

maternal employment and child outcomes

Analysis of two Birth Cohort Studies

By Heather Joshi and Georgia Verropoulou

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Summary

This report is about the long-term consequences for children of their mother going out to work. The main study concerns 1,700 school-children whose mothers were part of the 1958 birth cohort study (NCDS) of everyone born in a week in March 1958. These children were aged 5-17 at an interview in 1991, when they were assessed for reading, maths, and behavioural adjustment. The research project looked for relationships between these outcomes and the employment of their mothers, adjusting for other family circumstances. The results were mixed.

- Employment of the mother in the first year of a child's life tends to go with poorer outcomes later on, but only for reading is this statistically significant.
- There are (small) positive associations with mother's employment at later stages, most significant for the score rating freedom from worry and unhappiness, possibly reflecting social skills in that child.
- Poor economic circumstances in the home, and mother's own academic ability and attainments, were more important predictors of the child's academic (and aggression) scores than mother's employment.
- Children in families with no earner, other things being equal, scored more poorly on both maths and anxiety scores, than those in families with at least one earner.

A supplementary analysis looked at 9000 young people born in 1970, where there were also just half of the mothers with some employment when they had been under five.

- This employment was negatively related to the children's eventual level of qualifications, but not by very much. It was not at all related to substantial unemployment between school leaving and age 26, neither to the chances of a girl becoming a teenage mother, nor to test scores in reading and maths conducted at age 10.
- There is a lot of variability in how children turn out, even on the measures used here, over and above that which is related systematically to the predictors we have looked at. Maternal employment is only one of these, and not the most important.

Policy makers should note a risk that later child development may be impaired when mothers go out to work early in their lives, especially during their infancy, but also that there are some benefits to be gained (in emotional adjustment) where mothers have paid work during later pre-school years. Neither good nor bad effects are very great. This adds to the case for allowing mothers (and fathers) more choice about when to work while their children are very young, and to the case for ensuring a high standard of day care. Longer maternity leave would be more effective in providing such choice if complemented by longer (and better) payment than the current statutory 18 weeks, and by more flexible employment practices for parents with young children.

1: Introduction

Mothers are increasingly combining their family responsibilities with paid work. Are children better or worse off? Does it make a difference how young the child is when the mother takes paid work - or if her job is full or part-time? Are there effects on the child beyond the immediate impact of early employment? These questions are not usually posed about fathers, because their employment is generally regarded as normal and beneficial to family life. It brings in money, and offers a role model, though some see long work hours as a problem (Creighton, 1999, Hewitt, 1993). People are more ambivalent about mothers. The majority of adults in the 1994 British Social Attitudes Survey agreed that 'children suffer if mothers of pre-school children go out to work' (Scott, 1999). This attitude was most firmly endorsed by men, and then by women without jobs, but almost half the women in jobs also still agreed.

This is an issue on which strong views are held. These may be more related to views about the role of women in the home and the workplace, than to what children actually experience. So far, little evidence has been taken from the children. This report offers an account of what becomes of children whose mothers did, and did not, have paid work when they were young, based on two of the National Birth Cohort Studies. This study is about children, the question of how women fare is the subject of many others, see Dex and Joshi (1999) and Rake (ed) (2000).

A mother's employment might be thought to affect the child's development in a variety of ways. It could be harmful if it deprives the child of the mother's nurturing time and energy, particularly when the child is very young. On the other hand, it could be directly beneficial through the provision of a positive role model, and indirectly help the child's upbringing through the extra cash resources it brings in to the family. Evidence on the association of child outcomes with mother's employment is difficult to interpret, partly because effects may be operating in both directions - the child's

development affecting the mother's employment, as well as vice versa. Interpretation is also complicated because a number of other factors may come into play - the quality of alternative child-care, and the competence of the mother at managing multiple roles, the involvement of the father or other family members in childrearing, the flexibility of the workplace, and the child's own personality and adaptability - and these may not all be measured. If mothers drop out of jobs when their children fail to settle in alternative care, only the successful arrangements will be observed. There is also the possibility that the more competent or healthy mothers will be 'selected into' observed employment. If they are successful in holding down a 'double burden' this does not necessarily prove that other mothers and children will be equally well suited. Especially where the quality of alternative care, or the personal qualities of the mother, are not observed, one must remain cautious about the interpretation of associations between child development and mother's employment as 'effects'. Where one can look, prospectively, at child outcomes at a later date than the mother's employment, the possibility of reverse causation is not eliminated, but is weaker. Longitudinal evidence makes this possible, and is used here.

Literature review

Our research on what happens in and after school years must be prefaced by how what happens within the family during infancy is believed to affect babies. The paediatric and psychological literature suggests small babies (tend to) suffer 'attachment problems' when they are removed from their mother for long periods. (Belsky and Cassidy, 1994). Bonding between mothers and infants, breast feeding, and, perhaps, brain development is impeded. It is not clear how long the mother's specific input is necessary (Kraemer and Roberts, 1996). Children also benefit from bonding with their fathers (Lamb 1981, Kraemer 1995).

