverb	-.0092828	.0018725	-4.96	0.000	-.0129527	-.0056128
mothhr	.0019806	.0014651	1.35	0.176	-.000891	.0048522
fathhr	.0010189	.0016848	0.60	0.545	-.0022833	.004321
urban	.1046687	.046378	2.26	0.024	.0137694	.195568
lawseq	.0024911	.0053475	0.47	0.641	-.0079898	.0129719
caraloc	-.0094575	.005085	-1.86	0.063	-.0194239	.0005089
samepar	.0012983	.0634091	0.02	0.984	-.1229812	.1255778
incare	.1200457	.1684886	0.71	0.476	-.210186	.4502773
mea7_1	.0392052	.0450866	0.87	0.385	-.049163	.1275734
j255	-.2202478	.1835793	-1.20	0.230	-.5800566	.1395609
ratio	-.0017594	.0022201	-0.79	0.428	-.0061108	.002592
_cons	.5906156	.1976768	2.99	0.003	.2031762	.9780551

```
. linktest

Probit estimates                                  Number of obs   =       4378
                                                  LR chi2(2)      =     332.98
                                                  Prob > chi2     =     0.0000
Log likelihood = -2499.8632                       Pseudo R2       =     0.0624
```

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.085657	.1344587	8.07	0.000	.8221227	1.349191
_hatsq	.0819739	.1164509	0.70	0.481	-.1462657	.3102135
_cons	.0115613	.0391643	0.30	0.768	-.0651992	.0883218

Data set 2

```
Probit estimates                                  Number of obs   =       4379
                                                  Wald chi2(21)   =     326.03
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2493.3415                 Pseudo R2       =     0.0653
```

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0473984	.0216874	-2.19	0.029	-.089905	-.0048917
fac2_1	.0974046	.0232405	4.19	0.000	.051854	.1429552
fac3_1	.0532873	.0214529	2.48	0.013	.0112404	.0953343
fac4_1	.0608176	.0203873	2.98	0.003	.0208592	.1007759
mothhlth	-.0926551	.0619528	-1.50	0.135	-.2140805	.0287702
fathhlth	.0467572	.0641805	0.73	0.466	-.0790342	.1725487
fath_ed	-.0882914	.0462382	-1.91	0.056	-.1789165	.0023337

moth_ed	-.2150162	.0468836	-4.59	0.000	-.3069064	-.1231259
inc_10	-.088404	.01908	-4.63	0.000	-.1258001	-.0510078
num_chld	.036979	.0201293	1.84	0.066	-.0024736	.0764317
iq_nverb	-.0095662	.0018553	-5.16	0.000	-.0132026	-.0059298
mothhr	.0017382	.0014534	1.20	0.232	-.0011105	.0045869
fathhr	.0028349	.0016854	1.68	0.093	-.0004684	.0061382
urban	.1096278	.0466135	2.35	0.019	.0182671	.2009885
lawseq	.0000575	.005392	0.01	0.991	-.0105107	.0106256
caraloc	-.0062046	.0051709	-1.20	0.230	-.0163395	.0039302
samepar	.0796964	.0641536	1.24	0.214	-.0460424	.2054353
incare	.1207849	.1687279	0.72	0.474	-.2099156	.4514854
mea7_1	.030255	.0455366	0.66	0.506	-.0589952	.1195052
j255	-.2016892	.1777036	-1.13	0.256	-.5499818	.1466034
ratio	-.0017148	.0022238	-0.77	0.441	-.0060734	.0026438
_cons	.477698	.2009494	2.38	0.017	.0838444	.8715516

. linktest

Probit estimates

Number of obs = 4379
LR chi2(2) = 348.60
Prob > chi2 = 0.0000
Log likelihood = -2493.2621
Pseudo R2 = 0.0653

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.04626	.12862	8.13	0.000	.7941695	1.29835
_hatsq	.0450036	.1128207	0.40	0.690	-.1761208	.266128
_cons	.0056672	.0377249	0.15	0.881	-.0682723	.0796066

Data set 3

Probit estimates

Number of obs = 4379
Wald chi2(21) = 341.46
Prob > chi2 = 0.0000
Log pseudolikelihood = -2488.6725
Pseudo R2 = 0.0671

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0388431	.0210638	-1.84	0.065	-.0801274	.0024413
fac2_1	.1275177	.0232849	5.48	0.000	.0818801	.1731553
fac3_1	.0417145	.0212416	1.96	0.050	.0000816	.0833473
fac4_1	.0588427	.0203457	2.89	0.004	.0189659	.0987195
mothhlth	-.0855508	.0633572	-1.35	0.177	-.2097287	.038627
fathhlth	.0189308	.0636676	0.30	0.766	-.1058554	.143717
fath_ed	-.0722914	.0463583	-1.56	0.119	-.1631519	.0185692
moth_ed	-.2355381	.0472572	-4.98	0.000	-.3281605	-.1429156
inc_10	-.0817488	.0190659	-4.29	0.000	-.1191173	-.0443804
num_chld	.0488383	.0200663	2.43	0.015	.009509	.0881676
iq_nverb	-.0084352	.0018405	-4.58	0.000	-.0120425	-.0048279
mothhr	.0026687	.0014489	1.84	0.065	-.0001712	.0055085
fathhr	.0008821	.0016916	0.52	0.602	-.0024334	.0041975
urban	.0835599	.0468876	1.78	0.075	-.008338	.1754578
lawseq	.0026537	.0053061	0.50	0.617	-.0077461	.0130536
caraloc	-.0097411	.0051576	-1.89	0.059	-.0198498	.0003676
samepar	.0785471	.063964	1.23	0.219	-.0468199	.2039142
incare	.1288381	.1674422	0.77	0.442	-.1993427	.4570189
mea7_1	.0725879	.0451778	1.61	0.108	-.015959	.1611348
j255	-.2372987	.1783638	-1.33	0.183	-.5868853	.1122878
ratio	.0010779	.0022092	0.49	0.626	-.003252	.0054077
_cons	.3664142	.2005185	1.83	0.068	-.0265948	.7594233

. linktest

Probit estimates

Number of obs = 4379
LR chi2(2) = 357.87
Prob > chi2 = 0.0000
Log likelihood = -2488.6251
Pseudo R2 = 0.0671

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_hat	.9653408	.1251967	7.71	0.000	.7199596	1.210722
_hatsq	-.0338973	.1102932	-0.31	0.759	-.2500681	.1822735
_cons	-.0040733	.0370522	-0.11	0.912	-.0766942	.0685477

Data 4

```
Probit estimates                                  Number of obs   =       4379
                                                  Wald chi2(21)   =     340.73
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2483.7873                 Pseudo R2       =     0.0689
```

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
fac1_1	-.044016	.0215548	-2.04	0.041	-.0862626	-.0017694
fac2_1	.107078	.0231593	4.62	0.000	.0616866	.1524695
fac3_1	.0528088	.0210586	2.51	0.012	.0115346	.094083
fac4_1	.0753532	.0199474	3.78	0.000	.0362571	.1144493
mothhlth	-.0670916	.0622835	-1.08	0.281	-.189165	.0549817
fathhlth	.0686903	.0643749	1.07	0.286	-.0574821	.1948627
fath_ed	-.1287572	.0461663	-2.79	0.005	-.2192414	-.038273
moth_ed	-.2040601	.0470325	-4.34	0.000	-.2962422	-.1118781
inc_10	-.0750365	.0187556	-4.00	0.000	-.1117969	-.0382761
num_chld	.0552962	.0199667	2.77	0.006	.0161622	.0944302
iq_nverb	-.0098492	.0018752	-5.25	0.000	-.0135245	-.0061739
mothhr	.0016966	.0014693	1.15	0.248	-.0011832	.0045765
fathhr	.0015766	.0016856	0.94	0.350	-.0017271	.0048802
urban	.0851288	.0467767	1.82	0.069	-.0065518	.1768094
lawseq	-.0049199	.005287	-0.93	0.352	-.0152822	.0054424
caraloc	-.0047164	.0051333	-0.92	0.358	-.0147775	.0053448
samepar	.0291896	.0635806	0.46	0.646	-.0954262	.1538053
incare	.0727934	.1680125	0.43	0.665	-.2565051	.4020918
mea7_1	.0665588	.0453404	1.47	0.142	-.0223068	.1554245
j255	-.1772785	.1764146	-1.00	0.315	-.5230447	.1684878
ratio	-.0007206	.0022105	-0.33	0.744	-.005053	.0036119
_cons	.5345602	.1993282	2.68	0.007	.143884	.9252364

```
. linktest

Probit estimates                                  Number of obs   =       4379
                                                  LR chi2(2)      =     367.68
                                                  Prob > chi2     =     0.0000
Log likelihood = -2483.7244                       Pseudo R2       =     0.0689
```

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_hat	1.03875	.1218209	8.53	0.000	.7999859	1.277515
_hatsq	.0381433	.1074233	0.36	0.723	-.1724025	.248689
_cons	.0042698	.0363819	0.12	0.907	-.0670373	.0755769

Data set 5

```
Probit estimates                                  Number of obs   =       4378
                                                  Wald chi2(21)   =     291.49
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood =  -2509.729                 Pseudo R2       =     0.0587
```

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
fac1_1	-.0363095	.0216201	-1.68	0.093	-.0786841	.0060651
fac2_1	.0742827	.0230598	3.22	0.001	.0290863	.1194791

fac3_1	.0600726	.0212028	2.83	0.005	.0185158	.1016293
fac4_1	.0582806	.0202922	2.87	0.004	.0185085	.0980526
mothhlth	-.138642	.0624728	-2.22	0.026	-.2610864	-.0161976
fathhlth	.0296645	.0651033	0.46	0.649	-.0979356	.1572647
fath_ed	-.0486127	.0463682	-1.05	0.294	-.1394927	.0422673
moth_ed	-.1901882	.0470605	-4.04	0.000	-.2824251	-.0979513
inc_10	-.0775329	.0190993	-4.06	0.000	-.1149669	-.0400988
num_chld	.0415836	.0201191	2.07	0.039	.0021508	.0810164
iq_nverb	-.0100571	.0018343	-5.48	0.000	-.0136522	-.006462
mothhr	.0030743	.001462	2.10	0.035	.0002088	.0059398
fathhr	.0018429	.0016688	1.10	0.269	-.0014279	.0051137
urban	.1069018	.0466016	2.29	0.022	.0155642	.1982394
lawseq	-.003355	.0053221	-0.63	0.528	-.0137861	.0070761
caraloc	-.0065933	.0050791	-1.30	0.194	-.0165481	.0033615
samepar	.0287607	.0623531	0.46	0.645	-.0934492	.1509706
incare	.1378556	.1665209	0.83	0.408	-.1885194	.4642306
mea7_1	.0852435	.0450005	1.89	0.058	-.0029557	.1734428
j255	-.2248524	.1783471	-1.26	0.207	-.5744063	.1247014
ratio	-.0004316	.0022167	-0.19	0.846	-.0047763	.003913
_cons	.5182513	.1977546	2.62	0.009	.1306593	.9058432

. linktest

Probit estimates | | Number of obs = 4378
LR chi2(2) = 313.31
Prob > chi2 = 0.0000
Log likelihood = -2509.6966 | | Pseudo R2 = 0.0588

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_hat	1.032121	.138826	7.43	0.000	.7600275	1.304215
_hatsq	.031201	.122372	0.25	0.799	-.2086436	.2710457
_cons	.0043878	.0400829	0.11	0.913	-.0741732	.0829487

Females

Data set 1

Probit estimates | | Number of obs = 4990
Wald chi2(21) = 398.48
Prob > chi2 = 0.0000
Log pseudolikelihood = -2838.3373 | | Pseudo R2 = 0.0707

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
fac1_1	-.0113381	.0211691	-0.54	0.592	-.0528287	.0301526
fac2_1	.0804365	.0227235	3.54	0.000	.0358992	.1249737
fac3_1	.0112277	.020207	0.56	0.578	-.0283773	.0508327
fac4_1	.0467398	.0200969	2.33	0.020	.0073506	.086129
mothhlth	-.0484884	.0579329	-0.84	0.403	-.1620347	.065058
fathhlth	.0268766	.0581487	0.46	0.644	-.0870928	.1408459
fath_ed	-.021481	.0432954	-0.50	0.620	-.1063384	.0633763
moth_ed	-.1423312	.0441747	-3.22	0.001	-.228912	-.0557504
inc_10	-.0815317	.018285	-4.46	0.000	-.1173696	-.0456938
num_chld	.0781162	.0185774	4.20	0.000	.0417053	.1145271
iq_nverb	-.011393	.0018313	-6.22	0.000	-.0149823	-.0078037
mothhr	.003267	.0013887	2.35	0.019	.0005452	.0059888
fathhr	-.0007684	.0015812	-0.49	0.627	-.0038674	.0023306
urban	.1568931	.0441936	3.55	0.000	.0702753	.2435109
lawseq	-.0038149	.0047729	-0.80	0.424	-.0131696	.0055398
caraloc	-.0151821	.0048809	-3.11	0.002	-.0247484	-.0056158
samepar	-.1063078	.056967	-1.87	0.062	-.2179611	.0053455
incare	.2646524	.1556584	1.70	0.089	-.0404324	.5697372
mea7_1	.0419034	.0439229	0.95	0.340	-.044184	.1279908
j255	.0983441	.1697633	0.58	0.562	-.2343857	.431074
ratio	-.001277	.0020865	-0.61	0.541	-.0053664	.0028124
_cons	.8893235	.1844567	4.82	0.000	.527795	1.250852

. linktest

```
Probit estimates                                  Number of obs   =       4990
                                                  LR chi2(2)      =     436.02
                                                  Prob > chi2     =     0.0000
Log likelihood = -2836.1088                       Pseudo R2       =     0.0714
```

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.196635	.106156	11.27	0.000	.9885732	1.404697
_hatsq	.2037628	.0964433	2.11	0.035	.0147375	.3927881
_cons	.0166313	.0326685	0.51	0.611	-.0473976	.0806603

Data set 2

```
Probit estimates                                  Number of obs   =       4990
                                                  Wald chi2(21)   =     409.24
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2834.5707                 Pseudo R2       =     0.0719
```

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0129808	.021222	0.61	0.541	-.0286135	.0545751
fac2_1	.1086823	.023423	4.64	0.000	.0627741	.1545906
fac3_1	.0481275	.0202183	2.38	0.017	.0085003	.0877547
fac4_1	.0404282	.0201294	2.01	0.045	.0009753	.0798811
mothhlth	-.0766984	.0583159	-1.32	0.188	-.1909955	.0375987
fathhlth	.0553333	.0583265	0.95	0.343	-.0589846	.1696511
fath_ed	-.0335514	.0432231	-0.78	0.438	-.1182672	.0511644
moth_ed	-.1599852	.0440593	-3.63	0.000	-.2463399	-.0736305
inc_10	-.0717273	.0182156	-3.94	0.000	-.1074291	-.0360255
num_chld	.0886824	.0185206	4.79	0.000	.0523826	.1249821
iq_nverb	-.0111123	.0018232	-6.09	0.000	-.0146858	-.0075389
mothhr	.0011698	.0014123	0.83	0.407	-.0015981	.0039378
fathhr	.0009885	.0015813	0.63	0.532	-.0021107	.0040878
urban	.1424198	.0441884	3.22	0.001	.0558122	.2290274
lawseq	-.0039734	.004812	-0.83	0.409	-.0134046	.0054579
caraloc	-.0099802	.004908	-2.03	0.042	-.0195996	-.0003608
samepar	-.0714343	.0569714	-1.25	0.210	-.1830962	.0402277
incare	.2778063	.1548937	1.79	0.073	-.0257798	.5813924
mea7_1	.0339527	.044283	0.77	0.443	-.0528404	.1207457
j255	.0721639	.167944	0.43	0.667	-.2570004	.4013282
ratio	-.0019897	.0020945	-0.95	0.342	-.0060948	.0021153
_cons	.6780507	.1823693	3.72	0.000	.3206133	1.035488

```
. linktest

Probit estimates                                  Number of obs   =       4990
                                                  LR chi2(2)      =     442.94
                                                  Prob > chi2     =     0.0000
Log likelihood = -2832.6489                       Pseudo R2       =     0.0725
```

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.178945	.104349	11.30	0.000	.9744248	1.383465
_hatsq	.1857396	.0946848	1.96	0.050	.0001607	.3713185
_cons	.0145797	.032411	0.45	0.653	-.0489448	.0781041

Data set 3

```
Probit estimates                                  Number of obs   =       4989
                                                  Wald chi2(21)   =     407.75
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2835.5586                 Pseudo R2       =     0.0712
```

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	-.0111331	.0210245	-0.53	0.596	-.0523404	.0300742
fac2_1	.1106413	.0231491	4.78	0.000	.0652698	.1560128
fac3_1	-.0113041	.0200997	-0.56	0.574	-.0506988	.0280906
fac4_1	.0700537	.0201441	3.48	0.001	.030572	.1095354
mothhlth	-.0296951	.0581903	-0.51	0.610	-.143746	.0843557
fathhlth	.013415	.0581976	0.23	0.818	-.1006501	.1274802
fath_ed	-.0746268	.0432554	-1.73	0.084	-.1594058	.0101522
moth_ed	-.1318883	.0442478	-2.98	0.003	-.2186123	-.0451643
inc_10	-.0758295	.0182412	-4.16	0.000	-.1115815	-.0400774
num_chld	.0814452	.0184369	4.42	0.000	.0453096	.1175808
iq_nverb	-.0116258	.0018257	-6.37	0.000	-.015204	-.0080475
mothhr	.0032323	.001411	2.29	0.022	.0004668	.0059978
fathhr	.0003707	.0016077	0.23	0.818	-.0027803	.0035216
urban	.120549	.0438643	2.75	0.006	.0345765	.2065216
lawseq	-.0060729	.0048072	-1.26	0.206	-.0154948	.003349
caraloc	-.0109862	.0049966	-2.20	0.028	-.0207793	-.001193
samepar	-.0937772	.0569506	-1.65	0.100	-.2053983	.0178438
incare	.2369412	.1562446	1.52	0.129	-.0692927	.543175
mea7_1	.0109991	.0441142	0.25	0.803	-.0754631	.0974613
j255	.1053038	.1659712	0.63	0.526	-.2199937	.4306014
ratio	-.0023219	.0020785	-1.12	0.264	-.0063957	.0017519
_cons	.8391754	.1843495	4.55	0.000	.4778571	1.200494

```
. linktest

Iteration 0:   log likelihood = -3052.9211
Iteration 1:   log likelihood = -2833.8351
Iteration 2:   log likelihood = -2832.7605
Iteration 3:   log likelihood = -2832.7603

Probit estimates                                  Number of obs   =       4989
                                                  LR chi2(2)      =     440.32
                                                  Prob > chi2     =     0.0000
Log likelihood = -2832.7603                       Pseudo R2       =     0.0721
```

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.219058	.1059155	11.51	0.000	1.011467	1.426648
_hatsq	.2247661	.0949661	2.37	0.018	.0386359	.4108963
_cons	.0193096	.032793	0.59	0.556	-.0449636	.0835828

Data set 4

```
Probit estimates                                  Number of obs   =       4989
                                                  Wald chi2(21)   =     423.21
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -2825.9029                 Pseudo R2       =     0.0746
```

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0086056	.0207751	0.41	0.679	-.0321129	.0493241
fac2_1	.0883576	.0231967	3.81	0.000	.0428929	.1338222
fac3_1	.0561682	.0198407	2.83	0.005	.0172811	.0950554
fac4_1	.0505378	.0195563	2.58	0.010	.0122081	.0888675
mothhlth	-.0512735	.0588033	-0.87	0.383	-.1665259	.0639788
fathhlth	.0337065	.0574665	0.59	0.558	-.0789257	.1463388
fath_ed	-.0828218	.0435791	-1.90	0.057	-.1682353	.0025917
moth_ed	-.1222721	.0446383	-2.74	0.006	-.2097615	-.0347826
inc_10	-.0757087	.018072	-4.19	0.000	-.1111291	-.0402883
num_chld	.0895495	.0185389	4.83	0.000	.0532139	.1258851
iq_nverb	-.0109693	.0018267	-6.00	0.000	-.0145496	-.007389
mothhr	.0023082	.0014029	1.65	0.100	-.0004415	.0050579
fathhr	-.0001004	.0015997	-0.06	0.950	-.0032358	.003035
urban	.134854	.0439428	3.07	0.002	.0487278	.2209802
lawseq	-.0039978	.0047852	-0.84	0.403	-.0133765	.005381
caraloc	-.0160172	.004955	-3.23	0.001	-.0257288	-.0063056

samepar	-.0874486	.0567965	-1.54	0.124	-.1987677	.0238705
incare	.2714796	.1553903	1.75	0.081	-.0330799	.5760391
mea7_1	.0244768	.0443954	0.55	0.581	-.0625366	.1114903
j255	.0925145	.1716112	0.54	0.590	-.2438372	.4288663
ratio	-.0033225	.0021102	-1.57	0.115	-.0074585	.0008135
_cons	.8775863	.1840307	4.77	0.000	.5168929	1.23828

. linktest

Probit estimates Number of obs = 4989
LR chi2(2) = 457.62
Prob > chi2 = 0.0000
Log likelihood = -2824.9539 Pseudo R2 = 0.0749

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.119281	.0995941	11.24	0.000	.9240805	1.314482
_hatsq	.125094	.0907191	1.38	0.168	-.0527122	.3029002
_cons	.0084878	.031718	0.27	0.789	-.0536782	.0706539