Attempts to detect an impact of mothers' employment

on children's development in large scale survey data have not been very conclusive. In North America, researchers have tended to find adverse associations between employment begun in the first year of a child's life, rather than after age 1, when there is not much association either way. This applies to both cognitive development and behavioural adjustment (Baydar and Brooks-Gunn 1991, Blau and Grossberg 1992, Lefebvre and Merrigan 1998, among others). Desai et al (1989) found a negative impact on boys' reading of mother's employment, allowing for beneficial contributions of high income. There are indications that the quality of day care and the intensity (hours) of employment also matter. The NICHD Early Child Care Research Network (1998, 1999 and forthcoming) has looked for effects of early daycare (especially in the first year of life) on several child outcomes during subsequent pre-school years (up to 3). These outcomes are self-control, compliance and problem behaviour; the mother's sensitivity to the child and the child's engagement with the mother; and a battery of language tests. The study has unusually good information on the quality of care, which appears to be a better predictor of language development than maternal employment. The relationships with behavioural outcomes are complex, some appear to be negative, though, arguably, not large. Belsky and Eggebeen (1991) found a significant negative effect on the behaviour of children aged 4-6 of mothers' working full-time in the first two years of a child's life. Belsky (1999) and Hoffman and Youngblade (1999) report an association between early daycare, and externalising behaviour among boys. Belsky suggests there may be negative synergy between the quality of much US daycare and the stresses experienced by working parents. Han, Waldfogel and Brooks-Gunn (1999) have recently analysed data on children of the National Longitudinal Survey of Youth, aged 3-4 in 1986, 5-6 in 1988 and 7-8 in 1990, which found negative effects of maternal employment in the child's first year on cognitive scores - reading, vocabulary and maths - at 3-4, reduced at 7-8. They also found negative outcomes in behaviour, significant only at age 7-8, for whites only, where the mother had been employed in the first three months of

the child's life. The timing of employment in the first year appeared to matter (as in Baydar and Brooks-Gunn 1991), but not whether the employment was full or part-time. An extensive bibliography of North American literature on effects on children of mothers' employment and family poverty is attached in the Appendix to this chapter.

Turning to British evidence on somewhat older children, we note a local study in East London by O'Brien and Jones (1999). Teenagers, interviewed a year or two before sitting their GCSE exams, showed the best chances of getting high results in these exams if they came from families where the mother had a part-time job. Dual-earner families with a mother in full-time work also did better than single-earner two-parent families, other things being equal. Any employment of the mother also appeared to protect against getting the lowest marks, with less difference between full-timers and part-timers. According to the children, the time they spent with their mother was greatest where she worked part-time, and about the same in the sole and dual full-time earner couples. Among other significant predictors of exam achievement were home ownership, the child's own aspirations to go on to further education, and the mother's propensity to praise.

Kiernan (1996) also uses British data, on young adults born in 1958 - the National Child Development Study (NCDS) - to relate their achievements to the employment of the mother at 16. The main association was a positive one for girls with a lone mother. Their qualifications were higher, and their chances of early childbearing lower, if their mother was in employment when they were 16. The interpretation offered was that this reflects a positive role model.

Ermisch and Francesconi (1998 and forthcoming) use young people of a similar age (16-27) drawn from the British Household Panel Study (BHPS), and born between 1970 and 1981, with data on both parents' employment going back to the child's birth. Some negative effect of early (child 5 or under) maternal

employment on educational attainment is reported, particularly if the employment was full-time, and particularly if they control for unobserved qualities of the woman which may be correlated with her labour force participation. They do this by using sibling pairs. Associations with other outcomes appear more beneficial - less economic inactivity, less chance of heavy smoking, fewer symptoms of psychological distress, and (generally) lower chances of early motherhood. No significant associations were found for fathers' employment and their offspring's outcomes. In an analysis of 18 year olds in a New Zealand birth cohort study, Horwood and Fergusson (1999) found that a positive association between academic attainment and mother's employment was accounted for by the inclusion of additional information about the family: socio-economic status, maternal education, child IQ and early mother-child interaction.

Most of these studies, on either side of the Atlantic, bring out the importance of family cash resources for the successful cognitive development (see for example Duncan and Brooks-Gunn 1997). The work of Gregg et al (1999) on the generation born in 1958 (NCDS) shows a consistent negative influence on staying on at school and obtaining educational qualifications of growing up in a family which had experienced financial difficulties. They have also found the negative relationship of family financial difficulties in the first generation persists into the second generation, when they look at the reading and maths test score of children aged 6-9, whose parents were members of the 1958 cohort.

McCulloch and Joshi (1999) investigated the children in this second generation sample who were aged 5-17 in 1991. The primary focus was on the effect of income and other measures of family resources on one test - vocabulary. Besides income, the analysis controlled for whether there were one or two parents present and whether, at that time (ie when the children were of school age) either one had a paid job. Apart from its effect via income, the unemployment of the father appeared to make no significant difference compared

with two-parent families with a father in employment. Neither, on the whole, did the mother's employment. Income was more strongly related to the child's test score than the number of parents and their employment, but indicators of long-term poverty (social housing, no car) out-performed income itself as predicting underachievement in children. Emotionally supportive parenting made a positive difference, whatever the family's economic situation.

Objectives of this Research

The link between children's welfare and mother's employment cannot be made in isolation from other relevant issues. One is what happens to the children while the mother is at her job. Who else is taking what sort of care of them, where, and with what other children? Another issue is how far children benefit from the money brought into the family by the mother as well as the father. The third issue is of the ways in which children may suffer, or gain, at what age, from the very fact of having an employed mother. They may be affected not only from separation but from the mother's state of mind when she is with them. While the first relationship is assumed to be detrimental, at least in the short-run, it is not clear that employment necessarily has a bad effect on the mother's parenting capacity when she is present. With our data we cannot answer the important question about alternative care and its quality, but we did address the second and third questions in our analyses.

Our aim is, first, to examine the relationship between mother's employment in the early years of a child's life and several children's outcomes in two sets of survey data. One is a sample of school age children whose mothers' employment can be traced back to their birth, and the other a sample of young people followed from birth up to age 26. In the first sample, the outcomes are maths and reading (cognitive) and aggression and anxiety (behavioural). In the second, we look at maths and reading scores at 10, teenage motherhood and unemployment after leaving school, and qualifications attained. In all cases, we make an attempt to control for

other relevant factors which may account for, or obscure, the association of interest.

Ultimately, the objective is to inform policy makers, public opinion and parents of young children, on whether particular paths of parental employment are likely to have good or bad consequences, for those aspects of child development we can measure.

Plan of the Report

The next chapter introduces the two sources of our data, the Second Generation of the 1958 Birth Cohort Study

(NCDS) and 1970 Birth Cohort themselves (BCS70). It describes the studies and the particular variables used in this report. Further details are given in the Appendix to Chapter 2. Chapter 3 sets out briefly the methods we have used to look for relationships in the statistics, with more technical information on multi-level modelling in its appendix. The results of the analysis of children whose mothers were born in 1958 is given in Chapter 4, and those for members of the 1970 cohort in Chapter 5. Full details tables of regression results for these two chapters are to be found in their respective appendices. Chapter 6 discusses our conclusions.

2: The Data

The Second Generation of NCDS

The NCDS is a study of over 17,000 people in Britain, born in one week in 1958 (see Ferri, 1993). Follow-up sweeps took place in 1965, 1969, 1974, 1981 and 1991. When respondents were age 33, information was additionally obtained on the children of 1 in 3 cohort members. The main evidence in this report comes from these children, those with mothers born in 1958. The NCDS sweep in 1991 relates several indicators of child development to indicators of the mother's employment. This is unique in that it can relate the child's progress at later ages to the mother's employment in early life. The child's progress is assessed in terms of relatively few quantified indicators, which cover several, but inevitably not all, domains of life. Another unfortunate limitation is that we do not have complete evidence about the type and quality of the care that was provided to the children we study, though much of it was likely to be informal. We do have some data on the level of family prosperity, and a set of measures on the mother's own academic abilities, which might be suspected of causing a spurious relationship between the child's attainments and the mother's employment.

For the purposes of this analysis, we restrict our sample to children aged 5-17 in 1991, old enough to participate in the relevant tests, and who had a mother who was an NCDS cohort member. We do not use the smaller number of children whose fathers were the cohort member because we do not have enough information on the mother's employment history. These sample restrictions leave us with a total of 1730 children of 1136 mothers. The average age of the children in our sample is 9, and there are fewer teenagers than children of primary school age. They are evenly divided between girls and boys, 35% are first-born and 61% have a sibling old enough to be in the sample.

Dependent Variables (NCDS)

We analyse four measures of children's cognitive and behavioural development. Cognitive development is

measured by two sub-scales of the Peabody Individual Achievement Test (PIAT, Dunn and Markwardt, 1970). The reading recognition sub-scale measures ability in oral reading, the mathematics score assesses ability in mathematics as taught in mainstream education. Instead of standardising the test scores for the influence of age linear and quadratic age terms are included as covariates in all models.

To assess children's emotional adjustment, we include data from both the Behavior Problems Index - BPI (Peterson & Zill, 1986), and the Rutter A Scale (Rutter, Tizard, & Whitmore, 1970). The 28-item BPI was asked of children under 8 years of age, while the 18-item Rutter Scale was asked of older children. For each scale, the mother was asked if her child exhibited various elements of antisocial, anxious, headstrong, hyperactive or dependent behaviour. (It has been suggested that the mother's own well-being may influence these reports. However, in the NCDS, for example, a measure of mother's mental well being (malaise) correlated only very weakly (0.03) with reports of child adjustment.) The scales have been subdivided and labelled as non-aggressive (externalised) and non-anxious (internalised) behaviour, using exploratory factor analysis (McCulloch et al., forthcoming). Aggressive items include bullying, disobedience and restlessness. Anxiety is indicated among other things by reports of the child as worried or unhappy. Details can be found in the Appendix to this chapter, Table A2.1.

The four 'outcome' variables, measuring children's academic progress and behavioural adjustment, are measured as percentages of the maximum score it would be possible to get. The average score for reading and maths is around the half-way mark, and the average score for both measures of behavioural adjustment is close to 70%. 'Bad' behaviour scores low and a lack of any reported problems scores high, which is closer to the average experience. (For all these scores there is a standard deviation of around half the mean).

Descriptives for these and all other variables included in our analyses are presented in Table A2.2 in the Appendix to this chapter.

Explanatory Variables (NCDS)

First we must allow for the fact that we don't expect children of different ages to achieve the same scores, particularly in reading and maths. We do this by entering age of child and its square in all regressions, rather than making a separate age adjustment to the scores (following Wiggins & Wale, 1996). Note that the age squared term has been divided by 100, to avoid reporting too many zeros after the decimal point in the estimated coefficient. It has also to be noted that the age of the child also contains information about the age of the mother at the time of the child's birth. This is inevitable with samples of children based on a birth cohort. The child's sex is included to allow for differences in biological nature or gendered nurture affecting the scores.