Data set 5

Probit estimates Number of obs = 4989
Wald chi2(21) = 416.35
Prob > chi2 = 0.0000
Log pseudolikelihood = -2834.1924 Pseudo R2 = 0.0719

low_inc	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0019268	.0211419	0.09	0.927	-.0395105	.0433642
fac2_1	.0987193	.0227004	4.35	0.000	.0542273	.1432113
fac3_1	.0128148	.0196776	0.65	0.515	-.0257525	.0513821
fac4_1	.0425554	.0199021	2.14	0.032	.0035479	.0815629
mothhlth	-.0412108	.0574	-0.72	0.473	-.1537128	.0712912
fathhlth	.0485943	.058383	0.83	0.405	-.0658344	.163023
fath_ed	-.0358938	.0432818	-0.83	0.407	-.1207246	.0489371
moth_ed	-.1309412	.0444357	-2.95	0.003	-.2180336	-.0438487
inc_10	-.087017	.0180836	-4.81	0.000	-.1224601	-.0515738
num_chld	.0795708	.0183106	4.35	0.000	.0436826	.115459
iq_nverb	-.011245	.0018266	-6.16	0.000	-.014825	-.0076649
mothhr	.0013248	.0014032	0.94	0.345	-.0014254	.004075
fathhr	.0022106	.0015757	1.40	0.161	-.0008777	.0052989
urban	.1388697	.0437968	3.17	0.002	.0530295	.2247098
lawseq	-.003209	.0048299	-0.66	0.506	-.0126755	.0062575
caraloc	-.0139413	.0049589	-2.81	0.005	-.0236605	-.0042221
samepar	-.1447107	.0572211	-2.53	0.011	-.2568619	-.0325595
incare	.2356388	.1574872	1.50	0.135	-.0730304	.544308
mea7_1	.0295714	.0443717	0.67	0.505	-.0573956	.1165384
j255	.0763831	.1707813	0.45	0.655	-.2583421	.4111084
ratio	-.0017703	.002107	-0.84	0.401	-.0058999	.0023592
_cons	.830842	.1833452	4.53	0.000	.471492	1.190192

. linktest

Probit estimates Number of obs = 4989
LR chi2(2) = 444.89
Prob > chi2 = 0.0000
Log likelihood = -2831.318 Pseudo R2 = 0.0728

low_inc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.221482	.1057128	11.55	0.000	1.014289	1.428675
_hatsq	.2276044	.0949769	2.40	0.017	.041453	.4137558
_cons	.0190701	.0326472	0.58	0.559	-.0449172	.0830573

Ordered probit: occupational status (age 30)

Males

Data set 1

```
Ordered probit estimates                          Number of obs   =       4830
                                                  Wald chi2(21)   =     969.33
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -5515.1868                 Pseudo R2       =     0.0846

------------------------------------------------------------------------------
             |               Robust
      oclass |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       fac1_1 |   .0658256   .0167432     3.93   0.000     .0330095    .0986417
       fac2_1 |   .1322228   .0175416     7.54   0.000     .0978418    .1666038
       fac3_1 |   .0181483   .0159512     1.14   0.255    -.0131154     .049412
       fac4_1 |  -.0100278   .0161603    -0.62   0.535    -.0417015    .0216458
     mothhlth |   .0472333   .0452771     1.04   0.297    -.0415082    .1359748
     fathhlth |   .0547033   .0503781     1.09   0.278     -.044036    .1534426
      fath_ed |  -.1262672   .0364017    -3.47   0.001    -.1976133   -.0549212
      moth_ed |  -.1359328   .0355897    -3.82   0.000    -.2056873   -.0661784
       inc_10 |  -.0952629   .0141569    -6.73   0.000      -.12301   -.0675158
     num_chld |  -.0041006   .0165265    -0.25   0.804     -.036492    .0282908
     iq_nverb |  -.0189068   .0014472   -13.06   0.000    -.0217432   -.0160704
       mothhr |   .0004201   .0010952     0.38   0.701    -.0017264    .0025666
       fathhr |   .0001962   .0013012     0.15   0.880    -.0023541    .0027466
        urban |   .1965268    .037339     5.26   0.000     .1233437    .2697099
       lawseq |  -.0046952   .0041051    -1.14   0.253    -.0127411    .0033507
      caraloc |  -.0130577   .0038587    -3.38   0.001    -.0206207   -.0054948
      samepar |   .0721335   .0519634     1.39   0.165    -.0297129      .17398
       incare |   .1809374   .1378948     1.31   0.189    -.0893314    .4512061
       mea7_1 |  -.0062017   .0340157    -0.18   0.855    -.0728713    .0604678
         j255 |   -.254231   .1109768    -2.29   0.022    -.4717416   -.0367205
        ratio |  -.0018072   .0016924    -1.07   0.286    -.0051244    .0015099
-------------+----------------------------------------------------------------
        _cut1 |  -3.816927   .1681637          (Ancillary parameters)
        _cut2 |  -2.438292   .1628637
        _cut3 |  -.9341081   .1600056
        _cut4 |    .059204   .1629499
------------------------------------------------------------------------------

. linktest

Ordered probit estimates                          Number of obs   =       4830
                                                  LR chi2(2)      =    1039.77
                                                  Prob > chi2     =     0.0000
Log likelihood = -5505.1643                       Pseudo R2       =     0.0863

------------------------------------------------------------------------------
      oclass |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .1310404   .1966414     0.67   0.505    -.2543696    .5164504
      _hatsq |   -.198531   .0443659    -4.47   0.000    -.2854866   -.1115754
-------------+----------------------------------------------------------------
        _cut1 |  -2.930178    .214498          (Ancillary parameters)
        _cut2 |  -1.537953   .2141344
        _cut3 |  -.0369199   .2119931
        _cut4 |   .9488751   .2126652
------------------------------------------------------------------------------
```

Data set 2

```
Ordered probit estimates                          Number of obs   =       4830
                                                  Wald chi2(21)   =     969.69
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -5543.4415                 Pseudo R2       =     0.0799

------------------------------------------------------------------------------
             |               Robust
      oclass |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
```

fac1_1	.0257185	.0168474	1.53	0.127	-.0073017	.0587387
fac2_1	.1011673	.0172572	5.86	0.000	.0673438	.1349907
fac3_1	.0194934	.0161955	1.20	0.229	-.0122492	.051236
fac4_1	.0193788	.0158235	1.22	0.221	-.0116347	.0503923
mothhlth	.035499	.0472581	0.75	0.453	-.0571252	.1281232
fathhlth	.0999439	.0500971	2.00	0.046	.0017554	.1981325
fath_ed	-.1322205	.0360115	-3.67	0.000	-.2028017	-.0616393
moth_ed	-.1522426	.0357937	-4.25	0.000	-.222397	-.0820882
inc_10	-.0969768	.0141179	-6.87	0.000	-.1246474	-.0693063
num_chld	.0012885	.0167235	0.08	0.939	-.0314889	.034066
iq_nverb	-.0181657	.0014237	-12.76	0.000	-.0209561	-.0153753
mothhr	-.0001108	.0010992	-0.10	0.920	-.0022652	.0020436
fathhr	.0005876	.0013205	0.44	0.656	-.0020005	.0031757
urban	.1427485	.0375723	3.80	0.000	.0691082	.2163888
lawseq	-.0037589	.0040897	-0.92	0.358	-.0117745	.0042567
caraloc	-.0186896	.0039531	-4.73	0.000	-.0264376	-.0109416
samepar	.0762891	.0513266	1.49	0.137	-.0243093	.1768874
incare	.1459837	.1391906	1.05	0.294	-.126825	.4187923
mea7_1	.0042175	.0342861	0.12	0.902	-.0629821	.0714171
j255	-.237423	.1121272	-2.12	0.034	-.4571884	-.0176576
ratio	.0002339	.0016675	0.14	0.888	-.0030343	.0035021
_cut1	-3.810107	.1677723	(Ancillary parameters)			
_cut2	-2.444967	.1627248				
_cut3	-.9477087	.1602132				
_cut4	.0436416	.1639206				

. linktest

Ordered probit estimates   Number of obs = 4830
                            LR chi2(2) = 973.03
                            Prob > chi2 = 0.0000
Log likelihood = -5538.5351   Pseudo R2 = 0.0807

oclass	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.3655238	.2051962	1.78	0.075	-.0366535	.767701
_hatsq	-.1445059	.0461537	-3.13	0.002	-.2349655	-.0540463
_cut1	-3.156178	.2251667	(Ancillary parameters)			
_cut2	-1.783225	.2245405				
_cut3	-.2884496	.2223082				
_cut4	.6978203	.2228914				

Data set 3

Ordered probit estimates   Number of obs = 4830
                            Wald chi2(21) = 998.89
                            Prob > chi2 = 0.0000
Log pseudolikelihood = -5520.4754   Pseudo R2 = 0.0837

oclass	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0500142	.0160309	3.12	0.002	.0185943	.0814342
fac2_1	.1399678	.0169491	8.26	0.000	.1067483	.1731874
fac3_1	.0107387	.0158873	0.68	0.499	-.0203999	.0418772
fac4_1	.0083894	.0158716	0.53	0.597	-.0227183	.0394972
mothhlth	.019813	.0469747	0.42	0.673	-.0722557	.1118817
fathhlth	.0378438	.0496356	0.76	0.446	-.0594401	.1351278
fath_ed	-.1654474	.036339	-4.55	0.000	-.2366705	-.0942243
moth_ed	-.163529	.0360806	-4.53	0.000	-.2342457	-.0928122
inc_10	-.0859311	.0141823	-6.06	0.000	-.113728	-.0581342
num_chld	.0083136	.0165864	0.50	0.616	-.0241952	.0408225
iq_nverb	-.0177161	.0014273	-12.41	0.000	-.0205137	-.0149186
mothhr	.0001694	.0010941	0.15	0.877	-.001975	.0023138
fathhr	.0000415	.0013137	0.03	0.975	-.0025332	.0026162
urban	.140883	.0375878	3.75	0.000	.0672122	.2145537
lawseq	-.007263	.004085	-1.78	0.075	-.0152695	.0007435

caraloc	-.0144667	.0039164	-3.69	0.000	-.0221426	-.0067908
samepar	.0470712	.0506794	0.93	0.353	-.0522586	.146401
incare	.1667724	.1419586	1.17	0.240	-.1114615	.4450062
mea7_1	.002868	.0342748	0.08	0.933	-.0643093	.0700453
j255	-.2290129	.1126403	-2.03	0.042	-.4497839	-.0082419
ratio	.0006304	.001673	0.38	0.706	-.0026486	.0039094
_cut1	-3.763623	.1685398	(Ancillary parameters)			
_cut2	-2.391487	.1636025				
_cut3	-.8858335	.1608558				
_cut4	.1128133	.1649442				

. linktest

```
Ordered probit estimates                          Number of obs   =       4830
                                                  LR chi2(2)      =    1018.69
                                                  Prob > chi2     =     0.0000
Log likelihood = -5515.7068                       Pseudo R2       =     0.0845
```

oclass	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.4095892	.1938712	2.11	0.035	.0296087	.7895697
_hatsq	-.1381225	.0447509	-3.09	0.002	-.2258326	-.0504124
_cut1	-3.175633	.2070868	(Ancillary parameters)			
_cut2	-1.795499	.2063015				
_cut3	-.2922558	.2039946				
_cut4	.7005234	.2045476				

Data set 4

```
Ordered probit estimates                          Number of obs   =       4829
                                                  Wald chi2(21)   =     979.26
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -5517.4632                 Pseudo R2       =     0.0841
```

oclass	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0455452	.016469	2.77	0.006	.0132666	.0778238
fac2_1	.120626	.0175122	6.89	0.000	.0863027	.1549494
fac3_1	.025962	.015848	1.64	0.101	-.0050994	.0570235
fac4_1	.004397	.0160103	0.27	0.784	-.0269825	.0357765
mothhlth	.0465089	.046496	1.00	0.317	-.0446215	.1376393
fathhlth	.0952115	.0494136	1.93	0.054	-.0016375	.1920604
fath_ed	-.120889	.0363518	-3.33	0.001	-.1921372	-.0496408
moth_ed	-.1237289	.0360681	-3.43	0.001	-.194421	-.0530368
inc_10	-.102705	.0142503	-7.21	0.000	-.1306351	-.0747749
num_chld	.0151341	.0163027	0.93	0.353	-.0168186	.0470868
iq_nverb	-.018467	.0014612	-12.64	0.000	-.0213309	-.0156031
mothhr	.0001698	.0011051	0.15	0.878	-.0019963	.0023358
fathhr	.0010205	.0013091	0.78	0.436	-.0015452	.0035863
urban	.1594019	.0373615	4.27	0.000	.0861747	.2326291
lawseq	-.0074539	.0040284	-1.85	0.064	-.0153495	.0004416
caraloc	-.0162509	.0039332	-4.13	0.000	-.0239598	-.008542
samepar	.0279392	.0518936	0.54	0.590	-.0737704	.1296488
incare	.1138251	.1431416	0.80	0.427	-.1667272	.3943775
mea7_1	.0152662	.0342174	0.45	0.655	-.0517988	.0823312
j255	-.2275772	.1170224	-1.94	0.052	-.4569368	.0017824
ratio	.0013187	.0016828	0.78	0.433	-.0019794	.0046169
_cut1	-3.805985	.1694836	(Ancillary parameters)			
_cut2	-2.433934	.1642915				
_cut3	-.9274162	.1617853				
_cut4	.0715713	.1657713				

. linktest

```
Ordered probit estimates                          Number of obs   =       4829
```

	LR chi2(2) =	1018.90
	Prob > chi2 =	0.0000
Log likelihood = -5514.804	Pseudo R2 =	0.0846

oclass	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.5510456	.1972776	2.79	0.005	.1643886	.9377027
_hatsq	-.1024436	.0444345	-2.31	0.021	-.1895336	-.0153536
_cut1	-3.345855	.2159235		(Ancillary parameters)		
_cut2	-1.96787	.2152432				
_cut3	-.4636567	.2127251				
_cut4	.5306416	.2130307				

Data set 5

Ordered probit estimates	Number of obs =	4829
	Wald chi2(21) =	965.79
	Prob > chi2 =	0.0000
Log pseudolikelihood = -5537.5291	Pseudo R2 =	0.0808

oclass	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0173264	.0165101	1.05	0.294	-.0150327	.0496856
fac2_1	.1371953	.0172797	7.94	0.000	.1033277	.171063
fac3_1	-.0170748	.0160738	-1.06	0.288	-.0485788	.0144292
fac4_1	.0069559	.0162796	0.43	0.669	-.0249517	.0388634
mothhlth	.0253666	.0468851	0.54	0.588	-.0665266	.1172597
fathhlth	.0437124	.0501252	0.87	0.383	-.0545313	.141956
fath_ed	-.1622812	.036446	-4.45	0.000	-.233714	-.0908483
moth_ed	-.1215458	.0358007	-3.40	0.001	-.1917138	-.0513777
inc_10	-.0878154	.0143292	-6.13	0.000	-.1159001	-.0597308
num_chld	-.0037856	.016497	-0.23	0.819	-.036119	.0285479
iq_nverb	-.0190392	.0014246	-13.36	0.000	-.0218314	-.0162471
mothhr	.0005557	.0011012	0.50	0.614	-.0016025	.0027139
fathhr	.001131	.0012823	0.88	0.378	-.0013822	.0036443
urban	.1620376	.0375867	4.31	0.000	.088369	.2357061
lawseq	-.0042286	.0040788	-1.04	0.300	-.012223	.0037657
caraloc	-.0118238	.0038345	-3.08	0.002	-.0193392	-.0043083
samepar	.0576623	.0505998	1.14	0.254	-.0415115	.156836
incare	.1921333	.1361026	1.41	0.158	-.0746229	.4588895
mea7_1	-.01931	.03446	-0.56	0.575	-.0868503	.0482303
j255	-.2793655	.1126573	-2.48	0.013	-.5001698	-.0585612
ratio	.0015991	.0016819	0.95	0.342	-.0016973	.0048955
_cut1	-3.685126	.1661983		(Ancillary parameters)		
_cut2	-2.316803	.1610353				
_cut3	-.819105	.1587754				
_cut4	.1713844	.1628725				

. linktest

Ordered probit estimates	Number of obs =	4829
	LR chi2(2) =	982.05
	Prob > chi2 =	0.0000
Log likelihood = -5532.9535	Pseudo R2 =	0.0815

oclass	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.4252786	.1928014	2.21	0.027	.0473948	.8031624
_hatsq	-.1386517	.0458644	-3.02	0.003	-.2285443	-.0487591
_cut1	-3.130559	.2001441		(Ancillary parameters)		
_cut2	-1.75497	.1991123				
_cut3	-.2595549	.1968737				
_cut4	.726119	.1978404				

Females

Data set 1

Ordered probit estimates			
	Number of obs	=	4241
	Wald chi2(21)	=	791.44
	Prob > chi2	=	0.0000
Log pseudolikelihood = -4628.984	Pseudo R2	=	0.0841

oclass	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0297165	.0192793	1.54	0.123	-.0080702	.0675032
fac2_1	.1369095	.0202469	6.76	0.000	.0972263	.1765927
fac3_1	-.0122736	.017694	-0.69	0.488	-.0469531	.022406
fac4_1	-.021951	.0182466	-1.20	0.229	-.0577137	.0138117
mothhlth	-.0375822	.0495762	-0.76	0.448	-.1347499	.0595854
fathhlth	.0722792	.0502997	1.44	0.151	-.0263065	.1708649
fath_ed	-.0724033	.0383135	-1.89	0.059	-.1474963	.0026898
moth_ed	-.1745296	.0385096	-4.53	0.000	-.2500071	-.0990522
inc_10	-.0975792	.0156806	-6.22	0.000	-.1283126	-.0668458
num_chld	.0258119	.0188923	1.37	0.172	-.0112164	.0628401
iq_nverb	-.0175835	.0016048	-10.96	0.000	-.0207289	-.014438
mothhr	.0005892	.0012428	0.47	0.635	-.0018466	.003025
fathhr	.0015873	.0014925	1.06	0.288	-.001338	.0045125
urban	.158558	.0409128	3.88	0.000	.0783705	.2387455
lawseq	-.0048099	.004126	-1.17	0.244	-.0128967	.0032769
caraloc	-.0217299	.004514	-4.81	0.000	-.0305771	-.0128827
samepar	-.0468363	.0550553	-0.85	0.395	-.1547426	.06107
incare	.0942258	.1616266	0.58	0.560	-.2225566	.4110082
mea7_1	-.0091898	.0394814	-0.23	0.816	-.0865718	.0681923
j255	-.3084404	.136921	-2.25	0.024	-.5768007	-.0400801
ratio	.0030147	.0018611	1.62	0.105	-.0006329	.0066624
_cut1	-4.137238	.1768677	(Ancillary parameters)			
_cut2	-2.501144	.1695206				
_cut3	-.9771832	.1660069				
_cut4	.0475735	.1682065				

. linktest

Ordered probit estimates			
	Number of obs	=	4241
	LR chi2(2)	=	850.05
	Prob > chi2	=	0.0000
Log likelihood = -4628.9692	Pseudo R2	=	0.0841

oclass	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.9631565	.2175641	4.43	0.000	.5367386	1.389574
_hatsq	-.0083431	.0486252	-0.17	0.864	-.1036468	.0869606
_cut1	-4.099235	.2407003	(Ancillary parameters)			
_cut2	-2.462481	.2396593				
_cut3	-.9387519	.2365572				
_cut4	.085527	.2360443				

Data set 2

Ordered probit estimates			
	Number of obs	=	4241
	Wald chi2(21)	=	756.66
	Prob > chi2	=	0.0000
Log pseudolikelihood = -4650.241	Pseudo R2	=	0.0799

oclass	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0005201	.0190815	0.03	0.978	-.036879	.0379192
fac2_1	.1452527	.020447	7.10	0.000	.1051774	.185328

fac3_1	.0030608	.0178024	0.17	0.863	-.0318312	.0379528
fac4_1	-.0149287	.0179718	-0.83	0.406	-.0501528	.0202954
mothhlth	-.0397095	.050602	-0.78	0.433	-.1388875	.0594685
fathhlth	.091454	.0504239	1.81	0.070	-.0073751	.190283
fath_ed	-.0664306	.0383618	-1.73	0.083	-.1416185	.0087572
moth_ed	-.2136512	.0381966	-5.59	0.000	-.2885151	-.1387873
inc_10	-.089914	.0154112	-5.83	0.000	-.1201195	-.0597086
num_chld	.0385237	.0188931	2.04	0.041	.001494	.0755534
iq_nverb	-.0151908	.0016167	-9.40	0.000	-.0183595	-.0120221
mothhr	.0006474	.0012401	0.52	0.602	-.0017831	.003078
fathhr	.0013651	.0014567	0.94	0.349	-.0014899	.0042201
urban	.1220045	.040503	3.01	0.003	.04262	.2013891
lawseq	-.0034213	.0041092	-0.83	0.405	-.0114752	.0046325
caraloc	-.0237887	.0044777	-5.31	0.000	-.0325648	-.0150126
samepar	-.0520182	.0535504	-0.97	0.331	-.1569749	.0529386
incare	.0712425	.1684414	0.42	0.672	-.2588965	.4013815
mea7_1	.0287612	.0396079	0.73	0.468	-.0488688	.1063913
j255	-.3690526	.1363016	-2.71	0.007	-.6361989	-.1019063
ratio	.0011862	.0018604	0.64	0.524	-.0024601	.0048326
_cut1	-3.958655	.1726102		(Ancillary parameters)		
_cut2	-2.330015	.1657853				
_cut3	-.8175169	.1625243				
_cut4	.2022328	.1641881				

. linktest

Ordered probit estimates

Number of obs = 4241
LR chi2(2) = 807.57
Prob > chi2 = 0.0000
Log likelihood = -4650.2129
Pseudo R2 = 0.0799

oclass	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	.9508259	.210374	4.52	0.000	.5385004	1.363151
_hatsq	-.0120057	.0506106	-0.24	0.812	-.1112006	.0871893
_cut1	-3.911915	.2166941		(Ancillary parameters)		
_cut2	-2.282393	.2151891				
_cut3	-.7702121	.2121626				
_cut4	.2488996	.2120874				

Data set 3

Ordered probit estimates

Number of obs = 4241
Wald chi2(21) = 783.00
Prob > chi2 = 0.0000
Log pseudolikelihood = -4637.4906
Pseudo R2 = 0.0824

oclass	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0171972	.0187891	0.92	0.360	-.0196288	.0540231
fac2_1	.1411728	.0205073	6.88	0.000	.1009792	.1813663
fac3_1	-.0114444	.0177886	-0.64	0.520	-.0463095	.0234207
fac4_1	-.005648	.0179817	-0.31	0.753	-.0408915	.0295955
mothhlth	-.0248199	.0499712	-0.50	0.619	-.1227617	.073122
fathhlth	.0620672	.0500235	1.24	0.215	-.0359771	.1601115
fath_ed	-.1067949	.0385015	-2.77	0.006	-.1822565	-.0313333
moth_ed	-.1958385	.0381307	-5.14	0.000	-.2705734	-.1211037
inc_10	-.0851071	.0154502	-5.51	0.000	-.1153889	-.0548253
num_chld	.0272993	.0188078	1.45	0.147	-.0095634	.064162
iq_nverb	-.0159357	.0016144	-9.87	0.000	-.0190998	-.0127715
mothhr	.0018155	.0012571	1.44	0.149	-.0006484	.0042795
fathhr	.0000455	.0015117	0.03	0.976	-.0029174	.0030085
urban	.1347041	.0402538	3.35	0.001	.0558081	.2136001
lawseq	-.0024776	.0041037	-0.60	0.546	-.0105207	.0055654
caraloc	-.0254578	.0045717	-5.57	0.000	-.0344182	-.0164974
samepar	-.0714851	.0535665	-1.33	0.182	-.1764736	.0335034
incare	.0349175	.1660234	0.21	0.833	-.2904824	.3603175
mea7_1	.0085097	.039476	0.22	0.829	-.0688619	.0858813
j255	-.3475957	.1329032	-2.62	0.009	-.6080812	-.0871102

```
       ratio |   .0022165     .00185     1.20   0.231    -.0014095    .0058424
-------------+----------------------------------------------------------------
       _cut1 |  -4.098735   .1791438          (Ancillary parameters)
       _cut2 |  -2.469607   .1725543
       _cut3 |  -.9477487   .1693715
       _cut4 |   .0787222   .1712112
------------------------------------------------------------------------------

. linktest

Ordered probit estimates                          Number of obs   =       4241
                                                  LR chi2(2)      =     833.05
                                                  Prob > chi2     =     0.0000
Log likelihood =  -4637.474                       Pseudo R2       =     0.0824

------------------------------------------------------------------------------
      oclass |      Coef.   Std. Err.       z     P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.038813   .2160275     4.81   0.000     .6154068    1.462219
      _hatsq |   .0088817   .0487654     0.18   0.855    -.0866967      .10446
-------------+----------------------------------------------------------------
       _cut1 |  -4.138397   .2370902          (Ancillary parameters)
       _cut2 |  -2.509912    .235771
       _cut3 |  -.9877983   .2326062
       _cut4 |   .0391524   .2322436
------------------------------------------------------------------------------
```

Data set 4

```
Ordered probit estimates                          Number of obs   =       4240
                                                  Wald chi2(21)   =     734.32
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -4646.4418                 Pseudo R2       =     0.0805

------------------------------------------------------------------------------
             |               Robust
      oclass |      Coef.   Std. Err.       z     P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      fac1_1 |    -.01579   .0188333    -0.84   0.402    -.0527025    .0211226
      fac2_1 |   .1296625    .020729     6.26   0.000     .0890344    .1702906
      fac3_1 |   .0324644   .0170191     1.91   0.056    -.0008924    .0658211
      fac4_1 |  -.0093795   .0173762    -0.54   0.589    -.0434362    .0246771
    mothhlth |  -.0611478    .050379    -1.21   0.225    -.1598889    .0375933
    fathhlth |   .0764745   .0499609     1.53   0.126     -.021447     .174396
     fath_ed |  -.0596311   .0385799    -1.55   0.122    -.1352463    .0159841
     moth_ed |  -.1595801   .0382503    -4.17   0.000    -.2345493    -.084611
      inc_10 |   -.091567    .015413    -5.94   0.000     -.121776   -.0613581
    num_chld |   .0303705   .0187071     1.62   0.104    -.0062947    .0670357
    iq_nverb |  -.0164564   .0015858   -10.38   0.000    -.0195645   -.0133482
      mothhr |    .000542   .0012379     0.44   0.661    -.0018842    .0029682
      fathhr |   .0001403   .0014686     0.10   0.924    -.0027381    .0030186
       urban |   .1825965   .0400696     4.56   0.000     .1040616    .2611314
      lawseq |   .0019712   .0041743     0.47   0.637    -.0062102    .0101526
     caraloc |  -.0258134   .0046898    -5.50   0.000    -.0350053   -.0166214
     samepar |  -.0410961   .0553604    -0.74   0.458    -.1496005    .0674083
      incare |   .0697001    .166644     0.42   0.676    -.2569161    .3963163
      mea7_1 |   .0102707   .0394023     0.26   0.794    -.0669564    .0874979
        j255 |  -.3299084    .136281    -2.42   0.015    -.5970143   -.0628026
       ratio |   .0022385   .0018454     1.21   0.225    -.0013784    .0058554
-------------+----------------------------------------------------------------
       _cut1 |  -4.025642   .1751052          (Ancillary parameters)
       _cut2 |  -2.396665   .1681413
       _cut3 |  -.8835251   .1649984
       _cut4 |   .1384299   .1666915
------------------------------------------------------------------------------

. linktest

Ordered probit estimates                          Number of obs   =       4240
                                                  LR chi2(2)      =     813.66
                                                  Prob > chi2     =     0.0000
Log likelihood = -4646.3989                       Pseudo R2       =     0.0805

------------------------------------------------------------------------------
      oclass |      Coef.   Std. Err.       z     P>|z|     [95% Conf. Interval]
```

_hat	.9381761	.2142527	4.38	0.000	.5182485	1.358104
_hatsq	-.0146546	.0500758	-0.29	0.770	-.1128014	.0834923
_cut1	-3.9649	.2270628	(Ancillary parameters)			
_cut2	-2.334821	.2258003				
_cut3	-.822056	.2228243				
_cut4	.1990569	.222421				

.

Data set 5

```
Ordered probit estimates                          Number of obs   =       4240
                                                  Wald chi2(21)   =     750.45
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -4651.1825                 Pseudo R2       =     0.0793
```

oclass	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
fac1_1	.0021425	.0191109	0.11	0.911	-.0353141	.0395991
fac2_1	.1181871	.0198603	5.95	0.000	.0792616	.1571127
fac3_1	.0223587	.01763	1.27	0.205	-.0121955	.0569129
fac4_1	-.0057797	.0176962	-0.33	0.744	-.0404636	.0289041
mothhlth	-.0132863	.0491325	-0.27	0.787	-.1095842	.0830115
fathhlth	.1137616	.0498436	2.28	0.022	.0160699	.2114533
fath_ed	-.0569913	.0379632	-1.50	0.133	-.1313978	.0174153
moth_ed	-.166901	.0384192	-4.34	0.000	-.2422012	-.0916008
inc_10	-.0921428	.0154304	-5.97	0.000	-.1223858	-.0618997
num_chld	.0354889	.0185695	1.91	0.056	-.0009066	.0718844
iq_nverb	-.0176016	.0015888	-11.08	0.000	-.0207156	-.0144876
mothhr	.0014005	.0012251	1.14	0.253	-.0010007	.0038017
fathhr	.0016806	.001479	1.14	0.256	-.0012182	.0045794
urban	.1595922	.0402587	3.96	0.000	.0806866	.2384978
lawseq	.002469	.0041254	0.60	0.550	-.0056166	.0105546
caraloc	-.0241811	.0044442	-5.44	0.000	-.0328916	-.0154705
samepar	-.0277051	.0554398	-0.50	0.617	-.1363651	.0809549
incare	.086938	.1639644	0.53	0.596	-.2344263	.4083024
mea7_1	-.0036808	.0397029	-0.09	0.926	-.081497	.0741355
j255	-.360869	.1366202	-2.64	0.008	-.6286396	-.0930984
ratio	.0015814	.0018546	0.85	0.394	-.0020535	.0052162
_cut1	-3.980645	.1779246	(Ancillary parameters)			
_cut2	-2.355544	.1712857				
_cut3	-.8423567	.1684079				
_cut4	.1786627	.1708888				

. linktest

```
Ordered probit estimates                          Number of obs   =       4240
                                                  LR chi2(2)      =     802.08
                                                  Prob > chi2     =     0.0000
Log likelihood = -4650.7853                       Pseudo R2       =     0.0794
```

oclass	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.191031	.2173377	5.48	0.000	.7650573	1.617005
_hatsq	.0458711	.0514573	0.89	0.373	-.0549833	.1467255
_cut1	-4.166204	.2273379	(Ancillary parameters)			
_cut2	-2.544056	.2257161				
_cut3	-1.029558	.2225548				
_cut4	-.0059832	.2221355				

Complete results for estimations using maternal ratings

Results based on combined parameter estimates and variances from multiply imputed data sets.

Males

OLS: log of weekly earnings (age 30)

Males

Overall estimates

Number of obs (min) = 4466
Number of obs (max) = 4467

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_m	-.0101	.01146	-0.88	0.378	-.0326	.0124	651.33*
fac2_m	.00908	.01272	0.71	0.479	-.01664	.0348	39.24*
fac3_m	-.00905	.01263	-0.72	0.479	-.03472	.01662	34.08*
fac4_m	-.00316	.01102	-0.29	0.774	-.02483	.0185	430.66*
fac5_m	-.03817	.01363	-2.80	0.006	-.06505	-.01128	195.02*
mothhlth	-.01422	.03366	-0.42	0.673	-.08047	.05202	299.26*
fathhlth	-.05142	.03728	-1.38	0.168	-.12452	.02169	2234.44*
fath_ed	.03101	.02873	1.08	0.291	-.0281	.09012	25.55*
moth_ed	.08789	.02584	3.40	0.001	.03658	.13921	92.14*
inc_10	.04803	.01065	4.51	0.000	.02693	.06913	111.72*
num_chld	-.0009	.01111	-0.08	0.935	-.02302	.02122	77.80*
iq_nverb	.00427	.00093	4.61	0.000	.00245	.00609	509.33*
mothhr	-.00083	.00081	-1.03	0.306	-.00244	.00077	102.33*
fathhr	.00031	.00089	0.35	0.724	-.00143	.00206	366.29*
urban	-.05099	.02905	-1.76	0.091	-.11066	.00868	26.29*
lawseq	.0046	.00335	1.37	0.181	-.00226	.01146	28.63*
caraloc	.00966	.00289	3.34	0.001	.00391	.0154	91.26*
samepar	-.02016	.04072	-0.49	0.623	-.10251	.0622	39.29*
incare	-.30318	.11483	-2.64	0.008	-.52826	-.07809	15324.28*
mea7_1	-.00343	.02312	-0.15	0.882	-.04877	.0419	3096.70*
j255	.14648	.09528	1.54	0.124	-.0403	.33326	8140.21*
ratio	-.00071	.00132	-0.54	0.591	-.00336	.00193	55.25*
_cons	5.1369	.10627	48.34	0.000	4.9273	5.3464	199.24*

Females

Overall estimates

Number of obs (min) = 3855
Number of obs (max) = 3856

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_m	-.01505	.01709	-0.88	0.379	-.04857	.01847	1202.62*
fac2_m	-.00083	.02203	-0.04	0.970	-.0455	.04383	36.57*
fac3_m	-.05009	.01941	-2.58	0.011	-.08866	-.01153	88.50*
fac4_m	-.02647	.01805	-1.47	0.145	-.06215	.00921	140.00*
fac5_m	-.01546	.01868	-0.83	0.413	-.05333	.02241	36.54*
mothhlth	.04758	.04451	1.07	0.286	-.04013	.13528	228.39*
fathhlth	.02005	.04774	0.42	0.675	-.07418	.11428	173.81*
fath_ed	.011	.03564	0.31	0.758	-.0592	.0812	247.63*
moth_ed	.04865	.03652	1.33	0.185	-.02341	.1207	182.57*
inc_10	.07593	.0139	5.46	0.000	.04862	.10324	554.78*
num_chld	-.01916	.01658	-1.16	0.249	-.05186	.01355	191.54*
iq_nverb	.01142	.00136	8.42	0.000	.00875	.01409	304.01*
mothhr	-.00123	.0012	-1.02	0.309	-.00362	.00115	108.21*
fathhr	-.0013	.00141	-0.92	0.357	-.00408	.00148	204.42*
urban	-.10005	.03903	-2.56	0.011	-.17697	-.02313	221.53*
lawseq	.00887	.00375	2.37	0.018	.00151	.01624	584.22*
caraloc	.00989	.00397	2.49	0.013	.0021	.01769	818.98*

samepar	.0353	.05229	0.68	0.500	-.06774	.13834	229.63*
incare	.04307	.15235	0.28	0.777	-.25556	.3417	17039.74*
mea7_1	.02567	.03847	0.67	0.507	-.051	.10234	73.27*
j255	.12103	.11557	1.05	0.295	-.1057	.34776	1223.34*
ratio	-.00361	.00208	-1.73	0.099	-.00795	.00074	20.31*
_cons	3.9898	.16107	24.77	0.000	3.6715	4.3082	144.62*

Probit: low income (age 30)

Males

Overall estimates

Number of obs (min) = 4378
Number of obs (max) = 4379

low_inc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac2_m	.04115	.02181	1.89	0.061	-.00188	.08417	182.35*
fac3_m	.00214	.02109	0.10	0.919	-.0394	.04367	265.60*
fac4_m	.04131	.0246	1.68	0.101	-.00836	.09097	41.40*
fac1_m	.00934	.02249	0.42	0.678	-.03502	.0537	195.26*
fac5_m	.02651	.02508	1.06	0.295	-.02362	.07663	63.28*
mothhlth	-.08079	.07053	-1.15	0.255	-.22118	.0596	78.97*
fathhlth	.05351	.06824	0.78	0.434	-.08082	.18784	280.15*
moth_ed	-.20271	.05017	-4.04	0.000	-.30147	-.10395	271.79*
fath_ed	-.08713	.05808	-1.50	0.144	-.20572	.03146	30.12*
inc_10	-.08551	.0208	-4.11	0.000	-.1266	-.04442	154.24*
num_chld	.0382	.02226	1.72	0.089	-.00586	.08226	123.72*
mothhr	.0019	.00164	1.16	0.249	-.00136	.00517	86.56*
fathhr	.00177	.00189	0.93	0.353	-.00199	.00553	88.22*
urban	.08533	.04869	1.75	0.080	-.01031	.18097	546.55*
j255	-.22699	.18214	-1.25	0.213	-.58399	.13	45198.42*
ratio	-.00055	.00259	-0.21	0.832	-.00573	.00463	55.58*
mea7_1	.06989	.05008	1.40	0.166	-.02936	.16914	109.63*
caraloc	-.01032	.00568	-1.82	0.072	-.02159	.00095	94.88*
lawseq	-6.0e-05	.00655	-0.01	0.993	-.01337	.01325	34.20*
iq_nverb	-.01113	.00185	-6.01	0.000	-.01477	-.0075	746.31*
incare	.11475	.16946	0.68	0.498	-.21739	.44689	57174.92*
samepar	.05837	.07387	0.79	0.433	-.08962	.20635	56.03*
_cons	.68974	.20048	3.44	0.001	.29574	1.0837	441.53*

Females

Overall estimates

Number of obs (min) = 4989
Number of obs (max) = 4990

low_inc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac2_m	.08838	.02561	3.45	0.001	.0373	.13947	68.89*
fac3_m	.02549	.02735	0.93	0.360	-.03092	.08191	24.22*
fac4_m	.04503	.02384	1.89	0.062	-.00231	.09237	93.78*
fac1_m	-.00472	.02277	-0.21	0.836	-.05013	.04069	71.07*
fac5_m	6.1e-05	.02165	0.00	0.998	-.04296	.04308	89.34*
mothhlth	-.04848	.06164	-0.79	0.432	-.1697	.07274	360.96*
fathhlth	.03879	.06168	0.63	0.530	-.0825	.16008	366.57*
moth_ed	-.13303	.04838	-2.75	0.007	-.22857	-.03748	160.34*
fath_ed	-.05498	.05359	-1.03	0.312	-.16396	.05401	33.32*
inc_10	-.07858	.01886	-4.17	0.000	-.1156	-.04156	760.95*
num_chld	.07617	.0204	3.73	0.000	.03583	.11651	135.80*
mothhr	.00205	.00179	1.15	0.262	-.00162	.00573	26.90*
fathhr	.00062	.00206	0.30	0.765	-.00363	.00488	23.91*
urban	.12443	.0471	2.64	0.009	.03169	.21717	259.70*
j255	.09515	.17046	0.56	0.577	-.23902	.42933	5402.32*
ratio	-.00209	.00229	-0.91	0.364	-.00662	.00244	146.31*
mea7_1	.04028	.0447	0.90	0.368	-.04736	.12792	4633.28*
caraloc	-.0153	.00539	-2.84	0.005	-.02596	-.00463	137.08*
lawseq	-.00413	.00489	-0.84	0.398	-.01372	.00546	2291.62*
iq_nverb	-.01341	.00182	-7.37	0.000	-.01698	-.00983	612.00*

incare	.26153	.15856	1.65	0.099	-.04935	.57242	3588.82*
samepar	-.09213	.06666	-1.38	0.172	-.22571	.04144	55.13*
_cons	1.0403	.18803	5.53	0.000	.67025	1.4103	300.01*

Probit: economically active (age 30)

Males

Overall estimates

Number of obs (min) = 5429
Number of obs (max) = 5430

empact	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac2_m	-.13073	.02442	-5.35	0.000	-.17866	-.0828	806.25*
fac3_m	-.01902	.02761	-0.69	0.493	-.074	.03595	77.67*
fac4_m	-.0425	.02775	-1.53	0.129	-.0975	.0125	110.66*
fac1_m	-.03395	.03086	-1.10	0.277	-.09601	.02812	47.19*
fac5_m	-.00505	.02877	-0.18	0.861	-.06188	.05179	151.62*
mothhlth	-.07797	.07657	-1.02	0.309	-.22819	.07225	1181.98*
fathhlth	-.05895	.09726	-0.61	0.549	-.25792	.14003	28.82*
moth_ed	-.00467	.06058	-0.08	0.938	-.12345	.11411	2663.07*
fath_ed	.11628	.09472	1.23	0.247	-.09405	.32661	10.25*
inc_10	.06687	.02584	2.59	0.010	.01603	.11771	318.36*
num_chld	-.02578	.0264	-0.98	0.330	-.07781	.02624	223.60*
mothhr	.00015	.00202	0.07	0.942	-.00387	.00417	75.98*
fathhr	.00277	.00225	1.24	0.218	-.00165	.0072	266.70*
urban	-.23208	.0698	-3.33	0.002	-.37442	-.08974	31.10*
j255	-.24574	.20141	-1.22	0.223	-.64067	.1492	2762.24*
ratio	.00573	.003	1.91	0.057	-.00018	.01163	283.94*
mea7_1	-.19445	.0694	-2.80	0.009	-.33671	-.05218	27.57*
caraloc	.01176	.00704	1.67	0.099	-.00224	.02576	85.92*
lawseq	-.0032	.00697	-0.46	0.646	-.01688	.01048	606.24*
iq_nverb	.00821	.00254	3.23	0.002	.00313	.01329	68.27*
incare	-.33044	.19029	-1.74	0.082	-.70342	.04253	52454.35*
samepar	.14294	.07836	1.82	0.069	-.01137	.29725	257.10*
_cons	.20209	.26353	0.77	0.445	-.32029	.72446	107.60*

Females

Overall estimates

Number of obs (min) = 5751
Number of obs (max) = 5752

empact	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac2_m	-.06624	.02327	-2.85	0.005	-.11229	-.02019	125.42*
fac3_m	-.01913	.02405	-0.80	0.430	-.06741	.02915	51.07*
fac4_m	-.01294	.02511	-0.52	0.610	-.06395	.03806	34.35*
fac1_m	-.02576	.02025	-1.27	0.204	-.06559	.01407	346.03*
fac5_m	.0132	.02006	0.66	0.511	-.02637	.05278	192.72*
mothhlth	.00964	.06123	0.16	0.875	-.11172	.13101	107.90*
fathhlth	-.02168	.06344	-0.34	0.733	-.14789	.10454	81.05*
moth_ed	.07566	.04684	1.62	0.108	-.01692	.16825	142.79*
fath_ed	.02699	.04316	0.63	0.532	-.05773	.11171	784.82*
inc_10	.05121	.01865	2.75	0.007	.01447	.08795	222.40*
num_chld	-.09343	.02055	-4.55	0.000	-.13462	-.05225	54.82*
mothhr	-.00044	.00179	-0.24	0.810	-.00419	.00331	19.39*
fathhr	-.00111	.00156	-0.71	0.476	-.00417	.00195	1166.84*
urban	-.11124	.05191	-2.14	0.039	-.2165	-.00597	36.17*
j255	-.19266	.1444	-1.33	0.182	-.47569	.09037	35796.56*
ratio	.0059	.00259	2.28	0.031	.00058	.01121	26.10*
mea7_1	.01882	.04773	0.39	0.694	-.07584	.11348	102.57*
caraloc	.01593	.00566	2.81	0.007	.00452	.02734	44.97*
lawseq	-.00087	.00502	-0.17	0.863	-.0108	.00907	144.91*
iq_nverb	.01198	.00234	5.13	0.000	.00705	.0169	17.27*
incare	-.14025	.14543	-0.96	0.335	-.42529	.1448	30007.38*
samepar	.14663	.06293	2.33	0.023	.02072	.27254	59.24*
_cons	-.64425	.22131	-2.91	0.008	-1.1012	-.18728	23.80*