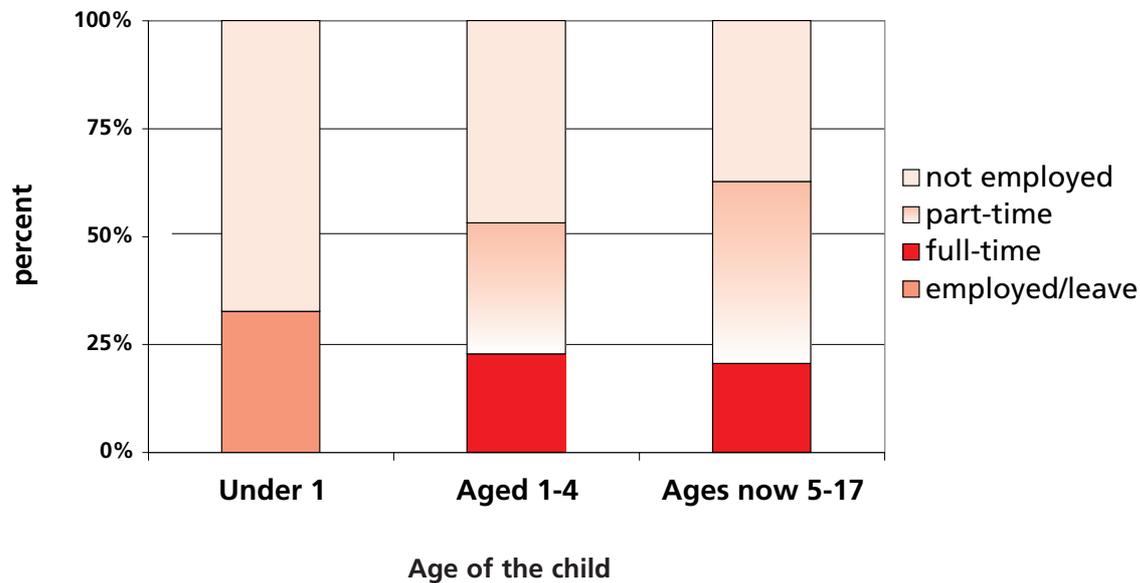
The information on the mother's employment at various past ages of each child has been inferred from the retrospective job history, which cohort members filled in themselves in 1991. Since they were not explicitly asked to relate their job history to their children's ages, we have to rely on complete, and consistent and correct dates being reported. The quality of these reports were not always precise enough to attribute an employment state to every month on the calendar. Under these circumstances, we use indicators of whether or not there was any employment in a period, rather than counting the exact number of months the women had been in paid work. For 17 percent of children's first year of life, there was insufficient evidence to assign an employment status to the mother (at least 6 months unknown and no definite record of a job at all). For the period between first and fifth birthdays the percentage unknown was 14. We do not attempt to measure how much time the labour market took the mother out of contact with her child, just whether or not she had any contact with the labour market. Of course the amount of time that mothers' spend in the labour market is not necessarily all diverted from attention to the child. Employed mothers also forgo leisure.

Of the children with known data in our sample, one third had mothers who were in employment during the first year of their lives (see Figure 2.1). Another limitation to our work history data for these particular years, is that we do not know whether women who were on maternity leave reported themselves as being in employment or not. Technically, those who are on leave have an employment contract, and may have considered the period as one of unbroken employment, others may have perceived themselves as taking a break, and reported accordingly. There was no explicit instruction about this. We presume that the 17% 'employed throughout' had maternity leave for some of that time. The 16% who reported a mix of months in and out of employment, in the first 12 months of their child's life, could have been on leave, but not necessarily. Not all employees would have been eligible. Those who were could have exercised a statutory right to return up to seven months after the birth, some employers had more generous schemes. These births occurred between 1974 and 1986, a period when the provision and practice of maternity leave was spreading rapidly (Callender et al 1997). Because of the uncertainty about leave during the first year, we did not attempt to distinguish between full-time and part-time jobs at this juncture.

Over the period between the child's first and fifth birthdays, the proportion of known cases with any employment rose to 53%, (30% only part-time, 23% full-time at some point); while the child was 1-2 the employment rate was 41%; and while the child was aged 3 and 4 it was 51%. On the whole, once mothers had been in paid work in one period, they stayed in at the next. Over the whole period from birth to 5th birthday, the proportion of mothers with some employment is 57%. By 1991, when all these children are at various ages over 5, the employment propensities of the mothers at the time of interview has again risen to 62%, two-thirds of which is part-time.

By the time of the interview, 12% of these children were living with a lone mother, 14% in a two parent family with a step father, and nearly three quarters (74%) with

Figure 2.1: Mother's employment at different ages of child. *NCDS 2nd Generation*