Ordered probit: occupational status (age 30)

Males

Overall estimates

Number of obs (min) = 4829
Number of obs (max) = 4830

oclass	Coef.	Std.Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac2_m	.02254	.01631	1.38	.201	-.01147	.05441	288
fac3_m	.02146	.01674	1.28	.168	-.00959	.05467	246
fac4_m	.09811	.01820	5.39	.000	.06168	.13445	65
fac1_m	.01413	.01838	0.77	.445	-.02255	.05082	66
fac5_m	.00742	.01735	0.42	.672	-.02688	.04162	176
mothhlth	.03798	.04904	0.77	.439	-.058408	.13437	430
fathhlth	.07593	.05721	1.33	.189	-.03817	.19003	70
fath_ed	-.15008	.04171	-3.60	.0001	-.23333	-.06682	67
moth_ed	-.14056	.04221	-3.33	.002	-.22525	-.05586	52
inc_10	-.09120	.01657	-5.61	.000	-.12360	-.05881	74
num_chld	.00691	.01884	0.37	.715	-.03059	.04441	80
iq_nverb	-.02013	.00161	-12.51	.000	-.02335	-.01690	57
mothhr	.00038	.00116	0.33	.744	-.00191	.00267	308
fathhr	.00037	.00142	0.26	.793	-.002435	.00318	132
urban	.16150	.04373	3.69	.001	.07390	.24911	56
lawseq	-.00504	.00488	-1.03	.308	-.01489	.04813	43
caraloc	-.01719	.00467	-3.68	.001	-.02663	-.00774	40
samepar	.04577	.05705	0.80	.424	-.06723	.15878	115
incare	.12437	.14695	0.85	.398	-.16456	.41329	385
mea7_1	.00194	.03690	0.05	.958	-.07081	.07469	209
j255	-.26805	.11606	-2.31	.021	-.49563	-.04048	2847
ratio	.00032	.00228	0.14	.891	-.00446	.00509	19

Females

Overall estimates

Number of obs (min) = 4240
Number of obs (max) = 4241

oclass	Coef.	Std.Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac2_m	.00535	0.00236	0.23	.822	-.04187	.05250	71
fac3_m	.00408	0.02045	0.20	.842	-.03612	.04430	390
fac4_m	.08050	0.00214	3.76	.000	.03840	0.12268	346
fac1_m	.02141	0.02097	1.02	.311	-.020489	.06330	64
fac5_m	-.02733	0.00198	-1.38	.171	-.06665	.01199	106
mothhlth	-.03923	0.05416	-0.72	.470	-.14162	.67726	164
fathhlth	.09005	0.05517	1.63	.104	-.01905	.19915	135
fath_ed	-.07937	0.04249	-1.87	.064	-.16357	.00482	112
moth_ed	-.18334	0.04351	-4.21	.000	-.2699	-.09674	79
inc_10	-.08938	0.01660	-5.38	.000	-.12209	-.05667	226
num_chld	.035092	0.01979	1.77	.075	-.003762	.07395	742
iq_nverb	-.01867	0.00182	10.23	.000	-.02234	-.01500	48
mothhr	.00130	0.00141	0.92	.359	-.00151	.00411	78
fathhr	.00090	0.00171	0.53	.601	-.002532	.00434	60
urban	.15479	0.00046	3.32	.002	.06164	.24794	67
lawseq	-.001404	0.00575	-0.24	.810	-.01353	.01073	17
caraloc	-.02651	0.00503	-5.27	.000	-.03649	-.01653	102
samepar	-.04879	0.05933	-0.82	.412	-.16599	.06839	156
incare	.06162	0.16754	0.37	.713	-.16456	.41233	21037
mea7_1	.01969	0.04293	0.46	.647	-.07081	.07469	168
j255	-.32906	0.13808	-2.38	.017	-.49563	-.04047	1850
ratio	.00225	0.00209	1.08	.282	-.00446	.00509	89

Complete results for OLS estimations by occupational category

Results based on combined parameter estimates and variances from multiply imputed data sets.

Males

Professional

Overall estimates

Number of obs = 364

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.04707	.0687	0.69	0.498	-.09295	.18708	31.58
fac2_1	-.05352	.07967	-0.67	0.515	-.22755	.1205	11.73
fac3_1	-.00962	.04589	-0.21	0.835	-.10272	.08349	35.68
fac4_1	.01636	.0893	0.18	0.859	-.1861	.21882	8.87
mothhlth	-.01629	.10188	-0.16	0.873	-.21746	.18488	163.11
fathhlth	-.24812	.21699	-1.14	0.253	-.67417	.17792	684.97
fath_ed	.0717	.12182	0.59	0.560	-.17485	.31825	38.28
moth_ed	.15816	.11412	1.39	0.172	-.07109	.38742	49.63
inc_10	-.02121	.04395	-0.48	0.631	-.10887	.06645	69.33
num_chld	-.00206	.04387	-0.05	0.963	-.08893	.0848	119.44
iq_nverb	-.00431	.00373	-1.16	0.249	-.01166	.00303	292.90
mothhr	-.00116	.00289	-0.40	0.689	-.00682	.00451	1629.67
fathhr	.00099	.00334	0.30	0.768	-.00579	.00778	35.57
urban	-.03532	.12307	-0.29	0.776	-.28464	.21401	37.20
lawseq	.01748	.01462	1.20	0.244	-.01272	.04768	23.69
caraloc	.01774	.01016	1.75	0.081	-.00221	.03769	593.15
samepar	.16087	.21263	0.76	0.452	-.26444	.58618	60.07
incare	-.11519	.37492	-0.31	0.763	-.91264	.68227	15.37
mea7_1	.08416	.1238	0.68	0.499	-.16281	.33113	68.93
j255	.10934	.14548	0.75	0.452	-.17582	.39451	16899.23
ratio	-.00217	.00525	-0.41	0.680	-.01261	.00827	80.90
_cons	5.706	.51126	11.16	0.000	4.6988	6.7132	238.67

Managerial/technical

Overall estimates

Number of obs (min) = 1521
Number of obs (max) = 1522

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.03404	.02055	1.66	0.098	-.00628	.07437	1321.48*
fac2_1	-.01914	.03096	-0.62	0.544	-.08432	.04604	17.49*
fac3_1	-.02606	.02745	-0.95	0.355	-.08358	.03146	18.70*
fac4_1	-.01707	.02505	-0.68	0.504	-.06946	.03531	19.25*
mothhlth	-.0329	.06228	-0.53	0.598	-.1559	.09011	156.61*
fathhlth	.0569	.07158	0.79	0.427	-.08364	.19745	676.05*
fath_ed	-.0302	.05279	-0.57	0.569	-.13555	.07515	67.33*
moth_ed	.10498	.04508	2.33	0.020	.01656	.19341	1436.22*
inc_10	.03888	.01733	2.24	0.025	.00489	.07288	1796.77*
num_chld	-.02104	.02205	-0.95	0.340	-.06436	.02227	509.85*
iq_nverb	.00203	.00196	1.04	0.301	-.00184	.0059	115.90*
mothhr	-.00091	.00136	-0.67	0.506	-.0036	.00178	193.09*
fathhr	.00157	.00166	0.95	0.344	-.00169	.00483	3512.61*
urban	-.00335	.05262	-0.06	0.949	-.10697	.10028	250.57*
lawseq	.0084	.00515	1.63	0.104	-.00173	.01853	443.68*
caraloc	.00537	.00512	1.05	0.294	-.00468	.01542	447.30*
samepar	-.00705	.07571	-0.09	0.926	-.15643	.14233	182.97*
incare	-.33416	.19664	-1.70	0.089	-.71958	.05126	25362.02*
mea7_1	-.04136	.04535	-0.91	0.362	-.13047	.04774	487.72*
j255	.29646	.13956	2.12	0.034	.02293	.57	38286.37*
ratio	-.00129	.00268	-0.48	0.636	-.00686	.00429	21.03*
_cons	5.5282	.22239	24.86	0.000	5.0876	5.9688	112.98*

Skilled non-manual

Overall estimates

Number of obs = 561

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.07875	.03126	2.52	0.015	.01618	.14132	58.36
fac2_1	.01502	.03614	0.42	0.680	-.05793	.08796	41.71
fac3_1	-.05346	.0387	-1.38	0.182	-.13417	.02726	20.03
fac4_1	-.06066	.03585	-1.69	0.107	-.13555	.01424	19.56
mothhlth	.10072	.1117	0.90	0.367	-.11821	.31966	1.37e+05
fathhlth	-.12838	.1071	-1.20	0.231	-.33867	.0819	677.25
fath_ed	-.03613	.0694	-0.52	0.604	-.17391	.10165	95.21
moth_ed	.08423	.07161	1.18	0.244	-.05903	.22748	59.78
inc_10	.00691	.03141	0.22	0.827	-.05666	.07048	38.45
num_chld	.00047	.02519	0.02	0.985	-.04913	.05008	247.36
iq_nverb	.00436	.00245	1.78	0.075	-.00045	.00916	1695.08
mothhr	.00016	.00253	0.06	0.950	-.00489	.00521	59.94
fathhr	-.0004	.0024	-0.17	0.868	-.00515	.00435	116.49
urban	.02353	.06565	0.36	0.720	-.10527	.15232	1261.17
lawseq	.00772	.00802	0.96	0.337	-.00814	.02359	138.28
caraloc	-.00064	.00705	-0.09	0.927	-.01447	.01318	989.90
samepar	-.08244	.08715	-0.95	0.346	-.25464	.08977	148.91
incare	-.11348	.25208	-0.45	0.653	-.60832	.38136	777.80
mea7_1	-.03613	.06406	-0.56	0.573	-.16245	.09019	199.02
j255	-.45602	.28979	-1.57	0.116	-1.0251	.11304	641.11
ratio	-.00237	.00352	-0.67	0.504	-.00939	.00466	71.22
_cons	5.4622	.31792	17.18	0.000	4.8329	6.0916	122.33

Skilled manual

Overall estimates

Number of obs (min) = 1407
Number of obs (max) = 1408

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.05164	.02159	2.39	0.028	.00624	.09704	17.78*
fac2_1	-.04113	.02333	-1.76	0.089	-.08889	.00663	28.41*
fac3_1	-.01659	.0177	-0.94	0.353	-.05204	.01886	56.89*
fac4_1	-.01633	.02451	-0.67	0.517	-.06929	.03663	12.97*
mothhlth	-.01769	.05987	-0.30	0.769	-.13918	.10379	35.41*
fathhlth	-.08962	.05708	-1.57	0.117	-.20156	.02232	2181.86*
fath_ed	.04886	.04239	1.15	0.257	-.03739	.13511	32.83*
moth_ed	.01118	.0389	0.29	0.774	-.06567	.08803	152.98*
inc_10	.05942	.01881	3.16	0.003	.02126	.09758	35.86*
num_chld	-.0035	.01586	-0.22	0.825	-.03465	.02765	515.76*
iq_nverb	-.00075	.00193	-0.39	0.699	-.00467	.00316	35.49*
mothhr	-.00098	.0012	-0.81	0.416	-.00334	.00138	877.91*
fathhr	-.00108	.00144	-0.75	0.457	-.00394	.00178	118.29*
urban	-.07765	.04567	-1.70	0.105	-.17326	.01795	18.97*
lawseq	.00549	.00429	1.28	0.208	-.00317	.01414	42.84*
caraloc	.00826	.00443	1.87	0.063	-.00047	.01699	226.65*
samepar	.02577	.05338	0.48	0.630	-.07973	.13127	147.61*
incare	-.10658	.14168	-0.75	0.452	-.38427	.17111	2.99e+05*
mea7_1	.02589	.03831	0.68	0.502	-.05074	.10252	60.01*
j255	.31349	.22277	1.41	0.160	-.12395	.75093	640.97*
ratio	.00052	.00199	0.26	0.797	-.00344	.00447	114.57*
_cons	5.4676	.19069	28.67	0.000	5.0845	5.8508	49.51*

Unskilled/semiskilled

Overall estimates

Number of obs = 545

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.05735	.03175	1.81	0.071	-.00489	.11958	5087.86
fac2_1	.02783	.03529	0.79	0.437	-.04435	.10001	29.01

fac3_1	-.02721	.03288	-0.83	0.410	-.09266	.03824	78.20
fac4_1	-.02721	.02728	-1.00	0.319	-.08077	.02634	767.32
mothhlth	-.04219	.08114	-0.52	0.603	-.20139	.117	1221.29
fathhlth	.04392	.06223	0.71	0.481	-.07912	.16697	137.92
fath_ed	.02303	.0531	0.43	0.665	-.08132	.12739	463.87
moth_ed	.0315	.06239	0.50	0.614	-.09096	.15395	834.81
inc_10	.02832	.02797	1.01	0.313	-.02698	.08362	139.88
num_chld	.02777	.01989	1.40	0.164	-.01134	.06688	391.95
iq_nverb	.00266	.00267	1.00	0.323	-.00268	.00799	59.55
mothhr	-.00207	.00214	-0.97	0.335	-.0063	.00216	153.04
fathhr	.00154	.00248	0.62	0.534	-.00333	.00642	320.93
urban	-.02436	.05187	-0.47	0.639	-.12609	.07737	1930.70
lawseq	-.0069	.00878	-0.79	0.432	-.02416	.01036	429.03
caraloc	.00486	.00817	0.59	0.553	-.01127	.02099	161.85
samepar	-.01281	.08414	-0.15	0.879	-.17805	.15244	607.71
incare	-.57209	.32209	-1.78	0.076	-1.2034	.05922	75860.77
mea7_1	-.00548	.06524	-0.08	0.933	-.13417	.1232	191.35
j255	-.10565	.29298	-0.36	0.718	-.68005	.46875	3980.37
ratio	-.0006	.00308	-0.19	0.846	-.00667	.00547	274.46
_cons	5.2187	.26105	19.99	0.000	4.6987	5.7388	74.65

Females

Professional

Overall estimates

Number of obs = 179

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	-.02527	.12686	-0.20	0.847	-.31465	.26412	8.53
fac2_1	-.075	.12494	-0.60	0.556	-.33919	.1892	16.51
fac3_1	-.05873	.07665	-0.77	0.445	-.21011	.09266	159.03
fac4_1	-.02332	.061	-0.38	0.702	-.14322	.09659	427.37
mothhlth	.10585	.24687	0.43	0.668	-.37965	.59134	358.33
fathhlth	.05444	.23466	0.23	0.817	-.40636	.51525	629.93
fath_ed	.008	.22518	0.04	0.972	-.44472	.46072	48.19
moth_ed	-.07731	.17257	-0.45	0.655	-.41707	.26245	268.59
inc_10	.09289	.07595	1.22	0.222	-.05625	.24203	641.28
num_chld	-.04835	.07443	-0.65	0.516	-.19423	.09752	2.83e+05
iq_nverb	.00207	.01025	0.20	0.843	-.01993	.02408	13.86
mothhr	.00132	.00641	0.21	0.838	-.012	.01465	21.22
fathhr	.0002	.00604	0.03	0.974	-.01246	.01286	18.62
urban	-.13488	.27078	-0.50	0.622	-.68477	.41502	34.67
lawseq	.03543	.0245	1.45	0.164	-.01583	.0867	19.11
caraloc	-.03074	.02403	-1.28	0.209	-.07944	.01797	36.53
samepar	-.01729	.31476	-0.05	0.957	-.69426	.65968	13.60
incare	-.10376	.39577	-0.26	0.794	-.89363	.68612	67.38
mea7_1	.16152	.15497	1.04	0.299	-.14549	.46853	113.10
j255	.46661	.21981	2.12	0.036	.03172	.9015	129.30
ratio	.00246	.00773	0.32	0.751	-.01287	.01778	100.38
_cons	5.5294	.69599	7.94	0.000	4.1383	6.9206	62.15

Managerial/technical

Overall estimates

Number of obs = 1377

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.06106	.02968	2.06	0.047	.00091	.1212	36.75
fac2_1	-.04314	.04248	-1.02	0.331	-.13644	.05017	11.20
fac3_1	-.04408	.03262	-1.35	0.193	-.1125	.02433	18.41
fac4_1	-.00059	.02384	-0.02	0.980	-.04743	.04625	550.85
mothhlth	-.00419	.05816	-0.07	0.943	-.11883	.11045	212.73
fathhlth	.03966	.06422	0.62	0.538	-.08733	.16664	138.36
fath_ed	-.06916	.05518	-1.25	0.212	-.17823	.03991	142.18
moth_ed	.02711	.05415	0.50	0.617	-.0798	.13403	166.47
inc_10	.06021	.02103	2.86	0.005	.01861	.10181	132.75

num_chld	-.04214	.02564	-1.64	0.101	-.09252	.00824	435.48
iq_nverb	.00399	.00226	1.76	0.080	-.00048	.00846	171.53
mothhr	-.00194	.00165	-1.17	0.243	-.00522	.00134	100.26
fathhr	-.00216	.00211	-1.02	0.306	-.00629	.00198	1302.91
urban	-.07667	.06875	-1.12	0.265	-.21177	.05843	450.86
lawseq	.00899	.00541	1.66	0.097	-.00164	.01961	896.87
caraloc	.00701	.00613	1.14	0.255	-.00512	.01913	126.15
samepar	-.05007	.08331	-0.60	0.549	-.21521	.11507	107.92
incare	-.27367	.1266	-2.16	0.031	-.52256	-.02477	397.17
mea7_1	-.00763	.05626	-0.14	0.892	-.11993	.10466	67.34
j255	-.08098	.13654	-0.59	0.553	-.34884	.18689	1282.83
ratio	-8.2e-05	.0029	-0.03	0.978	-.00596	.00579	38.38
_cons	5.1832	.30463	17.01	0.000	4.5795	5.7869	109.92

Skilled non-manual

Overall estimates

Number of obs (min) = 1501
Number of obs (max) = 1502

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.00767	.03364	0.23	0.823	-.06459	.07994	13.78*
fac2_1	-.04581	.03086	-1.48	0.146	-.10833	.0167	37.09*
fac3_1	-.02076	.02889	-0.72	0.481	-.08112	.0396	19.48*
fac4_1	-.00588	.03001	-0.20	0.847	-.06868	.05692	19.06*
mothhlth	-.05165	.07102	-0.73	0.468	-.19158	.08829	231.04*
fathhlth	.10814	.075	1.44	0.158	-.04421	.26049	34.37*
fath_ed	-.02143	.05062	-0.42	0.673	-.12231	.07944	73.75*
moth_ed	.02634	.04735	0.56	0.578	-.06654	.11922	1622.38*
inc_10	.0393	.02068	1.90	0.059	-.00144	.08005	225.02*
num_chld	.01221	.02276	0.54	0.592	-.03264	.05706	226.37*
iq_nverb	.00581	.00215	2.70	0.008	.00155	.01008	115.74*
mothhr	.00029	.00171	0.17	0.867	-.00309	.00366	171.57*
fathhr	.00162	.00203	0.80	0.424	-.00239	.00564	117.25*
urban	-.1033	.04994	-2.07	0.040	-.20171	-.00488	222.94*
lawseq	.00734	.00575	1.28	0.206	-.00416	.01884	58.56*
caraloc	.00765	.00667	1.15	0.256	-.00574	.02105	50.61*
samepar	.05473	.07184	0.76	0.447	-.087	.19647	183.06*
incare	.24494	.30917	0.79	0.428	-.36103	.85091	6.30e+05*
mea7_1	.04751	.05581	0.85	0.397	-.06354	.15855	80.87*
j255	-.19341	.22228	-0.87	0.384	-.62911	.24229	13947.88*
ratio	-.00505	.00228	-2.22	0.027	-.00953	-.00058	703.87*
_cons	4.3456	.24896	17.45	0.000	3.8476	4.8436	59.85*