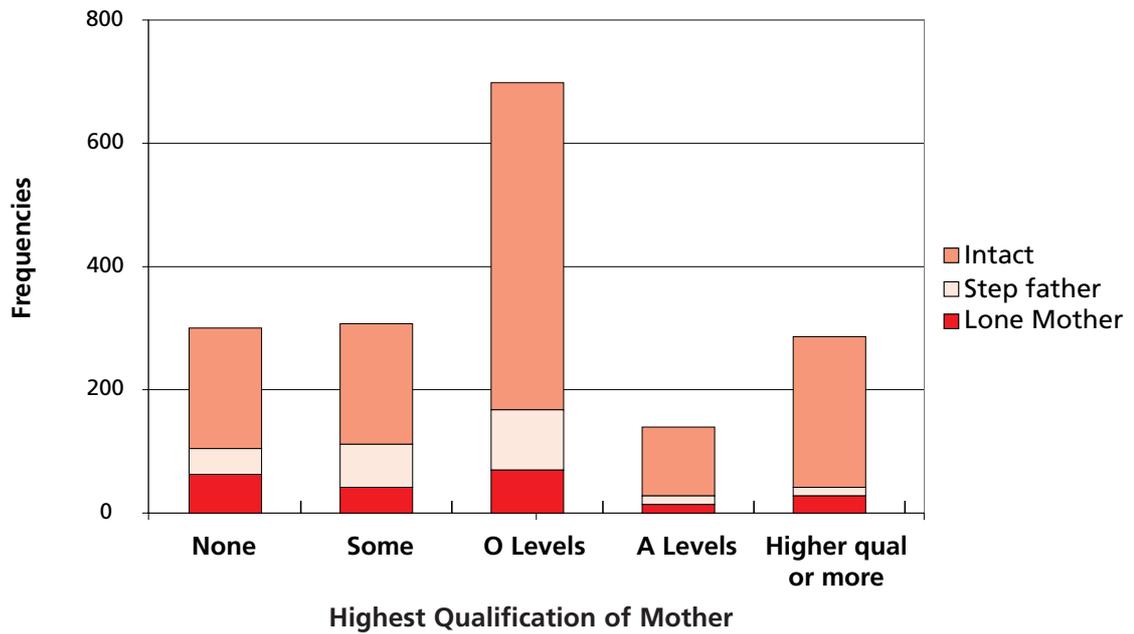


both natural parents. A very small minority not living with their own mother have been excluded (ie lone father families, step mother families and children in care) as there are not enough of them for their distinctive situation to be given due attention. Apart from this, the sample should still not be taken as representative of all families, since it come from a single cohort of mothers, and children whose mothers were over 28 when they were born are not covered. There is also more loss to follow-up of lone parent families. Of the 201 children who were observed with lone mothers, half (54%) had mothers in jobs. In families with a father present, in 11% of cases he was out of work. 12% of the children lived in families (one- or two- parent) where no parent earned. 27% of the children lived in local authority or housing association accommodation, which we take to be an indication of long-term poverty.

A mother's qualifications are relevant to this analysis for two reasons. Firstly, they affect a woman's earning power and therefore her chances of being in full-time (or any) employment. Secondly, it may be argued, but not so easily observed, that education also equips people to be more productive or efficient in child-rearing - better

informal education, better support for school education, better advocacy with health services, for example. Qualifications are measured as a linear scale, where each unit gained is one step up a ladder from no qualifications (zero) to degree or above (5). Intermediate points represent the highest NVQ level attained through. The mother's average level of qualification, 1.9 on this 0-5 scale, is below that for female members of the 1958 cohort as a whole (2.3), reflecting the social selectivity of the early childbearing. Figure 2.2 also shows that children with mothers educated to A level and above are almost all living in intact two-parent families, while the less educated mothers are more likely to be in single-parent or step families. This association between educational attainment and type of family involves the earlier childbearing of the less educated women, and their greater risk and opportunity to experience family change. The fact that explanatory variables are correlated among themselves calls out for some sort of multivariate analysis. However, we have found that the age of the mother when she had her first child is so strongly related to qualifications, and the number of a child's older siblings, that we have not explicitly included it in the regressions. Most of the mothers had their first child

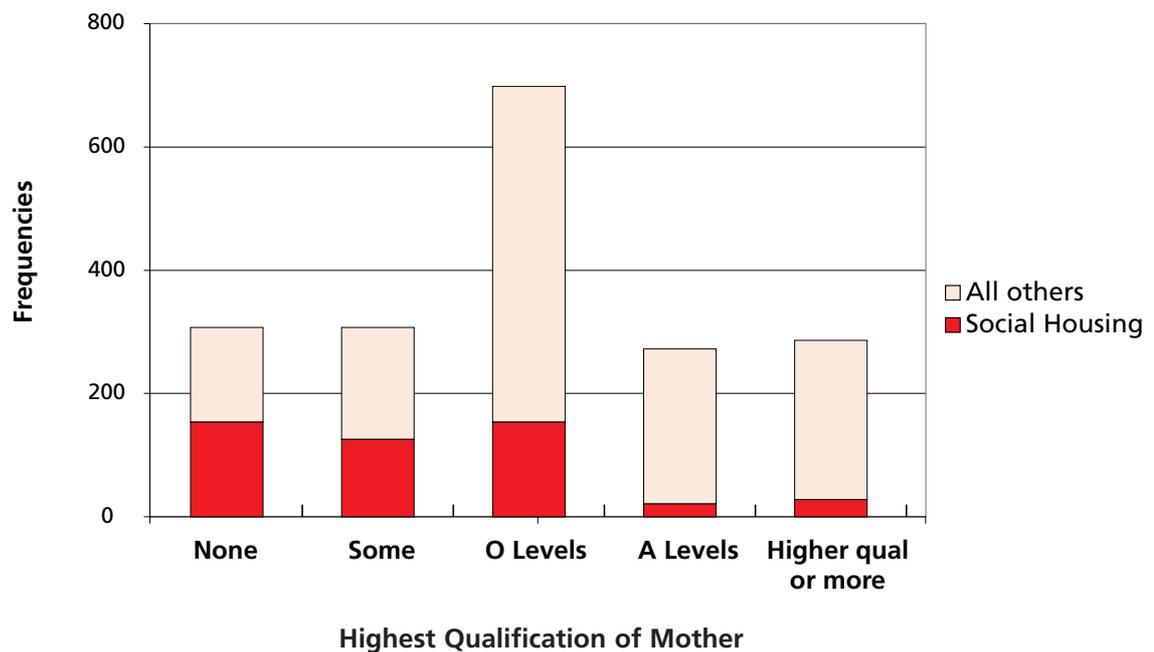
Figure 2.2: Family Status by Highest Qualification of Mother. NCDS 2nd Generation



between ages 20 and 28, but the minority of teenaged mothers is above the national average. Apart from mother's education, we include an indicator of parental resources in terms of housing tenure in 1991. Social housing is considered a good proxy of long term poverty

(McCulloch and Joshi, 1999). Again, we see a socially differentiated pattern within education groups. Figure 2.3 shows that almost all the children in social housing had mothers with O level or less.

Figure 2.3: Housing Tenure by Highest Qualification of Mother. NCDS 2nd Generation



An association between mother's qualifications and child outcomes might also arise for the spurious reason that they were both associated with a third factor, the mother's competence or ability. Such a factor might also be spuriously correlated with mother's employment, keeping the woman in the labour market and also giving her child a 'headstart'. This could give the appearance of a beneficial effect of employment when the true relationship might work in the opposite direction. We have therefore also included measures of the mother's childhood test scores, to 'unpack' the 'qualification effect' and to guard against attributing to employment any gain to children from having a mother with some exceptional coping skill. Although we have not measured competence directly, we are uniquely fortunate to have measures of the mother's cognitive ability (or attainment) which were collected 22 and 26 years earlier - their test scores in a general ability test at 11 and a reading test at age 7. Only the prospective design of the cohort study makes this possible. We also tried including the mother's maths score at 7 and her behaviour problems (Rutter score) at age 16, but these added little explanatory power.

Young people born in 1970 (BCS70)

The 1970 British Cohort Study (BCS70) is a continuing, multi-disciplinary longitudinal study which takes as its subjects all those living in Great Britain who were born between 5 and 11 April, 1970. BCS70 began when data were collected about the births and families of 17,198 babies born in the UK. Since then there have been four attempts to gather information from the full cohort. With each successive attempt, the scope of enquiry has broadened from a strictly medical focus at birth, to encompass physical and educational development at the age of five, physical, educational and social development at the ages of ten and sixteen, and also economic development at 26 years (Bynner et al 1997).

Dependent Variables

Five outcome variables are used in the analysis. Firstly, the impact of various factors, including mother's early employment, on the cognitive development of the cohort members when they were aged 10 is assessed. Children's

cognitive development is measured using maths and reading tests. Although they are not identical tests, and the BCS70 children are all the same age, this roughly parallels our analysis of cognitive tests for the NCDS children, aged 5-17 in 1991. Then, the impact of these factors is estimated on adult outcomes, which we can't yet observe for the children of NCDS. The adult outcomes include teenage motherhood, highest academic qualifications acquired by age 26, for men and women, and time spent unemployed at age 26. Descriptives for these and all other variables included in the regressions are presented in Table A2.3.

Explanatory Variables

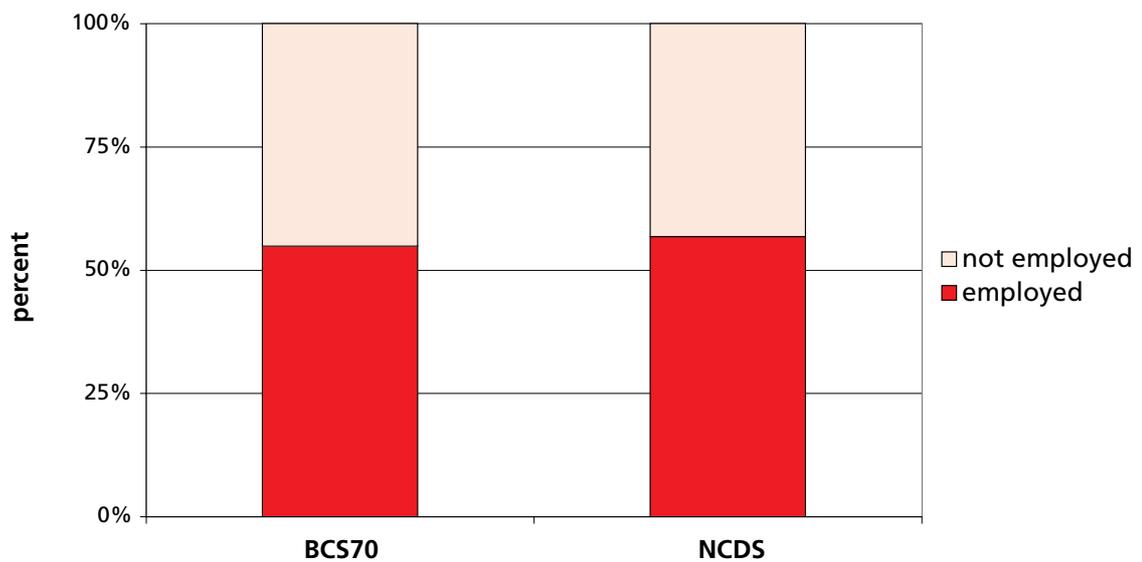
As all these subjects were born in the same week, there is no age variation in this sample. The cohort member's sex has been included in the explanatory variables to control for gender differentials affecting the maths and reading scores in childhood. For the adult outcomes, the sample is split into separate models for men and women, looking at women only in the case of teenage motherhood. There are more women than men in our sample at age 26 (54.4 percent female), reflecting greater survey loss among males.