Skilled manual

Number of obs = 287

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.0176	.05328	0.33	0.742	-.08915	.12435	55.57
fac2_1	-.12682	.08849	-1.43	0.174	-.31683	.06319	13.83
fac3_1	-.05156	.05873	-0.88	0.383	-.1688	.06568	66.23
fac4_1	-.01551	.05693	-0.27	0.787	-.13017	.09915	45.17
mothhlth	.34212	.21975	1.56	0.123	-.09452	.77876	88.97
fathhlth	-.21103	.18747	-1.13	0.266	-.58872	.16665	44.58
fath_ed	-.11791	.12842	-0.92	0.359	-.3705	.13468	343.56
moth_ed	.02186	.16016	0.14	0.893	-.30916	.35287	23.39
inc_10	.04583	.0729	0.63	0.535	-.1045	.19615	24.38
num_chld	-.01823	.0473	-0.39	0.700	-.11097	.07452	2230.73
iq_nverb	-.00106	.00673	-0.16	0.876	-.01493	.01281	24.35
mothhr	.00062	.00501	0.12	0.903	-.00986	.0111	18.83
fathhr	-.0062	.00514	-1.21	0.239	-.01681	.0044	24.19
urban	.13089	.13068	1.00	0.317	-.1261	.38788	361.90
lawseq	.01647	.01509	1.09	0.275	-.01314	.04609	1035.19
caraloc	-.00816	.0177	-0.46	0.646	-.04325	.02694	104.55
samepar	.07739	.17266	0.45	0.654	-.26232	.41711	314.48
incare	.03455	.29445	0.12	0.907	-.54411	.61321	453.70
mea7_1	-.12166	.12686	-0.96	0.338	-.37108	.12776	390.28
j255	1.2363	.88406	1.40	0.162	-.49685	2.9695	4792.27
ratio	-.00889	.00639	-1.39	0.165	-.02145	.00366	376.38

_cons	5.3478	.47325	11.30	0.000	4.419	6.2766	890.02

Unskilled/semi-skilled

Overall estimates

Number of obs (min) = 500
Number of obs (max) = 501

logern	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	MI.df
fac1_1	.00599	.06404	0.09	0.926	-.12661	.13859	22.62*
fac2_1	-.00048	.05531	-0.01	0.993	-.10959	.10862	190.66*
fac3_1	-.03861	.05676	-0.68	0.503	-.15573	.07852	24.09*
fac4_1	-.01172	.05662	-0.21	0.836	-.12341	.09998	186.01*
mothhlth	.12111	.13934	0.87	0.387	-.15484	.39706	117.49*
fathhlth	.02144	.15142	0.14	0.887	-.27621	.3191	413.49*
fath_ed	.11344	.12295	0.92	0.358	-.1305	.35738	99.53*
moth_ed	-.22388	.13803	-1.62	0.108	-.4981	.05034	90.11*
inc_10	.0292	.06173	0.47	0.639	-.09526	.15365	43.32*
num_chld	.01845	.04938	0.37	0.709	-.07936	.11627	115.51*
iq_nverb	.0078	.0042	1.86	0.063	-.00043	.01604	1141.03*
mothhr	-.00248	.00384	-0.65	0.522	-.0102	.00524	46.80*
fathhr	-.00218	.00371	-0.59	0.557	-.00946	.0051	2604.08*
urban	-.04275	.12333	-0.35	0.731	-.29305	.20755	35.27*
lawseq	.01061	.01464	0.72	0.473	-.01892	.04014	42.67*
caraloc	-.01831	.01269	-1.44	0.154	-.04362	.007	71.16*
samepar	.04457	.1449	0.31	0.759	-.24215	.33128	127.57*
incare	.33486	.31135	1.08	0.282	-.27602	.94575	1125.34*
mea7_1	.12195	.11456	1.06	0.288	-.10368	.34759	247.56*
j255	-1.9954	.2453	-8.13	0.000	-2.4793	-1.5114	187.96*
ratio	-.0022	.00619	-0.35	0.725	-.01479	.0104	33.46*
_cons	4.2114	.53439	7.88	0.000	3.1483	5.2746	81.46*

Appendix: chapter 5

Multivariate models and diagnostic tests for each multiply imputed data set

Variable label definitions

Label	Definition
men	
fled	
speced	
age	Age at baseline
gender	Gender at baseline+ (1=male; 0=female)
class	Social class of parents 1.Professional 2.Managerial 3.Non-manual skilled 4.Manual Skilled 5.Semi skilled 6.Unskilled 7.Never worked/student
mumatbir	Age of mother at birth of child
ghqscr	Mother's GHQ score at baseline (scale 0-12)
ethgrpc	Ethnicity + (1=white; 0=black, Asian or other)
largefam	Large family + (1=3 or more siblings; 0=less than 3 siblings)
ffscr	Family functioning score at baseline (scale 21-41)
singpar	Single parent family + (1=yes; 0=conventional or reconstituted family)
_pimpac00	SDQ impact score
readz	Reading test score

GLM (gamma) with log-link function: mental health service costs

Full estimation sample with Park test

Data set 1

```
Generalized linear models                          No. of obs      =        108
Optimization     : ML: Newton-Raphson              Residual df     =         96
                                                   Scale parameter =   2.248228
Deviance         =  187.0432136                    (1/df) Deviance =   1.948367
Pearson          =  215.8298639                    (1/df) Pearson  =   2.248228

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -807.1054533                AIC             =   15.16862
BIC                  =-262.4413842

------------------------------------------------------------------------------
             |               Robust
         men |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .1195851    .056312     2.12   0.034     .0092155    .2299547
      gender |    .627428   .3589201     1.75   0.080    -.0760425    1.330899
    mumatbir |   .0610717   .0293682     2.08   0.038     .0035112    .1186322
      ghqscr |   .0969381    .056843     1.71   0.088    -.0144722    .2083484
```

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ethgrpc	.8013635	.389212	2.06	0.040	.038522	1.564205
class	.0490412	.1273836	0.38	0.700	-.200626	.2987084
largefam	-3.513381	.8820552	-3.98	0.000	-5.242178	-1.784585
ffscr	-.1848186	.0641653	-2.88	0.004	-.3105803	-.059057
singpar	.2948066	.458004	0.64	0.520	-.6028648	1.192478
readz	-.3067706	.1690132	-1.82	0.070	-.6380305	.0244893
pimpac00	.0399015	.0556041	0.72	0.473	-.0690805	.1488834
_cons	6.439243	1.667175	3.86	0.000	3.171639	9.706847

men and predicted

Correlation	0.336
R-squared	0.113
Root MSE	2654.421

linktest

Iteration 1 : deviance = 6.84e+08

Residual df	= 105	No. of obs	= 108
Pearson X2	= 6.84e+08	Deviance	= 6.84e+08
Dispersion	= 6518779	Dispersion	= 6518779

Gaussian (normal) distribution, identity link

men	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-3505.011	2153.618	-1.63	0.107	-7775.239	765.2164
_hatsq	350.7384	174.3312	2.01	0.047	5.071857	696.4048
_cons	8630.885	6650.113	1.30	0.197	-4555.06	21816.83

(Model is ordinary regression, use regress instead)

_hat and _hatsq are, respectively, the predicted values of the dependent variable and the predicted values squared. Statistical significance of the latter would imply functional form mis-specification.

Park test

OLS regression: lnvar are the log scaled residuals and lnyhat are the log scaled predictions derived from a generalised linear model of cost.

Source	SS	df	MS
Model	331.123097	1	331.123097
Residual	422.084432	106	3.9819286
Total	753.207529	107	7.0393227

Number of obs	= 108
F(1, 106)	= 83.16
Prob > F	= 0.0000
R-squared	= 0.4396
Adj R-squared	= 0.4343
Root MSE	= 1.9955

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.03345	.2229901	9.12	0.000	1.591351	2.47555
_cons	-1.025418	1.456174	-0.70	0.483	-3.912425	1.86159

lscres

```
-----------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.850977      -2.138377
 5%    -1.330468      -1.850977
10%    -1.005251      -1.630874       Obs                 108
25%    -.2266144      -1.625062       Sum of Wgt.         108

50%     .8688629                      Mean           .8659408
                        Largest       Std. Dev.      1.421753
75%     1.781564       3.519892
90%      2.82869        3.52204       Variance       2.021382
95%     3.240273       3.918406       Skewness       .1570643
99%     3.918406       4.657011       Kurtosis       2.492671
```

The important statistic is the coefficient of kurtosis. If the log scaled residuals are heavy tailed (coefficient of kurtosis >3) then OLS with a log transformed dependent variable is recommended. For coefficient of kurtosis of <3 one of the family if GLM estimators is recommended. If lnyhat = 2 (Manning & Mullahy, 2001)recommend the adoption of a GLM gamma model.

Data set 2

```
Generalized linear models                          No. of obs      =        108
Optimization     : ML: Newton-Raphson              Residual df     =         96
                                                   Scale parameter =   2.324602
Deviance         =  188.6271434                    (1/df) Deviance =   1.964866
Pearson          =  223.1618096                    (1/df) Pearson  =   2.324602

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -807.8974182                AIC             =   15.18329
BIC                  =-260.8574544

------------------------------------------------------------------------------
             |               Robust
         men |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .1245942    .057245     2.18   0.030     .0123961    .2367923
      gender |    .633338   .3686435     1.72   0.086      -.08919    1.355866
    mumatbir |   .0538436   .0279417     1.93   0.054    -.0009211    .1086084
      ghqscr |     .08477   .0558312     1.52   0.129    -.0246572    .1941971
     ethgrpc |   .5394787   .4658048     1.16   0.247    -.3734819    1.452439
       class |   .0675893   .1280705     0.53   0.598    -.1834243     .318603
    largefam |  -3.543613   .8943429    -3.96   0.000    -5.296493   -1.790733
       ffscr |  -.1940085   .0588043    -3.30   0.001    -.3092629   -.0787541
     singpar |   .2416988   .4380779     0.55   0.581    -.6169181    1.100316
       readz |  -.2441689   .1625114    -1.50   0.133    -.5626854    .0743477
    pimpac00 |   .0581912   .0536224     1.09   0.278    -.0469068    .1632892
       _cons |   7.075838   1.505825     4.70   0.000     4.124476     10.0272
------------------------------------------------------------------------------


    Correlation         0.346
    R-squared           0.120
    Root MSE         2649.064

. linktest

Iteration 1 : deviance =   6.79e+08

Residual df  =        105                               No. of obs =        108
Pearson X2   =   6.79e+08                               Deviance   =   6.79e+08
```

Dispersion = 6462938 Dispersion = 6462938

Gaussian (normal) distribution, identity link

men	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-4262.407	2342.583	-1.82	0.072	-8907.316	382.5014
_hatsq	416.1017	189.7152	2.19	0.030	39.93153	792.2718
_cons	10763.69	7227.164	1.49	0.139	-3566.445	25093.82

(Model is ordinary regression, use regress instead)

Park test.

Source	SS	df	MS
Model	284.984027	1	284.984027
Residual	303.225313	106	2.86061616
Total	588.209341	107	5.49728356

Number of obs	= 108
F(1, 106)	= 99.62
Prob > F	= 0.0000
R-squared	= 0.4845
Adj R-squared	= 0.4796
Root MSE	= 1.6913

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	1.970078	.1973799	9.98	0.000	1.578753	2.361403
_cons	-.5350245	1.289439	-0.41	0.679	-3.091463	2.021414

lscres

	Percentiles	Smallest		
1%	-1.841836	-2.178889		
5%	-1.278939	-1.841836		
10%	-1.052471	-1.672244	Obs	108
25%	-.3290176	-1.638907	Sum of Wgt.	108
50%	.978131		Mean	.8732738
		Largest	Std. Dev.	1.423897
75%	1.87694	3.419816		
90%	2.849332	3.663259	Variance	2.027483
95%	3.190742	3.975827	Skewness	.1464875
99%	3.975827	4.650394	Kurtosis	2.494114

Data set 3

Generalized linear models No. of obs = 108
Optimization : ML: Newton-Raphson Residual df = 96
Scale parameter = 2.16494
Deviance = 183.1916105 (1/df) Deviance = 1.908246
Pearson = 207.8342766 (1/df) Pearson = 2.16494

Variance function: V(u) = u^2. [Gamma]
Link function : g(u) = ln(u) [Log]
Standard errors : Sandwich

Log pseudolikelihood = -805.1796518 AIC = 15.13296
BIC =-266.2929873

men	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.1154418	.0544092	2.12	0.034	.0088018	.2220819
gender	.6532987	.3516197	1.86	0.063	-.0358633	1.342461
mumatbir	.0654078	.0279336	2.34	0.019	.0106589	.1201568
ghqscr	.1148897	.0552242	2.08	0.037	.0066522	.2231272
ethgrpc	.8151566	.4041545	2.02	0.044	.0230284	1.607285
class	.0363125	.1266164	0.29	0.774	-.211851	.2844761
largefam	-3.494824	.8181923	-4.27	0.000	-5.098452	-1.891197
ffscr	-.1858926	.0634936	-2.93	0.003	-.3103378	-.0614474
singpar	.2638586	.4463418	0.59	0.554	-.6109553	1.138672
readz	-.3321495	.1587139	-2.09	0.036	-.6432229	-.021076
pimpac00	.036918	.0545964	0.68	0.499	-.070089	.143925

```
       _cons |  6.348017   1.707117     3.72   0.000     3.00213    9.693905
------------------------------------------------------------------------------

    Correlation          0.338
    R-squared            0.114
    Root MSE          2649.516

. linktest

Iteration 1 : deviance =  6.83e+08

Residual df  =       105                          No. of obs =       108
Pearson X2   =  6.83e+08                          Deviance   =  6.83e+08
Dispersion   =   6509093                          Dispersion =   6509093

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
         men |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -2730.32    1773.745     -1.54   0.127    -6247.328    786.6883
      _hatsq |  288.3425    144.7355      1.99   0.049     1.358711    575.3262
       _cons |  6271.643    5458.999      1.15   0.253    -4552.545    17095.83
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

Park test.

      Source |       SS       df       MS                  Number of obs =     108
-------------+------------------------------               F(  1,   106) =  121.25
       Model |  382.239388     1  382.239388               Prob > F      =  0.0000
    Residual |  334.157968   106  3.15243366               R-squared     =  0.5336
-------------+------------------------------               Adj R-squared =  0.5292
       Total |  716.397356   107   6.6953024               Root MSE      =  1.7755

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.075545   .1884896     11.01   0.000     1.701846    2.449244
       _cons |  -1.299287   1.228706     -1.06   0.293    -3.735315    1.136742
------------------------------------------------------------------------------


                            lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.878789      -2.070855
 5%    -1.337118      -1.878789
10%    -1.013937      -1.620647       Obs                 108
25%    -.1768657      -1.610298       Sum of Wgt.         108

50%     .8604605                      Mean           .8481093
                        Largest       Std. Dev.      1.411157
75%     1.684385        3.39156
90%     2.858675       3.492987       Variance       1.991365
95%     3.235829       3.914412       Skewness       .1863029
99%     3.914412       4.754675       Kurtosis        2.55213

.
.
```

Data set 4

```
.
Generalized linear models                          No. of obs      =       108
Optimization     : ML: Newton-Raphson              Residual df     =        96
                                                   Scale parameter =  2.174491
Deviance         =  184.6185363                    (1/df) Deviance =   1.92311
Pearson          =  208.7511197                    (1/df) Pearson  =  2.174491

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -805.8931146                AIC             =  15.14617
BIC                  =-264.8660615

------------------------------------------------------------------------------
```

men	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.1240466	.056261	2.20	0.027	.0137772	.2343161
gender	.7090406	.3632136	1.95	0.051	-.0028448	1.420926
mumatbir	.0689825	.0289099	2.39	0.017	.0123201	.125645
ghqscr	.1080424	.0546013	1.98	0.048	.0010259	.215059
ethgrpc	.7850798	.4360746	1.80	0.072	-.0696107	1.63977
class	.0585189	.1292089	0.45	0.651	-.1947259	.3117638
largefam	-3.462903	.8402955	-4.12	0.000	-5.109852	-1.815954
ffscr	-.2000219	.0616663	-3.24	0.001	-.3208856	-.0791583
singpar	.2581	.4179271	0.62	0.537	-.5610221	1.077222
readz	-.2699522	.1710744	-1.58	0.115	-.6052519	.0653474
pimpac00	.0434186	.0543209	0.80	0.424	-.0630485	.1498856
_cons	6.473692	1.629606	3.97	0.000	3.279723	9.667661

Correlation	0.349
R-squared	0.122
Root MSE	2640.016

. linktest

Iteration 1 : deviance = 6.80e+08

Residual df =	105	No. of obs =	108
Pearson X2 =	6.80e+08	Deviance =	6.80e+08
Dispersion =	6472670	Dispersion =	6472670

Gaussian (normal) distribution, identity link

men	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-3251.648	1939.046	-1.68	0.097	-7096.417	593.1214
_hatsq	331.8302	157.562	2.11	0.038	19.41378	644.2466
_cons	7796.609	5979.598	1.30	0.195	-4059.828	19653.05

(Model is ordinary regression, use regress instead)

Park test

.

Source	SS	df	MS		
				Number of obs =	108
				F(1, 106) =	125.31
Model	343.349812	1	343.349812	Prob > F =	0.0000
Residual	290.444103	106	2.74003871	R-squared =	0.5417
				Adj R-squared =	0.5374
Total	633.793915	107	5.92330762	Root MSE =	1.6553

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.021138	.1805535	11.19	0.000	1.663173	2.379102
_cons	-.8714268	1.177554	-0.74	0.461	-3.206042	1.463188

lscres

	Percentiles	Smallest		
1%	-1.869344	-2.066499		
5%	-1.314103	-1.869344		
10%	-1.093794	-1.65462	Obs	108
25%	-.2582256	-1.608282	Sum of Wgt.	108
50%	.8790173		Mean	.8547151
		Largest	Std. Dev.	1.413602
75%	1.818324	3.42114		
90%	2.85297	3.433569	Variance	1.998271
95%	3.142656	4.062833	Skewness	.1686968
99%	4.062833	4.723208	Kurtosis	2.538506

.

.

Data set 5

```
.
Generalized linear models                          No. of obs      =        108
Optimization     : ML: Newton-Raphson              Residual df     =         96
                                                   Scale parameter =   2.160907
Deviance         =  183.9994451                    (1/df) Deviance =   1.916661
Pearson          =  207.4470677                    (1/df) Pearson  =   2.160907

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -805.5835691                AIC             =   15.14044
BIC                  =-265.4851527

------------------------------------------------------------------------------
             |               Robust
         men |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .1141409   .0549452     2.08   0.038      .0064502    .2218316
      gender |   .6314074    .351556     1.80   0.072     -.0576296    1.320444
    mumatbir |   .0674238   .0290941     2.32   0.020      .0104004    .1244472
      ghqscr |   .1142768   .0564275     2.03   0.043      .0036809    .2248727
     ethgrpc |   .7053227   .4101208     1.72   0.085     -.0984993    1.509145
       class |   .0285003   .1284248     0.22   0.824     -.2232078    .2802084
    largefam |  -3.493579   .8166328    -4.28   0.000      -5.09415   -1.893008
       ffscr |  -.1839541   .0661505    -2.78   0.005     -.3136067   -.0543015
     singpar |   .2850751    .440445     0.65   0.517     -.5781813    1.148331
       readz |  -.3470653    .174227    -1.99   0.046      -.688544   -.0055866
    pimpac00 |   .0356321   .0560623     0.64   0.525      -.074248    .1455121
       _cons |   6.398575    1.69988     3.76   0.000      3.066872    9.730279
------------------------------------------------------------------------------


    Correlation          0.330
    R-squared            0.109
    Root MSE          2657.354

. linktest

Iteration 1 : deviance =  6.85e+08

Residual df  =       105                                No. of obs =       108
Pearson X2   =  6.85e+08                                Deviance   =  6.85e+08
Dispersion   =   6527690                                Dispersion =   6527690

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
         men |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -2702.126    1786.52    -1.51   0.133     -6244.466    840.2138
      _hatsq |   285.8807   145.9434     1.96   0.053     -3.498039    575.2595
       _cons |   6192.561   5492.038     1.13   0.262     -4697.135    17082.26
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

Park test.


      Source |       SS       df       MS              Number of obs =     108
-------------+------------------------------           F(  1,   106) =  126.23
       Model |   368.39638     1   368.39638           Prob > F      =  0.0000
    Residual |  309.356458   106  2.91845715           R-squared     =  0.5436
-------------+------------------------------           Adj R-squared =  0.5392
       Total |  677.752838   107  6.33413868           Root MSE      =  1.7083

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.046401   .1821419    11.24   0.000      1.685287    2.407515
       _cons |  -1.050774   1.187903    -0.88   0.378     -3.405907    1.304359
------------------------------------------------------------------------------


                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.859684      -2.086031
```

```
 5%    -1.347652       -1.859684
10%     -.977194       -1.626102       Obs                108
25%    -.2346932        -1.60421       Sum of Wgt.        108

50%     .8733231                       Mean          .8518493
                         Largest       Std. Dev.     1.415161
75%     1.665394        3.386171
90%      2.93332        3.472752       Variance      2.002679
95%     3.273496        3.898791       Skewness      .1847866
99%     3.898791        4.757165       Kurtosis      2.542486
```

GLM (gamma) with log-link function: mental health service costs

Trimmed estimation sample

Data set 1

```
Generalized linear models                          No. of obs      =        98
Optimization     : ML: Newton-Raphson              Residual df     =        86
                                                   Scale parameter =  1.111992
Deviance         =  103.4338796                    (1/df) Deviance =   1.20272
Pearson          =  95.63130938                    (1/df) Pearson  =  1.111992

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -700.2060269                AIC             =  14.53482
BIC                  =-290.8733235

------------------------------------------------------------------------------
             |               Robust
         men |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0073773   .0456092    -0.16   0.872    -.0967697    .0820152
      gender |   .3495603   .2560013     1.37   0.172     -.152193    .8513136
    mumatbir |   .0362438   .0238221     1.52   0.128    -.0104467    .0829343
      ghqscr |   .0424278   .0349945     1.21   0.225    -.0261601    .1110158
     ethgrpc |   .4147518   .3436687     1.21   0.227    -.2588264     1.08833
       class |   .0652221   .0886476     0.74   0.462    -.1085239    .2389682
    largefam |  -2.029767   .3938985    -5.15   0.000    -2.801794    -1.25774
       ffscr |  -.1067433   .0557169    -1.92   0.055    -.2159464    .0024599
     singpar |  -.4192318   .2594846    -1.62   0.106    -.9278122    .0893486
    pimpac00 |   .1576685   .0433635     3.64   0.000     .0726775    .2426595
       readz |  -.1813766   .0993879    -1.82   0.068    -.3761734    .0134201
       _cons |   6.606499   1.601363     4.13   0.000     3.467886    9.745113
------------------------------------------------------------------------------


    Correlation          0.512
    R-squared            0.262
    Root MSE           531.793

.
. linktest

Iteration 1 : deviance =  2.34e+07

Residual df  =         95                               No. of obs =        98
Pearson X2   =  2.34e+07                                Deviance   =  2.34e+07
Dispersion   =  245921.5                                Dispersion =  245921.5

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
         men |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
```

```
-------------+----------------------------------------------------------------
        _hat |  -723.8575   1349.344    -0.54   0.593    -3402.644    1954.929
      _hatsq |   97.50764   108.3453     0.90   0.370    -117.5849    312.6002
       _cons |   1277.062   4177.372     0.31   0.760    -7016.071    9570.194
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)
```

.