Of the mothers of the 1970 cohort members, just over half (with good data) had been employed before their children reached age 5. Their employment includes any work, regular or irregular, of any duration. We were not able to say for certain at what stage in the pre-school years employment had occurred, and so cannot replicate an indicator of employment in the first year of the child's life. These data all refer to the period 1970-4, which is before any of the children of the NCDS Second Generation were born. Given the upward trend over time in the employment of mothers with children under 5, we might have expected a higher rate of employment during the pre-school years (mostly early 1980s) among the mothers of the second generation, but, as Figure 2.4 shows, it was almost exactly the same (55% BCS70 and 57% NCDS). This failure of expectation is likely to be due to the fact that the BCS70 mothers are a more representative cross-section of mothers than the relatively

young (relatively unqualified) NCDS women who had become mothers by age 28. Father's social class at birth and a simple indicator of parent's education are included in the analysis as important predictors of children's test scores and adult outcomes, as documented by Bynner, Joshi and Tsatsas (1999). In our sample, 35 percent of fathers had a non-manual occupation in 1970. More than half of the fathers and mothers of the BCS70 children had left school by age 15.

Free school meals (at age 10) and rented accommodation at age 5 are taken as indicators of childhood poverty, which may additionally blight child development or attainments. About 8 percent of the children for whom the information is available had free school meals, while about 33 percent lived in a rented home at age 5.

Figure 2.4: Percentage of Mothers employed when child aged under 5



3: Methods

We use a variety of regression techniques to estimate associations with potentially explanatory variables. These may reflect causal effects, but this interpretation rests on unproven assumptions, so caution is urged.

The variables we put into the model do not tell us everything there is to know about each child. So for the analysis of the NCDS Second Generation, we adopt a technique that explicitly acknowledges that not all relevant factors are measured. The multi-level approach we use (described below) allows for such unobserved heterogeneity to have common elements between the different scores within a child, and between children, where more than one child is observed within the same family. We model the cognitive and behavioural development of children within families using hierarchical linear modelling. This is a variant of the multiple linear regression model for data with a hierarchical nesting structure (Goldstein 1995). A detailed description of these models is given in the Appendix to Chapter 3.

In the analysis of BCS70, where there is only one child per family, we have used ordinary linear regression for the test scores and the level of qualifications attained. Where the dependent variable is binary - teenage motherhood and unemployment - we apply logistic regression, using a maximum likelihood estimation technique. We report the impacts as odds ratios for experiencing the outcome relative to reference categories. If there is no difference, the odds ratio is one. The significance of any difference of these ratios from 1 is tested by a 'z' statistic of similar interpretation the 't'.

The tables of results in Appendices to Chapters 4 and 5 show multi-level modelling or ordinary regression coefficients, estimates of the impact of explanatory variables on the outcomes, with 't' statistics describing how well determined these estimates are. The bigger the 't' statistic, the smaller is the margin of error around our estimate. For 't' below 1.96, the 95% certainty margin of

error includes zero, so there is a significant chance that the underlying relationship might be zero or of opposite sign. In this case we describe the estimate as 'non-significant'. We also show an alternative way of reporting the associations identified, beta coefficients. These express the change in outcome variables in terms of standard deviations changing in response to a one standard deviation change in a predictor variable. They are thus measures of responsiveness net of the underlying variability in each variable, which facilitates comparison of estimates across predictors and across equations. Apart from age, where the cognitive scores vary about as much as the regressor, most of the estimated 'elasticities' are very small. They express the percentage points of a standard deviation of the score being analysed which is associated with one standard deviation change in each predictor variable, other things being equal.

The models also include terms for missing data. We do this to avoid discarding all cases with any missing information. If the value of a particular variable is missing, we set it equal to the mean (continuous variables) or to zero (dummy variables) and create a 'data missing' flag to test whether these cases are systematically different from the others. In many cases the flag suggests that the missing cases were not significantly different, in which case the terms can be safely ignored. In some cases they cannot, and a substantive explanation must be considered. For example, where the father's social class is missing, some of the cases will be the relatively small number where the father was absent at birth.

The Multi-level tables of Chapter 4 also show the variances and covariances of the element in the outcomes which we have not explained by the variables included in the model. These are organised into variances at the level of the mother, who may have more than one child in the analysis, and of the child. These are reported in the lower panel of each table along with the

association, or covariance of each error term with that of the previous equation(s). Thus the last set of two columns (under Non-anxiety) show three covariances (and the standard error of these estimates) between non-anxiety and maths, reading and non-aggression respectively. The last entry is the variance of the non-anxiety residuals. Similarly each of the preceding columns the lowest figure reported is a variance and the entries above it are covariances. For those children who are the sole representative of their family in the sample, the unexplained error is partitioned by the program into mother and child components.