Data set 2

```
.
.
Generalized linear models                          No. of obs      =        98
Optimization     : ML: Newton-Raphson              Residual df     =        86
                                                   Scale parameter =  1.127456
Deviance         =  103.7578091                    (1/df) Deviance =  1.206486
Pearson          =  96.96125219                    (1/df) Pearson  =  1.127456

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -700.3679916                AIC             =  14.53812
BIC                  =-290.5493941

------------------------------------------------------------------------------
             |               Robust
         men |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0064275   .0459456    -0.14   0.889    -.0964793    .0836243
      gender |   .3415961   .2580131     1.32   0.186    -.1641002    .8472924
   mumatbir |   .0292734   .0237412     1.23   0.218    -.0172584    .0758053
      ghqscr |   .0390979   .0362664     1.08   0.281    -.0319828    .1101787
     ethgrpc |   .2770922   .3793753     0.73   0.465    -.4664697    1.020654
       class |   .0809213   .0873351     0.93   0.354    -.0902523    .2520949
    largefam |  -2.094066   .3827782    -5.47   0.000    -2.844297   -1.343834
       ffscr |  -.1139906   .0517524    -2.20   0.028    -.2154234   -.0125578
     singpar |  -.4439424   .2557241    -1.74   0.083    -.9451525    .0572677
    pimpac00 |   .1655568   .0413133     4.01   0.000     .0845841    .2465294
       readz |  -.1636099   .0939768    -1.74   0.082    -.3478011    .0205813
       _cons |   7.094658   1.443086     4.92   0.000     4.266261    9.923054
------------------------------------------------------------------------------


    Correlation           0.525
    R-squared             0.276
    Root MSE            525.314

.
. linktest

Iteration 1 : deviance =  2.30e+07

Residual df  =        95                             No. of obs =        98
Pearson X2   =  2.30e+07                             Deviance   =  2.30e+07
Dispersion   =  242287.2                             Dispersion =  242287.2

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
         men |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -1051.405   1346.553    -0.78   0.437    -3724.652    1621.841
      _hatsq |   124.9116   107.9482     1.16   0.250    -89.39274    339.2159
       _cons |   2245.978   4177.125     0.54   0.592    -6046.664    10538.62
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)
```

Data set 3

```
Generalized linear models                          No. of obs      =        98
Optimization     : ML: Newton-Raphson              Residual df     =        86
                                                   Scale parameter =  1.120916
Deviance         =  102.2797841                    (1/df) Deviance =    1.1893
Pearson          =  96.39880162                    (1/df) Pearson  =  1.120916
```

```
Variance function: V(u) = u^2                          [Gamma]
Link function    : g(u) = ln(u)                        [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -699.6289791                    AIC             =  14.52304
BIC                  = -292.027419
```

men	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0102856	.0449399	-0.23	0.819	-.0983661	.0777949
gender	.3625686	.2537846	1.43	0.153	-.1348402	.8599773
mumatbir	.0347418	.02207	1.57	0.115	-.0085147	.0779982
ghqscr	.05481	.0339507	1.61	0.106	-.0117322	.1213521
ethgrpc	.4331052	.3701407	1.17	0.242	-.2923573	1.158568
class	.0622949	.0857817	0.73	0.468	-.1058342	.2304239
largefam	-2.068774	.3918815	-5.28	0.000	-2.836847	-1.3007
ffscr	-.1112002	.0549347	-2.02	0.043	-.2188702	-.0035302
singpar	-.4490677	.2605414	-1.72	0.085	-.9597194	.0615841
pimpac00	.1551152	.0439765	3.53	0.000	.0689229	.2413075
readz	-.1843704	.089573	-2.06	0.040	-.3599303	-.0088105
_cons	6.755803	1.620495	4.17	0.000	3.579691	9.931914

```
    Correlation          0.536
    R-squared            0.287
    Root MSE           522.737

.
. linktest

Iteration 1 : deviance =  2.26e+07

Residual df  =         95                              No. of obs =         98
Pearson X2   =  2.26e+07                               Deviance   =   2.26e+07
Dispersion   =  238231.4                               Dispersion =   238231.4

Gaussian (normal) distribution, identity link
```

men	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-979.4983	1280.81	-0.76	0.446	-3522.228	1563.231
_hatsq	118.9325	102.6598	1.16	0.250	-84.87311	322.738
_cons	2033.328	3972.198	0.51	0.610	-5852.482	9919.139

(Model is ordinary regression, use regress instead)

.

Data set 4

.

```
Generalized linear models                              No. of obs      =        98
Optimization     : ML: Newton-Raphson                  Residual df     =        86
                                                       Scale parameter =  1.128539
Deviance         =  104.0305961                        (1/df) Deviance =  1.209658
Pearson          =  97.05432658                        (1/df) Pearson  =  1.128539

Variance function: V(u) = u^2                          [Gamma]
Link function    : g(u) = ln(u)                        [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -700.5043851                    AIC             =  14.54091
BIC                  =-290.2766071
```

men	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.006267	.047261	-0.13	0.895	-.0988968	.0863628
gender	.3818714	.264763	1.44	0.149	-.1370545	.9007973
mumatbir	.0327011	.0245437	1.33	0.183	-.0154038	.0808059
ghqscr	.0482441	.0343508	1.40	0.160	-.0190822	.1155704
ethgrpc	.4265255	.3828498	1.11	0.265	-.3238463	1.176897
class	.0777782	.0905844	0.86	0.391	-.099764	.2553203
largefam	-2.095027	.3661759	-5.72	0.000	-2.812719	-1.377336

```
       ffscr |  -.1227738   .0527103    -2.33   0.020     -.226084   -.0194636
     singpar |  -.4389097   .2415878    -1.82   0.069    -.9124132    .0345938
    pimpac00 |   .1655536   .0417683     3.96   0.000     .0836891     .247418
       readz |  -.1330133   .0943734    -1.41   0.159    -.3179817    .0519551
       _cons |   7.037656   1.546015     4.55   0.000     4.007522    10.06779
------------------------------------------------------------------------------


    Correlation         0.511
    R-squared           0.261
    Root MSE          534.754

.
. linktest

Iteration 1 : deviance =  2.34e+07

Residual df  =         95                          No. of obs =         98
Pearson X2   =  2.34e+07                           Deviance   =   2.34e+07
Dispersion   =  245808.4                           Dispersion =   245808.4

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
         men |      Coef.   Std. Err.       t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -749.9788   1300.818    -0.58   0.566    -3332.429    1832.471
      _hatsq |   99.58472   104.1301     0.96   0.341    -107.1397    306.3091
       _cons |    1357.49   4041.251     0.34   0.738    -6665.408    9380.388
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

.
.
```

Data set 5

```
Generalized linear models                          No. of obs      =        98
Optimization     : ML: Newton-Raphson              Residual df     =        86
                                                   Scale parameter =  1.110237
Deviance         =  103.4164572                    (1/df) Deviance =  1.202517
Pearson          =  95.48035634                    (1/df) Pearson  =  1.110237

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -700.1973157                AIC             =  14.53464
BIC                  = -290.890746

------------------------------------------------------------------------------
             |               Robust
         men |      Coef.   Std. Err.       z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   -.008136   .0459509    -0.18   0.859    -.0981982    .0819261
      gender |   .3433916   .2580698     1.33   0.183     -.162416    .8491992
   mumatbir |    .034482   .0247149     1.40   0.163    -.0139584    .0829223
      ghqscr |   .0468002   .0345369     1.36   0.175    -.0208909    .1144913
     ethgrpc |   .3712202   .3643118     1.02   0.308    -.3428178    1.085258
       class |   .0560141   .0884425     0.63   0.527      -.11733    .2293581
    largefam |  -2.061193   .3887077    -5.30   0.000    -2.823046    -1.29934
       ffscr |  -.1044229   .0566537    -1.84   0.065     -.215462    .0066163
     singpar |   -.422168   .2567285    -1.64   0.100    -.9253466    .0810107
    pimpac00 |   .1547025   .0441353     3.51   0.000      .068199    .2412061
       readz |  -.1912044   .0972732    -1.97   0.049    -.3818565   -.0005524
       _cons |   6.683522   1.619433     4.13   0.000     3.509492    9.857551
------------------------------------------------------------------------------


    Correlation         0.521
    R-squared           0.271
    Root MSE          527.478

.
. linktest

Iteration 1 : deviance =  2.31e+07
```

```
Residual df   =        95                               No. of obs =         98
Pearson X2    =  2.31e+07                               Deviance   =   2.31e+07
Dispersion    =  243510.8                               Dispersion =   243510.8

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
         men |      Coef.   Std. Err.       t     P>|t|      [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -892.3714   1367.224    -0.65    0.516     -3606.654    1821.912
      _hatsq |   111.6716   109.6734     1.02    0.311     -106.0576    329.4008
       _cons |   1773.294   4237.077     0.42    0.677     -6638.367    10184.96
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

.
.
```

GLM (gamma) with log-link function: frontline education resources

Full estimation sample with Park test

Data set 1

```
Generalized linear models                          No. of obs      =       140
Optimization     : ML: Newton-Raphson              Residual df     =       128
                                                   Scale parameter =  5.722478
Deviance         =  635.7140768                    (1/df) Deviance =  4.966516
Pearson          =  732.4772283                    (1/df) Pearson  =  5.722478

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -1109.458205                AIC             =  16.02083
BIC                  = 3.183846711

------------------------------------------------------------------------------
             |               Robust
        fled |      Coef.   Std. Err.       z     P>|z|      [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   -.018344   .0906772    -0.20    0.840     -.1960681     .1593801
      gender |  -.9518178   .4378153    -2.17    0.030      -1.80992    -.0937155
    mumatbir |    .157055   .0450187     3.49    0.000        .06882       .24529
      ghqscr |  -.0574114   .1172179    -0.49    0.624     -.2871542     .1723314
     ethgrpc |  -.7903524   1.117188    -0.71    0.479     -2.980001     1.399296
       class |   .1302414   .1749007     0.74    0.456     -.2125577     .4730405
    largefam |  -.4535737   .6852623    -0.66    0.508     -1.796663     .8895157
       ffscr |   .0998433   .1405686     0.71    0.478     -.1756661     .3753528
    pimpac00 |   .2287748   .1462556     1.56    0.118      -.057881     .5154306
       readz |  -1.003808   .2291241    -4.38    0.000     -1.452883    -.5547329
     singpar |  -.3623655   .6384257    -0.57    0.570     -1.613657     .8889259
       _cons |   .6971274    3.46693     0.20    0.841     -6.097931     7.492186
------------------------------------------------------------------------------

    Correlation          0.056
    R-squared            0.003
    Root MSE         15010.825

. linktest


Park test

Residual df   =       137                               No. of obs =        140
Pearson X2    =  8.37e+09                               Deviance   =   8.37e+09
Dispersion    =  6.11e+07                               Dispersion =   6.11e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.       t     P>|t|      [95% Conf. Interval]
```

```
-------------+----------------------------------------------------------------
        _hat |   1927.377    2473.97     0.78   0.437    -2964.729    6819.483
      _hatsq |  -49.67146   170.9093    -0.29   0.772    -387.6329      288.29
       _cons |  -8452.765   8674.639    -0.97   0.332    -25606.27    8700.737
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)
```

```
                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.359554      -2.770911
 5%    -1.840501      -2.359554
10%     -1.40715      -2.093479       Obs                 140
25%     .3526455      -1.960157       Sum of Wgt.         140

50%     2.415679                      Mean           2.270407
                        Largest       Std. Dev.      2.379883
75%     4.205305       6.374098
90%     5.401386       6.398346       Variance       5.663845
95%      5.89355       6.696693       Skewness       -.145584
99%     6.696693       7.697846       Kurtosis       2.172084
```

Data set 2

```
Generalized linear models                          No. of obs      =       140
Optimization     : ML: Newton-Raphson              Residual df     =       128
                                                   Scale parameter =  5.382026
Deviance         =  642.9829557                    (1/df) Deviance =  5.023304
Pearson          =  688.8993856                    (1/df) Pearson  =  5.382026

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -1113.092645                AIC             =  16.07275
BIC                  = 10.45272559

------------------------------------------------------------------------------
             |               Robust
        fled |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0671973   .0834095    -0.81   0.420    -.2306768    .0962823
      gender |  -.7292481   .4319235    -1.69   0.091    -1.575802    .1173064
    mumatbir |   .1518512   .0407599     3.73   0.000     .0719633    .2317391
      ghqscr |  -.0072856   .1243613    -0.06   0.953    -.2510292     .236458
     ethgrpc |  -.7796862   1.142905    -0.68   0.495    -3.019738    1.460366
       class |   .0582916   .1832401     0.32   0.750    -.3008523    .4174355
    largefam |   .1106611   .6901202     0.16   0.873     -1.24195    1.463272
       ffscr |   .1865656   .1461124     1.28   0.202    -.0998094    .4729406
    pimpac00 |   .1704901   .1623555     1.05   0.294    -.1477209     .488701
       readz |  -1.125494   .2491731    -4.52   0.000    -1.613864   -.6371233
     singpar |  -.5797451   .5709761    -1.02   0.310    -1.698838    .5393476
       _cons |  -.8028032   3.558086    -0.23   0.821    -7.776523    6.170917
------------------------------------------------------------------------------


    Correlation          0.009
    R-squared            0.000
    Root MSE         28620.717

. linktest

Iteration 1 : deviance =  8.45e+09

Residual df  =        137                            No. of obs =        140
Pearson X2   =   8.45e+09                            Deviance   =   8.45e+09
Dispersion   =   6.17e+07                            Dispersion =   6.17e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.       t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   2623.866    2248.73     1.17   0.245    -1822.844    7070.575
```

```
      _hatsq |  -107.8933   154.7298    -0.70   0.487    -413.8607    198.0742
       _cons |  -10323.37   7927.466    -1.30   0.195    -25999.39    5352.649
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

Park test.

      Source |       SS       df       MS              Number of obs =     139
-------------+------------------------------           F(  1,   137) =  694.24
       Model |  1966.75216     1  1966.75216           Prob > F      =  0.0000
    Residual |  388.11463    137  2.83295351           R-squared     =  0.8352
-------------+------------------------------           Adj R-squared =  0.8340
       Total |  2354.86679   138  17.0642521           Root MSE      =  1.6831

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.127849    .080758    26.35   0.000     1.968155    2.287542
       _cons |  -1.029551   .5787514    -1.78   0.077    -2.173992    .1148903
------------------------------------------------------------------------------


                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%     -2.25239      -2.556221
 5%    -1.868955       -2.25239
10%    -1.368448      -2.252216       Obs                 140
25%     .4578344      -2.131851       Sum of Wgt.         140

50%     2.396657                      Mean           2.296368
                        Largest       Std. Dev.      2.399891
75%     4.155422       6.313035
90%     5.386085       6.400499       Variance       5.759479
95%     5.758095       6.454241       Skewness      -.1604717
99%     6.454241       7.734365       Kurtosis       2.126259
```

Data set 3

```
Generalized linear models                          No. of obs      =       140
Optimization     : ML: Newton-Raphson              Residual df     =       128
                                                   Scale parameter =  5.586518
Deviance         =  651.5960725                    (1/df) Deviance =  5.090594
Pearson          =  715.0743084                    (1/df) Pearson  =  5.586518

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -1117.399203                AIC             =  16.13427
BIC                  = 19.06584237

------------------------------------------------------------------------------
             |               Robust
        fled |      Coef.   Std. Err.       z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0246142   .0905125    -0.27   0.786    -.2020154    .1527871
      gender |  -.8074618   .4354704    -1.85   0.064    -1.660968    .0460445
    mumatbir |   .1533841   .0458972     3.34   0.001     .0634273     .243341
      ghqscr |  -.1422288   .0983513    -1.45   0.148    -.3349938    .0505361
     ethgrpc |  -.8570978    1.10136    -0.78   0.436    -3.015724    1.301528
       class |   .1095788   .1836375     0.60   0.551     -.250344    .4695017
    largefam |  -.3912486   .7015295    -0.56   0.577    -1.766221     .983724
       ffscr |   .1351866    .127992     1.06   0.291    -.1156731    .3860462
    pimpac00 |   .3747783   .1755933     2.13   0.033     .0306219    .7189348
       readz |  -.9904905   .2578643    -3.84   0.000    -1.495895   -.4850858
     singpar |   -.643001   .5679478    -1.13   0.258    -1.756158    .4701562
       _cons |   .0989535   3.462092     0.03   0.977    -6.686623     6.88453
------------------------------------------------------------------------------


    Correlation          -0.008
    R-squared             0.000
    Root MSE          26304.192
```

```
. linktest

Iteration 1 : deviance =  8.48e+09

Residual df   =        137                         No. of obs =        140
Pearson X2    =  8.48e+09                          Deviance   =   8.48e+09
Dispersion    =  6.19e+07                          Dispersion =   6.19e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   3138.749   2125.743      1.48   0.142    -1064.761    7342.259
      _hatsq |  -149.0706   144.4814     -1.03   0.304    -434.7727    136.6314
       _cons |  -11787.77   7573.834     -1.56   0.122    -26764.51    3188.963
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

Park test

. reg lnvar lnyhat if e(sample)

      Source |       SS       df       MS              Number of obs =     139
-------------+------------------------------           F(  1,    137) =  651.11
       Model |  2036.22363     1  2036.22363           Prob > F      =  0.0000
    Residual |  428.441396   137  3.12730946           R-squared     =  0.8262
-------------+------------------------------           Adj R-squared =  0.8249
       Total |  2464.66503   138  17.8598915           Root MSE      =  1.7684

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.098546   .0822415     25.52   0.000     1.935919    2.261173
       _cons |  -.8490059   .5930022     -1.43   0.155    -2.021627    .3236151
------------------------------------------------------------------------------


                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.264593      -2.600776
 5%    -1.773313      -2.264593
10%    -1.303734      -2.241522       Obs                 140
25%     .5528961       -2.20626       Sum of Wgt.         140

50%     2.438294                      Mean           2.327128
                        Largest       Std. Dev.      2.430572
75%     4.224447       6.333861
90%       5.5736       7.147312       Variance       5.907679
95%     5.948779       7.603399       Skewness      -.0949303
99%     7.603399       7.915112       Kurtosis       2.260237
```

Data set 4

```
Generalized linear models                          No. of obs      =       140
Optimization     : ML: Newton-Raphson              Residual df     =       128
                                                   Scale parameter =  5.413809
Deviance         =  638.3148282                    (1/df) Deviance =  4.986835
Pearson          =  692.9675317                    (1/df) Pearson  =  5.413809

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -1110.758581                AIC             =  16.03941
BIC                  =  5.78459807

------------------------------------------------------------------------------
             |               Robust
        fled |      Coef.   Std. Err.      z     P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0516681   .0844899     -0.61   0.541    -.2172653    .1139292
```

```
      gender | -.7162979   .4484473    -1.60   0.110    -1.595238    .1626428
    mumatbir |  .1562966   .0414148     3.77   0.000      .075125    .2374682
      ghqscr | -.0792865   .1076162    -0.74   0.461    -.2902103    .1316373
     ethgrpc |  -.970736   1.113786    -0.87   0.383    -3.153716    1.212244
       class |  .0648461   .1898797     0.34   0.733    -.3073113    .4370035
    largefam |  .0002802   .7106472     0.00   1.000    -1.392563    1.393123
       ffscr |  .1476493   .1487227     0.99   0.321    -.1438418    .4391403
    pimpac00 |  .2442103   .1505513     1.62   0.105    -.0508647    .5392854
       readz | -1.124026   .2645041    -4.25   0.000    -1.642444    -.605607
     singpar | -.6750307   .5393628    -1.25   0.211    -1.732162     .382101
       _cons |  .0836539     3.6644     0.02   0.982    -7.098438    7.265746
------------------------------------------------------------------------------


    Correlation          -0.005
    R-squared             0.000
    Root MSE          27945.331

. linktest

Iteration 1 : deviance =  8.46e+09

Residual df   =        137                          No. of obs =        140
Pearson X2    =   8.46e+09                          Deviance   =   8.46e+09
Dispersion    =   6.18e+07                          Dispersion =   6.18e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   2722.573   2003.969     1.36   0.177    -1240.137    6685.283
      _hatsq |  -119.3402   137.1576    -0.87   0.386      -390.56    151.8795
       _cons |  -10372.23    7102.34    -1.46   0.146    -24416.62    3672.161
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

Park test

      Source |       SS       df       MS               Number of obs =     139
-------------+------------------------------            F(  1,    137) =  518.63
       Model |  2114.32122     1  2114.32122            Prob > F      =  0.0000
    Residual |    558.5131   137  4.07673796            R-squared     =  0.7910
-------------+------------------------------            Adj R-squared =  0.7895
       Total |  2672.83432   138  19.3683646            Root MSE      =  2.0191

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.119703   .0930778    22.77   0.000     1.935649    2.303758
       _cons |  -1.103957   .6672186    -1.65   0.100    -2.423336    .2154218
------------------------------------------------------------------------------


                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.269232      -2.571014
 5%    -1.862986      -2.269232
10%    -1.369679       -2.16596       Obs                 140
25%     .4631205       -2.11656       Sum of Wgt.         140

50%     2.463123                      Mean           2.279695
                        Largest       Std. Dev.      2.399331
75%     4.217498       6.139411
90%     5.285341       7.262513       Variance       5.756788
95%     5.655204        7.55474       Skewness      -.1106855
99%      7.55474       7.829324       Kurtosis       2.230996
```

Data set 5

```
.
.
Generalized linear models                          No. of obs      =        140
Optimization      : ML: Newton-Raphson             Residual df     =        128
                                                   Scale parameter =   6.942719
Deviance          =  673.9612716                   (1/df) Deviance =   5.265322
```

```
Pearson          = 888.6679867                     (1/df) Pearson  =  6.942719

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -1128.581803                AIC             =  16.29403
BIC                  = 41.43104156

------------------------------------------------------------------------------
             |               Robust
        fled |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.1612243   .0816855    -1.97   0.048    -.3213248   -.0011237
      gender |  -.5119076   .4585476    -1.12   0.264    -1.410644    .3868291
    mumatbir |   .1525922   .0430959     3.54   0.000     .0681257    .2370586
      ghqscr |   .0530768   .1484675     0.36   0.721    -.2379141    .3440677
     ethgrpc |   .0766879   1.181991     0.06   0.948    -2.239973    2.393348
       class |   .0801175   .1993788     0.40   0.688    -.3106577    .4708928
    largefam |   .4480819   .8132794     0.55   0.582    -1.145916     2.04208
       ffscr |   .1060235   .1658026     0.64   0.523    -.2189437    .4309907
    pimpac00 |   .2939756   .1965827     1.50   0.135    -.0913195    .6792707
       readz |  -.8613363   .2495769    -3.45   0.001    -1.350498   -.3721747
     singpar |  -1.198826   .5486828    -2.18   0.029    -2.274225   -.1234276
       _cons |   1.009755   3.834096     0.26   0.792    -6.504934    8.524445
------------------------------------------------------------------------------


    Correlation          0.018
    R-squared            0.000
    Root MSE         19493.454

. linktest

Iteration 1 : deviance =  8.51e+09

Residual df  =       137                                No. of obs =       140
Pearson X2   =  8.51e+09                                Deviance   =  8.51e+09
Dispersion   =  6.21e+07                                Dispersion =  6.21e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   2758.055   2354.238     1.17   0.243    -1897.289      7413.4
      _hatsq |  -117.1004   159.6409    -0.73   0.464    -432.7792    198.5784
       _cons |  -10936.35   8472.696    -1.29   0.199    -27690.52    5817.823
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

Park test

      Source |       SS       df       MS              Number of obs =     139
-------------+------------------------------           F(  1,   137) =  815.04
       Model |  1753.25969     1  1753.25969           Prob > F      =  0.0000
    Residual |  294.703493   137  2.15112039           R-squared     =  0.8561
-------------+------------------------------           Adj R-squared =  0.8550
       Total |  2047.96318   138  14.8403129           Root MSE      =  1.4667

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.097336   .0734644    28.55   0.000     1.952065    2.242607
       _cons |  -.7317036    .533117    -1.37   0.172    -1.785906    .3224987
------------------------------------------------------------------------------


                           lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.359251      -2.937664
 5%    -1.741862      -2.359251
10%    -1.111977      -2.310665       Obs                 140
25%     .7411213      -2.290623       Sum of Wgt.         140

50%     2.699698                      Mean           2.407004
                        Largest       Std. Dev.      2.382209
```

```
75%      4.388035        6.073271
90%      5.353976        6.436381       Variance        5.674921
95%      5.699359        6.629952       Skewness       -.2845405
99%      6.629952        7.548481       Kurtosis        2.185189
```

Trimmed estimation sample

Data set 1

```
Generalized linear models                          No. of obs      =        131
Optimization     : ML: Newton-Raphson              Residual df     =        119
                                                   Scale parameter =   5.020962
Deviance         =  515.6098366                    (1/df) Deviance =   4.332856
Pearson          =   597.494431                    (1/df) Pearson  =   5.020962

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -968.2175343                AIC             =   14.96515
BIC                  =-64.53864482

------------------------------------------------------------------------------
             |               Robust
        fled |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0058853   .0804965    -0.07   0.942    -.1636556    .1518849
      gender |  -.7222114    .438874    -1.65   0.100    -1.582389    .1379659
    mumatbir |   .0975356    .046896     2.08   0.038     .0056212      .18945
      ghqscr |  -.1875272   .0817161    -2.29   0.022    -.3476879   -.0273666
     ethgrpc |  -1.452216   .9921442    -1.46   0.143    -3.396783    .4923505
       class |   .3129622   .1561064     2.00   0.045     .0069992    .6189253
    largefam |  -.0051233   .7500999    -0.01   0.995    -1.475292    1.465046
       ffscr |  -.1286253   .0586682    -2.19   0.028    -.2436129   -.0136377
     singpar |  -.5639791   .6553408    -0.86   0.389    -1.848423    .7204652
    pimpac00 |   .2302074   .1268229     1.82   0.069    -.0183609    .4787757
       readz |  -.7719307   .2295119    -3.36   0.001    -1.221766   -.3220956
       _cons |   7.779469   1.822125     4.27   0.000     4.208171    11.35077
------------------------------------------------------------------------------


    Correlation          0.012
    R-squared            0.000
    Root MSE          5023.892

. linktest

Iteration 1 : deviance =  5.15e+08

Residual df  =        128                               No. of obs =        131
Pearson X2   =  5.15e+08                                Deviance   =   5.15e+08
Dispersion   =   4025397                                Dispersion =    4025397

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1532.207   732.9067     2.09   0.039      82.0262    2982.388
      _hatsq |  -91.74214   56.01842    -1.64   0.104    -202.5842    19.09987
       _cons |  -4911.683   2344.909    -2.09   0.038    -9551.487   -271.8787
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)
```

Data set 2

```
Generalized linear models                          No. of obs      =        131
Optimization     : ML: Newton-Raphson              Residual df     =        119
                                                   Scale parameter =   4.729054
Deviance         =  493.6989374                    (1/df) Deviance =   4.148731
Pearson          =  562.7574042                    (1/df) Pearson  =   4.729054
```

Variance function: V(u) = u^2 [Gamma]
Link function : g(u) = ln(u) [Log]
Standard errors : Sandwich

Log pseudolikelihood = -957.2620847 AIC = 14.79789
BIC =-86.44954411

fled	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0170808	.0774146	-0.22	0.825	-.1688106	.1346491
gender	-.646435	.4320602	-1.50	0.135	-1.493257	.2003874
mumatbir	.0917987	.0408368	2.25	0.025	.01176	.1718373
ghqscr	-.1584867	.080185	-1.98	0.048	-.3156465	-.0013269
ethgrpc	-1.655913	.9579859	-1.73	0.084	-3.533531	.2217053
class	.2392652	.1539616	1.55	0.120	-.062494	.5410244
largefam	.4439536	.7006814	0.63	0.526	-.9293567	1.817264
ffscr	-.1321063	.0583609	-2.26	0.024	-.2464915	-.0177211
singpar	-.677624	.5644984	-1.20	0.230	-1.784021	.4287726
pimpac00	.1431024	.1168998	1.22	0.221	-.0860171	.3722218
readz	-.943997	.230079	-4.10	0.000	-1.394943	-.4930505
_cons	8.439574	1.837784	4.59	0.000	4.837584	12.04156

Correlation 0.072
R-squared 0.005
Root MSE 3567.326

. linktest

Iteration 1 : deviance = 5.10e+08

Residual df = 128 No. of obs = 131
Pearson X2 = 5.10e+08 Deviance = 5.10e+08
Dispersion = 3986717 Dispersion = 3986717

Gaussian (normal) distribution, identity link

fled	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	1226.562	773.7067	1.59	0.115	-304.3486	2757.473
_hatsq	-66.40175	60.99257	-1.09	0.278	-187.086	54.28247
_cons	-4012.445	2383.886	-1.68	0.095	-8729.37	704.4809

(Model is ordinary regression, use regress instead)

.

Data set 3

.

Generalized linear models No. of obs = 131
Optimization : ML: Newton-Raphson Residual df = 119
Scale parameter = 5.291852
Deviance = 523.1867598 (1/df) Deviance = 4.396527
Pearson = 629.7303672 (1/df) Pearson = 5.291852

Variance function: V(u) = u^2 [Gamma]
Link function : g(u) = ln(u) [Log]
Standard errors : Sandwich

Log pseudolikelihood = -972.0059959 AIC = 15.02299
BIC =-56.96172169

fled	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0032867	.0802936	-0.04	0.967	-.1606593	.1540859
gender	-.5324624	.4447821	-1.20	0.231	-1.404219	.3392944
mumatbir	.0911997	.0477523	1.91	0.056	-.0023931	.1847925
ghqscr	-.2085598	.0804825	-2.59	0.010	-.3663026	-.050817
ethgrpc	-1.138355	1.037535	-1.10	0.273	-3.171886	.8951766
class	.3197796	.159168	2.01	0.045	.007816	.6317431

largefam	.4235639	.7049367	0.60	0.548	-.9580866	1.805214
ffscr	-.1259235	.0653525	-1.93	0.054	-.2540121	.0021651
singpar	-1.06148	.5763516	-1.84	0.066	-2.191108	.0681488
pimpac00	.3288885	.1589484	2.07	0.039	.0173554	.6404216
readz	-.6369818	.2389774	-2.67	0.008	-1.105369	-.1685947
_cons	7.464288	1.965009	3.80	0.000	3.612941	11.31563

```
    Correlation         -0.000
    R-squared            0.000
    Root MSE          5992.218

. linktest

Iteration 1 : deviance =  5.19e+08

Residual df  =       128                          No. of obs =        131
Pearson X2   =  5.19e+08                          Deviance   =   5.19e+08
Dispersion   =   4058432                          Dispersion =    4058432

Gaussian (normal) distribution, identity link
```

fled	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	1371.235	681.59	2.01	0.046	22.5926	2719.877
_hatsq	-80.00521	51.68843	-1.55	0.124	-182.2796	22.26918
_cons	-4399.073	2210.559	-1.99	0.049	-8773.042	-25.1039

(Model is ordinary regression, use regress instead)

Data set 4

```
Generalized linear models                         No. of obs      =        131
Optimization     : ML: Newton-Raphson             Residual df     =        119
                                                  Scale parameter =   5.001074
Deviance         =  500.3417926                   (1/df) Deviance =   4.204553
Pearson          =  595.1277667                   (1/df) Pearson  =   5.001074

Variance function: V(u) = u^2                     [Gamma]
Link function    : g(u) = ln(u)                   [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -960.5835123               AIC             =    14.8486
BIC                  =-79.80668882
```

fled	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0150269	.0786252	-0.19	0.848	-.1691294	.1390755
gender	-.521205	.4431719	-1.18	0.240	-1.389806	.347396
mumatbir	.0951859	.0439447	2.17	0.030	.009056	.1813159
ghqscr	-.1687212	.0803398	-2.10	0.036	-.3261842	-.0112581
ethgrpc	-1.498371	.9976223	-1.50	0.133	-3.453675	.456933
class	.2195952	.1639929	1.34	0.181	-.1018251	.5410154
largefam	.6360041	.6932702	0.92	0.359	-.7227805	1.994789
ffscr	-.1319649	.06273	-2.10	0.035	-.2549133	-.0090164
singpar	-.9033691	.5499695	-1.64	0.100	-1.98129	.1745513
pimpac00	.2059965	.1365595	1.51	0.131	-.0616552	.4736483
readz	-.8815858	.2374114	-3.71	0.000	-1.346904	-.4162679
_cons	8.151372	1.934776	4.21	0.000	4.359281	11.94346

```
    Correlation          0.017
    R-squared            0.000
    Root MSE          6099.836

. linktest

Iteration 1 : deviance =  5.12e+08

Residual df  =       128                          No. of obs =        131
```

```
Pearson X2   =  5.12e+08                                Deviance    =  5.12e+08
Dispersion   =   3996437                                Dispersion =   3996437

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.       t    P>|t|      [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1249.321   665.2303     1.88   0.063     -66.95138    2565.592
      _hatsq |  -68.13568   51.03818    -1.33   0.184     -169.1234    32.85208
       _cons |  -4090.496   2123.431    -1.93   0.056     -8292.068    111.0749
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)
```

Data set 5

```
Generalized linear models                          No. of obs      =        131
Optimization      : ML: Newton-Raphson             Residual df     =        119
                                                   Scale parameter =   4.785696
Deviance          =  476.8007096                   (1/df) Deviance =   4.006729
Pearson           =  569.4978738                   (1/df) Pearson  =   4.785696

Variance function: V(u) = u^2                      [Gamma]
Link function     : g(u) = ln(u)                   [Log]
Standard errors   : Sandwich

Log pseudolikelihood = -948.8129708                AIC             =    14.6689
BIC                  =-103.3477718

------------------------------------------------------------------------------
             |               Robust
        fled |      Coef.   Std. Err.       z    P>|z|      [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0229911      .07842    -0.29   0.769     -.1766914    .1307092
      gender |  -.4403868     .446797    -0.99   0.324     -1.316093    .4353193
    mumatbir |   .0924465    .0397977     2.32   0.020      .0144444    .1704487
      ghqscr |  -.1380221    .0803047    -1.72   0.086     -.2954164    .0193722
     ethgrpc |  -1.654301    .9571205    -1.73   0.084     -3.530222    .2216213
       class |   .1425051    .1651498     0.86   0.388     -.1811825    .4661928
    largefam |   .9489754    .6817224     1.39   0.164      -.387176    2.285127
       ffscr |  -.1259081     .057335    -2.20   0.028     -.2382826   -.0135336
     singpar |  -.9142291    .5173554    -1.77   0.077     -1.928227    .0997688
    pimpac00 |   .1153861    .1156006     1.00   0.318     -.1111869     .341959
       readz |  -1.020022    .2191982    -4.65   0.000     -1.449642   -.5904012
       _cons |   8.471674    1.874133     4.52   0.000      4.798442    12.14491
------------------------------------------------------------------------------


    Correlation          0.150
    R-squared            0.022
    Root MSE          2739.257

. linktest

Iteration 1 : deviance =  5.05e+08

Residual df  =       128                                No. of obs =        131
Pearson X2   =  5.05e+08                                Deviance    =  5.05e+08
Dispersion   =   3946137                                Dispersion =   3946137

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
        fled |      Coef.   Std. Err.       t    P>|t|      [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   567.8727   762.6844     0.74   0.458     -941.2288    2076.974
      _hatsq |  -10.73941   62.15661    -0.17   0.863     -133.7269    112.2481
       _cons |  -2169.581   2272.698    -0.95   0.342     -6666.502     2327.34
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)
```

GLM (gamma) with log-link function: special education resources

Full estimation sample with Park test

Data set 1

```
Generalized linear models                          No. of obs      =        107
Optimization     : ML: Newton-Raphson              Residual df     =         95
                                                   Scale parameter =   5.695225
Deviance         =  370.9738052                    (1/df) Deviance =   3.904987
Pearson          =  541.0464071                    (1/df) Pearson  =   5.695225

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -895.0625541                AIC             =   16.95444
BIC                  =-72.94493409
```

speced	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.1444704	.0811658	1.78	0.075	-.0146117	.3035525
gender	.4074752	.465622	0.88	0.382	-.5051272	1.320078
mumatbir	.0955849	.0361044	2.65	0.008	.0248217	.1663482
ghqscr	.027996	.0648781	0.43	0.666	-.0991627	.1551547
ethgrpc	-2.013185	1.42823	-1.41	0.159	-4.812465	.7860951
class	-.1821163	.1144489	-1.59	0.112	-.406432	.0421994
largefam	-3.313045	.3657273	-9.06	0.000	-4.029857	-2.596232
ffscr	-.1668489	.0883826	-1.89	0.059	-.3400756	.0063777
singpar	-.3510105	.4908836	-0.72	0.475	-1.313125	.6111036
pimpac00	.1700037	.0821922	2.07	0.039	.00891	.3310974
readz	-1.260656	.1610704	-7.83	0.000	-1.576348	-.9449642
_cons	8.570414	3.900952	2.20	0.028	.9246887	16.21614

```
    Correlation          0.441
    R-squared            0.195
    Root MSE         14581.075

. linktest

Residual df  =        104                             No. of obs =        107
Pearson X2   =   1.29e+10                             Deviance   =   1.29e+10
Dispersion   =   1.24e+08                             Dispersion =   1.24e+08

Gaussian (normal) distribution, identity link
```

speced	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-9659.915	4540.761	-2.13	0.036	-18664.41	-655.4163
_hatsq	880.5957	303.2071	2.90	0.004	279.3246	1481.867
_cons	25799.22	16462.43	1.57	0.120	-6846.399	58444.84

(Model is ordinary regression, use regress instead)

Park test

```
      Source |       SS       df       MS              Number of obs =     107
-------------+------------------------------           F(  1,   105) =  151.23
       Model |  1821.88624     1  1821.88624           Prob > F      =  0.0000
    Residual |  1264.93572   105  12.0470068           R-squared     =  0.5902
-------------+------------------------------           Adj R-squared =  0.5863
       Total |  3086.82196   106  29.1209619           Root MSE      =  3.4709
```

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.387608	.194152	12.30	0.000	2.00264	2.772576
_cons	-3.511468	1.468784	-2.39	0.019	-6.423795	-.5991397

```
                                   lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.104532      -2.873703
 5%    -1.636175      -2.104532
10%    -1.052992      -1.959904       Obs                 107
25%     .2072594      -1.913281       Sum of Wgt.         107

50%     1.727736                      Mean           1.733522
                        Largest       Std. Dev.      2.114867
75%     3.041155       5.645607
90%     4.478195       5.900963       Variance       4.472662
95%     5.600211       6.324376       Skewness       .2246598
99%     6.324376        7.75971       Kurtosis       2.698437
```

Data set 2

```
Generalized linear models                          No. of obs      =        107
Optimization     : ML: Newton-Raphson              Residual df     =         95
                                                   Scale parameter =   5.585138
Deviance         =   366.848116                    (1/df) Deviance =   3.861559
Pearson          =  530.5881044                    (1/df) Pearson  =   5.585138

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -892.9997096                AIC             =   16.91588
BIC                  =-77.07062325
```

speced	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.1714627	.0834474	2.05	0.040	.0079087	.3350166
gender	.3900416	.4752976	0.82	0.412	-.5415246	1.321608
mumatbir	.1166323	.0397231	2.94	0.003	.0387764	.1944882
ghqscr	.0294205	.0686622	0.43	0.668	-.105155	.1639961
ethgrpc	-2.912558	1.590091	-1.83	0.067	-6.029079	.2039621
class	-.2122427	.1128622	-1.88	0.060	-.4334486	.0089632
largefam	-2.777146	.4305195	-6.45	0.000	-3.620948	-1.933343
ffscr	-.1454464	.1026873	-1.42	0.157	-.3467099	.055817
singpar	.0490821	.4873606	0.10	0.920	-.9061272	1.004291
pimpac00	.1348755	.0733122	1.84	0.066	-.0088137	.2785647
readz	-1.233736	.1542966	-8.00	0.000	-1.536152	-.9313203
_cons	8.060181	4.520486	1.78	0.075	-.7998076	16.92017

```
    Correlation          0.437
    R-squared            0.191
    Root MSE         13431.410

. linktest

Iteration 1 : deviance =  1.31e+10

Residual df  =        104                               No. of obs =        107
Pearson X2   =   1.31e+10                               Deviance   =   1.31e+10
Dispersion   =   1.26e+08                               Dispersion =   1.26e+08

Gaussian (normal) distribution, identity link
```

speced	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-9119.009	4793.056	-1.90	0.060	-18623.82	385.8009
_hatsq	850.4135	320.903	2.65	0.009	214.0507	1486.776
_cons	23715.43	17344.51	1.37	0.174	-10679.39	58110.24

```
(Model is ordinary regression, use regress instead)
```

.
.
.
Park test

Source	SS	df	MS
Model	1633.45612	1	1633.45612
Residual	1263.27952	105	12.0312335
Total	2896.73564	106	27.3276947

Number of obs	=	107
F(1, 105)	=	135.77
Prob > F	=	0.0000
R-squared	=	0.5639
Adj R-squared	=	0.5597
Root MSE	=	3.4686

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.31008	.1982569	11.65	0.000	1.916973	2.703186
_cons	-2.961912	1.494459	-1.98	0.050	-5.925148	.0013242

lscres

	Percentiles	Smallest		
1%	-2.043561	-2.804997		
5%	-1.718786	-2.043561		
10%	-1.146907	-2.020442	Obs	107
25%	.1700173	-1.921277	Sum of Wgt.	107
50%	1.853486		Mean	1.714243
		Largest	Std. Dev.	2.026696
75%	3.026435	5.346505		
90%	4.306331	6.001412	Variance	4.107498
95%	5.296626	6.2108	Skewness	.0456214
99%	6.2108	6.482461	Kurtosis	2.549337

.
.

Data set 3

.

```
Generalized linear models                         No. of obs      =        107
Optimization      : ML: Newton-Raphson            Residual df     =         95
                                                  Scale parameter =    6.31845
Deviance          =  390.9867526                  (1/df) Deviance =    4.11565
Pearson           =  600.2527614                  (1/df) Pearson  =    6.31845

Variance function: V(u) = u^2                     [Gamma]
Link function     : g(u) = ln(u)                  [Log]
Standard errors   : Sandwich

Log pseudolikelihood = -905.0690279               AIC             =   17.14148
BIC                  =-52.93198667
```

speced	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.0949647	.0809908	1.17	0.241	-.0637744	.2537038
gender	.1780225	.5132319	0.35	0.729	-.8278936	1.183939
mumatbir	.1037409	.039987	2.59	0.009	.0253678	.1821139
ghqscr	.0709827	.0614481	1.16	0.248	-.0494534	.1914189
ethgrpc	-1.539924	1.35464	-1.14	0.256	-4.194969	1.115122
class	-.1326866	.1205725	-1.10	0.271	-.3690043	.1036311
largefam	-3.375034	.4380885	-7.70	0.000	-4.233672	-2.516396
ffscr	-.2127514	.0840779	-2.53	0.011	-.3775411	-.0479617
singpar	-.4017477	.4956971	-0.81	0.418	-1.373296	.5698007
pimpac00	.1961669	.0826532	2.37	0.018	.0341696	.3581642
readz	-1.244288	.1641456	-7.58	0.000	-1.566008	-.922569
_cons	9.429871	3.800656	2.48	0.013	1.980723	16.87902

Correlation	0.405
R-squared	0.164
Root MSE	13899.538

```
. linktest

Iteration 1 : deviance =  1.35e+10

Residual df   =        104                             No. of obs =        107
Pearson X2    =   1.35e+10                             Deviance   =   1.35e+10
Dispersion    =   1.30e+08                             Dispersion =   1.30e+08

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
      speced |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -9602.249    5151.592    -1.86    0.065     -19818.05    613.5512
      _hatsq |    869.591    343.1341     2.53    0.013      189.1433    1550.039
       _cons |   25891.44     18763.4     1.38    0.171     -11317.09    63099.97
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)


Park test

      Source |       SS       df       MS                  Number of obs =     107
-------------+------------------------------               F(  1,    105) =  129.07
       Model |  1709.3355     1  1709.3355                 Prob > F      =  0.0000
    Residual | 1390.56724   105  13.2434975                R-squared     =  0.5514
-------------+------------------------------               Adj R-squared =  0.5471
       Total | 3099.90273   106  29.2443654                Root MSE      =  3.6392

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |   2.404531   .2116499    11.36    0.000      1.984869    2.824194
       _cons |  -3.777041   1.617337    -2.34    0.021     -6.983922   -.5701597
------------------------------------------------------------------------------


                            lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.147503      -2.945227
 5%    -1.610523      -2.147503
10%     -1.21174      -1.986134       Obs                 107
25%     .1408417      -1.775157       Sum of Wgt.         107

50%     2.205312                      Mean           1.827041
                        Largest       Std. Dev.      2.082996
75%     3.208972       5.629262
90%     4.493219       5.862659       Variance       4.338874
95%     5.297106       6.077029       Skewness      -.0502187
99%     6.077029        6.29403       Kurtosis       2.353377

.
```

Data set 4

```
.
Generalized linear models                          No. of obs      =       107
Optimization     : ML: Newton-Raphson              Residual df     =        95
                                                   Scale parameter =   5.69767
Deviance         =  359.2788746                    (1/df) Deviance =  3.781883
Pearson          =   541.278665                    (1/df) Pearson  =   5.69767

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -889.2150888                AIC             =  16.84514
BIC                  =-84.63986469

------------------------------------------------------------------------------
             |               Robust
      speced |      Coef.   Std. Err.       z     P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |    .125596   .0761043     1.65   0.099     -.0235656    .2747576
      gender |   .3942623   .4528831     0.87   0.384     -.4933722    1.281897
    mumatbir |   .1091652    .031458     3.47   0.001      .0475087    .1708217
      ghqscr |   .0351443   .0589721     0.60   0.551      -.080439    .1507276
```

```
     ethgrpc | -.3487021   .7390801    -0.47   0.637    -1.797272    1.099868
       class | -.1537053   .1086488    -1.41   0.157     -.366653    .0592424
    largefam | -3.087114   .3934333    -7.85   0.000    -3.858229   -2.315999
       ffscr | -.2031579   .0559314    -3.63   0.000    -.3127814   -.0935343
     singpar |  .1100202   .4601371     0.24   0.811    -.7918319    1.011872
    pimpac00 |   .090843   .0740412     1.23   0.220    -.0542752    .2359612
       readz | -1.273055   .1326042    -9.60   0.000    -1.532955   -1.013156
       _cons |  7.521339   2.246715     3.35   0.001     3.117859    11.92482
------------------------------------------------------------------------------

    Correlation         0.445
    R-squared           0.198
    Root MSE        15257.121

. linktest

Iteration 1 : deviance =  1.25e+10

Residual df  =       104                           No. of obs =       107
Pearson X2   =  1.25e+10                           Deviance   =  1.25e+10
Dispersion   =  1.20e+08                           Dispersion =  1.20e+08

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
      speced |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat | -9295.806   4374.914    -2.12   0.036    -17971.43   -620.1865
      _hatsq |  861.0624   290.2024     2.97   0.004     285.5801    1436.545
       _cons |  24385.39   15954.36     1.53   0.129    -7252.704    56023.49
------------------------------------------------------------------------------
Park test

      Source |       SS       df       MS              Number of obs =     107
-------------+------------------------------           F(  1,   105) =  140.44
       Model | 1807.91895     1  1807.91895            Prob > F      =  0.0000
    Residual | 1351.70009   105  12.8733342            R-squared     =  0.5722
-------------+------------------------------           Adj R-squared =  0.5681
       Total | 3159.61904   106  29.8077268            Root MSE      =  3.5879

------------------------------------------------------------------------------
       lnvar |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnyhat |  2.363498   .1994395    11.85   0.000     1.968046     2.75895
       _cons | -3.359408   1.498679    -2.24   0.027    -6.331011   -.3878047
------------------------------------------------------------------------------


                            lscres
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.939347      -2.905823
 5%    -1.663465      -1.939347
10%    -1.092964      -1.934617       Obs                 107
25%     .1333703      -1.928761       Sum of Wgt.         107

50%     1.606936                      Mean           1.678873
                        Largest       Std. Dev.      2.033922
75%     3.085516       5.234944
90%     4.441938        5.27436       Variance       4.136838
95%     4.991543       6.242092       Skewness       .0514812
99%     6.242092       6.491347       Kurtosis       2.329821
```

Data set 5

```
Generalized linear models                          No. of obs      =       107
Optimization     : ML: Newton-Raphson              Residual df     =        95
                                                   Scale parameter =   6.43244
Deviance         =  368.890728                     (1/df) Deviance =   3.88306
Pearson          = 611.0817833                     (1/df) Pearson  =   6.43244

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich
```

Log pseudolikelihood = -894.0210156 AIC = 16.93497
BIC =-75.02801126

speced	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.1401291	.0809673	1.73	0.084	-.0185639	.2988222
gender	.4470994	.4861177	0.92	0.358	-.5056738	1.399873
mumatbir	.0897647	.0376711	2.38	0.017	.0159306	.1635987
ghqscr	.0258742	.0658048	0.39	0.694	-.1031008	.1548491
ethgrpc	-1.907193	1.433479	-1.33	0.183	-4.71676	.9023736
class	-.1713594	.1108934	-1.55	0.122	-.3887065	.0459877
largefam	-3.354826	.4598546	-7.30	0.000	-4.256125	-2.453528
ffscr	-.1675704	.0918022	-1.83	0.068	-.3474994	.0123585
singpar	-.2998361	.4931547	-0.61	0.543	-1.266402	.6667294
pimpac00	.1834978	.0691039	2.66	0.008	.0480566	.318939
readz	-1.222068	.1533211	-7.97	0.000	-1.522572	-.921564
_cons	8.639718	4.045907	2.14	0.033	.7098852	16.56955

Correlation	0.429
R-squared	0.184
Root MSE	19613.498

. linktest

Iteration 1 : deviance = 1.24e+10

Residual df	= 104		No. of obs =	107
Pearson X2	= 1.24e+10		Deviance =	1.24e+10
Dispersion	= 1.20e+08		Dispersion =	1.20e+08

Gaussian (normal) distribution, identity link

speced	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-9487.797	4428.678	-2.14	0.034	-18270.03	-705.5616
_hatsq	863.1319	289.814	2.98	0.004	288.4199	1437.844
_cons	25542.08	16374.1	1.56	0.122	-6928.378	58012.54

(Model is ordinary regression, use regress instead)

.
Park test

Source	SS	df	MS		
				Number of obs =	107
				F(1, 105) =	141.55
Model	1871.21339	1	1871.21339	Prob > F =	0.0000
Residual	1388.02069	105	13.2192447	R-squared =	0.5741
				Adj R-squared =	0.5701
Total	3259.23409	106	30.7474914	Root MSE =	3.6358

lnvar	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyhat	2.410257	.2025839	11.90	0.000	2.00857	2.811943
_cons	-3.800367	1.530967	-2.48	0.015	-6.835993	-.7647412

lscres

	Percentiles	Smallest		
1%	-2.100412	-2.9474		
5%	-1.628693	-2.100412		
10%	-.9720821	-1.993048	Obs	107
25%	.2623258	-1.980122	Sum of Wgt.	107
50%	1.772101		Mean	1.723788
		Largest	Std. Dev.	2.007217
75%	3.087678	5.647025		
90%	4.452529	5.648638	Variance	4.028921
95%	5.130645	5.694739	Skewness	-.0054011
99%	5.694739	6.317863	Kurtosis	2.475919

Trimmed estimation sample

Data set 1

```
Generalized linear models                          No. of obs      =        97
Optimization     : ML: Newton-Raphson              Residual df     =        85
                                                   Scale parameter =  3.145357
Deviance         =  239.8051688                    (1/df) Deviance =  2.821237
Pearson          =  267.3553041                    (1/df) Pearson  =  3.145357

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -753.4783614                AIC             =  15.78306
BIC                  =-149.0452644

------------------------------------------------------------------------------
             |               Robust
      speced |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0006227   .0578739     0.01   0.991     -.112808    .1140534
      gender |   .8441737   .3291696     2.56   0.010     .1990131    1.489334
       class |   .0009766   .1135593     0.01   0.993    -.2215956    .2235487
    mumatbir |   .0500078   .0272836     1.83   0.067    -.0034671    .1034828
      ghqscr |   .1030744   .0590134     1.75   0.081    -.0125898    .2187386
     ethgrpc |  -1.012392   .9913089    -1.02   0.307    -2.955322    .9305378
    largefam |  -3.380206   .3841295    -8.80   0.000    -4.133086   -2.627327
       ffscr |  -.1331223   .0693349    -1.92   0.055    -.2690163    .0027716
     singpar |  -.3098651   .4453029    -0.70   0.487    -1.182643    .5629125
    pimpac00 |   .2558736   .0681442     3.75   0.000     .1223134    .3894338
       readz |  -1.060322   .1329639    -7.97   0.000    -1.320926   -.7997177
       _cons |   7.850136   2.578148     3.04   0.002     2.797058    12.90321
------------------------------------------------------------------------------


    Correlation          0.541
    R-squared            0.293
    Root MSE          6164.476

. linktest

Iteration 1 : deviance =  3.00e+09

Residual df  =        94                                No. of obs =        97
Pearson X2   =  3.00e+09                                Deviance   =  3.00e+09
Dispersion   =  3.20e+07                                Dispersion =  3.20e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
      speced |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -7555.137   2881.816    -2.62   0.010    -13277.05   -1833.223
      _hatsq |   715.7844   210.2079     3.41   0.001     298.4117    1133.157
       _cons |   19406.56   9534.042     2.04   0.045     476.4958    38336.63
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)
```

Data set 2

```
Generalized linear models                          No. of obs      =        97
Optimization     : ML: Newton-Raphson              Residual df     =        85
                                                   Scale parameter =  3.503387
Deviance         =  243.6691569                    (1/df) Deviance =  2.866696
Pearson          =  297.7878828                    (1/df) Pearson  =  3.503387

Variance function: V(u) = u^2                      [Gamma]
```

```
Link function     : g(u) = ln(u)                      [Log]
Standard errors   : Sandwich

Log pseudolikelihood = -755.4103555                   AIC             =  15.82289
BIC                  =-145.1812762

------------------------------------------------------------------------------
             |               Robust
      speced |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |    .028506   .0619929     0.46   0.646    -.0929978    .1500098
      gender |   .8089879   .3435401     2.35   0.019     .1356617    1.482314
       class |  -.0236109   .1171092    -0.20   0.840    -.2531406    .2059189
    mumatbir |   .0595517   .0294519     2.02   0.043      .001827    .1172763
      ghqscr |   .1096823   .0637533     1.72   0.085    -.0152719    .2346365
     ethgrpc |  -1.677521    1.13478    -1.48   0.139    -3.901649    .5466082
    largefam |  -3.069073   .4604789    -6.66   0.000    -3.971595   -2.166551
       ffscr |  -.1249758   .0757137    -1.65   0.099     -.273372    .0234205
     singpar |  -.1646661    .428162    -0.38   0.701    -1.003848    .6745161
    pimpac00 |   .2621618   .0654029     4.01   0.000     .1339745     .390349
       readz |  -1.039756   .1408345    -7.38   0.000    -1.315786   -.7637251
       _cons |   7.735963   2.894349     2.67   0.008     2.063143    13.40878
------------------------------------------------------------------------------

. glmcorr

    speced and predicted

    Correlation          0.463
    R-squared            0.214
    Root MSE          6629.815

. linktest

Iteration 1 : deviance =  3.20e+09

Residual df  =        94                                 No. of obs =        97
Pearson X2   =  3.20e+09                                 Deviance   =  3.20e+09
Dispersion   =  3.40e+07                                 Dispersion =  3.40e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
      speced |      Coef.   Std. Err.       t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |  -5462.083   3019.868    -1.81   0.074     -11458.1    533.9362
      _hatsq |   551.4102     217.41     2.54   0.013     119.7375    983.0828
       _cons |   13141.83   10121.99     1.30   0.197    -6955.624    33239.28
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

.
.
```

Data set 3

```
.

Generalized linear models                          No. of obs      =        97
Optimization     : ML: Newton-Raphson              Residual df     =        85
                                                   Scale parameter =  3.245862
Deviance         =  246.0821479                    (1/df) Deviance =  2.895084
Pearson          =  275.8982354                    (1/df) Pearson  =  3.245862

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood =  -756.616851                AIC             =  15.84777
BIC                  =-142.7682852

------------------------------------------------------------------------------
             |               Robust
      speced |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0371038   .0568619    -0.65   0.514    -.1485511    .0743434
      gender |   .6733289   .3407108     1.98   0.048     .0055479     1.34111
       class |   .0032015   .1186266     0.03   0.978    -.2293025    .2357054
    mumatbir |   .0419569   .0288341     1.46   0.146    -.0145569    .0984707
```

```
     ghqscr |   .1154686   .0600041     1.92   0.054    -.0021373    .2330744
    ethgrpc |   -.756199   .8748857    -0.86   0.387    -2.470944    .9585455
   largefam |  -3.474748   .4339396    -8.01   0.000    -4.325254   -2.624242
      ffscr |  -.1666006   .0611028    -2.73   0.006    -.2863599   -.0468413
    singpar |  -.0729447   .4356107    -0.17   0.867    -.9267261    .7808366
   pimpac00 |   .2732932   .0643967     4.24   0.000      .147078    .3995085
      readz |  -1.083398   .1361937    -7.95   0.000    -1.350332   -.8164629
      _cons |   9.012145    2.34559     3.84   0.000     4.414874    13.60942
------------------------------------------------------------------------------


   Correlation         0.497
   R-squared           0.247
   Root MSE         6430.910

. linktest

Iteration 1 : deviance =  3.07e+09

Residual df  =        94                             No. of obs =          97
Pearson X2   =  3.07e+09                             Deviance   =    3.07e+09
Dispersion   =  3.27e+07                             Dispersion =    3.27e+07

Gaussian (normal) distribution, identity link
------------------------------------------------------------------------------
     speced |      Coef.   Std. Err.       t     P>|t|      [95% Conf. Interval]
------------+-----------------------------------------------------------------
       _hat |  -6966.901   2944.096    -2.37   0.020    -12812.47   -1121.329
     _hatsq |   670.0687   213.4145     3.14   0.002     246.3292    1093.808
      _cons |   17624.73   9826.818     1.79   0.076     -1886.65    37136.11
------------------------------------------------------------------------------
(Model is ordinary regression, use regress instead)

.
.
```

Data set 4

```
.
Generalized linear models                          No. of obs      =        97
Optimization     : ML: Newton-Raphson              Residual df     =        85
                                                   Scale parameter =  3.041892
Deviance         =  234.6241671                    (1/df) Deviance =  2.760284
Pearson          =  258.5608538                    (1/df) Pearson  =  3.041892

Variance function: V(u) = u^2                      [Gamma]
Link function    : g(u) = ln(u)                    [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -750.8878606                AIC             =  15.72965
BIC                  =-154.2262661

------------------------------------------------------------------------------
            |               Robust
     speced |      Coef.   Std. Err.       z     P>|z|      [95% Conf. Interval]
------------+-----------------------------------------------------------------
        age |  -.0177711   .0556051    -0.32   0.749    -.1267552    .0912129
     gender |   .8483244   .3275764     2.59   0.010     .2062866    1.490362
      class |    .000728   .1047576     0.01   0.994    -.2045932    .2060492
   mumatbir |   .0671254   .0268023     2.50   0.012     .0145938     .119657
     ghqscr |   .1011323   .0565866     1.79   0.074    -.0097753    .2120399
    ethgrpc |   -.082545   .5932468    -0.14   0.889    -1.245287    1.080197
   largefam |  -3.211125   .3942533    -8.14   0.000    -3.983847   -2.438403
      ffscr |   -.187838   .0487729    -3.85   0.000    -.2834311   -.0922449
    singpar |   .1003456   .4070923     0.25   0.805    -.6975406    .8982319
   pimpac00 |    .196839   .0671634     2.93   0.003     .0652012    .3284768
      readz |  -1.089234    .127398    -8.55   0.000     -1.33893   -.8395387
      _cons |   7.967824   1.561729     5.10   0.000     4.906891    11.02876
------------------------------------------------------------------------------


   Correlation         0.500
   R-squared           0.250
   Root MSE         6639.231

. linktest

Iteration 1 : deviance =  3.11e+09
```

```
Residual df  =         94                           No. of obs =        97
Pearson X2   =   3.11e+09                           Deviance   =  3.11e+09
Dispersion   =   3.30e+07                           Dispersion =  3.30e+07

Gaussian (normal) distribution, identity link
```

speced	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-5591.955	2870.012	-1.95	0.054	-11290.43	106.5201
_hatsq	555.3577	205.2614	2.71	0.008	147.8064	962.9089
_cons	13797.59	9631.195	1.43	0.155	-5325.373	32920.55

(Model is ordinary regression, use regress instead)

.
.

Data set 5

.

```
Generalized linear models                         No. of obs      =        97
Optimization     : ML: Newton-Raphson             Residual df     =        85
                                                  Scale parameter =  3.236557
Deviance         =  248.6612785                   (1/df) Deviance =  2.925427
Pearson          =  275.1073378                   (1/df) Pearson  =  3.236557

Variance function: V(u) = u^2                     [Gamma]
Link function    : g(u) = ln(u)                   [Log]
Standard errors  : Sandwich

Log pseudolikelihood = -757.9064163               AIC             =  15.87436
BIC                  =-140.1891547
```

speced	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.01766	.0607465	-0.29	0.771	-.136721	.1014009
gender	.6808684	.3454752	1.97	0.049	.0037495	1.357987
class	-.0398022	.1174164	-0.34	0.735	-.2699342	.1903298
mumatbir	.0463363	.0286584	1.62	0.106	-.0098331	.1025057
ghqscr	.1013659	.0608686	1.67	0.096	-.0179343	.2206662
ethgrpc	-1.182665	1.013527	-1.17	0.243	-3.169141	.8038109
largefam	-3.437275	.446247	-7.70	0.000	-4.311904	-2.562647
ffscr	-.1593345	.067232	-2.37	0.018	-.2911068	-.0275622
singpar	-.1855356	.420513	-0.44	0.659	-1.009726	.6386548
pimpac00	.2952203	.0638451	4.62	0.000	.1700862	.4203544
readz	-1.048541	.1346196	-7.79	0.000	-1.312391	-.7846914
_cons	9.164524	2.636304	3.48	0.001	3.997464	14.33158

```
   Correlation          0.343
   R-squared            0.118
   Root MSE          7871.030

. linktest

Iteration 1 : deviance =  3.40e+09

Residual df  =         94                           No. of obs =        97
Pearson X2   =   3.40e+09                           Deviance   =  3.40e+09
Dispersion   =   3.61e+07                           Dispersion =  3.61e+07

Gaussian (normal) distribution, identity link
```

speced	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-3331.858	2917.538	-1.14	0.256	-9124.699	2460.983
_hatsq	382.2474	208.5341	1.83	0.070	-31.80195	796.2967
_cons	6782.371	9829.308	0.69	0.492	-12733.95	26298.69

(Model is ordinary regression, use regress instead)