Model Specification

The selection of variables to include in the regression analyses was determined by theoretical relevance, availability of data, and our success at detecting significant relationships. In the Second Generation sample there were two main classes of model: those where the employment predictor related to the years when the child had been under 5 (early employment), and the 'current employment' model which related what the parents were currently doing at the 1991 interview with the test scores collected at the same date. In each case there were a number of preliminary experiments to fit as much detail as possible to the data, which were subsequently simplified to the most parsimonious forms reported in Chapter 4. Some but not all of the exploratory estimates are also reported (tables A4.5 to A4.9).

Alongside each alternative set of employment terms we included a set of demographic controls (age, girl/boy, number of older siblings) and a set of socio-economic indicators (social housing, mother's qualifications,

mother's test scores, and for the current parental employment model, current family structure). We selected our socio-economic controls from those that showed significant effects in this or previous research. In particular we introduced some variables measuring the mother's own cognitive scores as a child, in order to control for the possibility that any positive association between an outcome of the child and the mother's employment might be due to a spurious correlation of mother's ability and labour force participation. A behaviour score at 16 was not significant, but general ability at 11 and Reading at 7 were. In the presence of these latter two terms, the mother's maths score when she was 7 did not add to the explanation. This strategy resembles the inclusion of AFQT (Armed Forces Qualifying Tests) scores in some of the models reported by Han et al (1999). It is also in the same spirit as the strategy adopted by Ermisch and Francesconi (forthcoming) but we have not taken sibling differences because that would eliminate the explanatory variable of interest in the current employment model and also reduced our sample size to 1,051. Models including interactions between mothers' qualifications and mother's current and past employment were examined but did not converge on a definite estimate.

With the BCS70 material there is only one maternal employment predictor. The other socio-economic variables for which we control, as described in Chapter 2, circumstances at birth and during childhood, are also the same with each of the five outcome, apart from the fact that the cohort member's test scores at 10 are both outcomes in the first two models, and predictors in the models of young adults outcomes.

4: Results: NCDS 2nd Generation study

The full results of the multi-level regressions are reported in Appendix to Chapter 4, Tables 4A.1 to 4A.4. Table A4.2 shows a streamlined version of the early employment model; and A4.4 a simplified, versions of the current employment model. Each of these tables is preceded by one of several explanatory models including more detail about employment: A4.1, early, and A4.3, current model.

The impact of maternal employment

For the model of mother's early employment, original investigations split up the ages of child into under 1, 1-2, 3-4. In each of the second two phases the set of variables distinguished whether the employment in the period in question was, at least for one month, full-time, whether any employment was part-time, or there was no employment (we also noted the cases where the majority of time was not well accounted for). This mass of detail did not produce a well-determined fit to the data, but some tendencies were apparent within the large margins of error. Since the model did not detect any significant difference between employment when the child was 1-2 and 3-4, we suppressed the distinction between these age bands to produce a variable spanning ages 1-4, which appears in the first regression in the Appendix, Table A4.1.

The associations with employment in the first year of the child's life tended to be negative, but were only significantly so for the reading score where mothers had been 'in employment' throughout the child's first twelve months. The signs on mother's employment when the child was one or older were generally positive, but too poorly determined to find a great difference between part-time and full-time employment. The exception here concerns the child's internalised behaviour, which was better (less anxious) if the mother had been employed at any time between infancy and compulsory school age, with an estimate that just reaches statistical significance if that employment had been only part-time. (If it had been full-time the estimate is the same, but with a bigger

margin of error). This apparently beneficial relation to anxiety was also marginally stronger if the employment was undertaken at ages 1-2.

We also investigated whether there might be a different pattern in the second year of life, when the children were 1, compared with ages 2, 3 and 4. When the period after the first birthday was split up into the year when the child was age 1 and the next three (ages 2 to 4 inclusive), the second year of the child's life appeared little different from the later three years. The positive sign on non-anxiety appears as early as age 1, and effects on reading have become insignificant by the second year, and maths and aggression are also insignificant, as at ages 2-4.

The results in Table A4.2 show a streamlined model which simplified the information on pre-school employment. All the terms for the first year of life were again negative, but again only the one for reading is significant. Children whose mothers had been employed during their first year scored, on average 2 percentage points less on the reading test than identical children whose mothers had not then been employed. Maternal employment of any sort over ages 1-4 showed virtually no relationship (small positive but insignificant) with any of the outcomes except for a 5 point reduction in the anxiety score of the children whose mothers had been employed.

For the model with current employment states, the detailed form (Table A4.3) distinguishes full from part-time and also includes whether or not a father, if present was unemployed. The presence of the father is recognised by a variable distinguishing lone mothers from two parent families, within which step families are distinguished from intact couples. A streamlined form of this specification just included whether there was any earner among the parents, or whether the child was living in a 'workless' family (Table A4.4), since the estimates for full- and part-time employment of the mother and the unemployment of the father were not too well determined, but all seemed to be pointing in the

same direction. In the first model, at whatever age between 5 and 17 the child was tested, we find the strongest positive association of current employment with non-anxiety. Children whose mothers currently had part-time jobs had a 5 point advantage on the percentage of worrying-type behaviour reported, and a 3.6 point lead if the mother's jobs were full-time. On two of the other relationships there were near-significant positive estimates, for full-time employment on maths and non-aggressive behaviour.

When the employment status of both parents was considered jointly, the children's current situation could be classified into those living in either a family with at least one earner or a 'workless' family. The no-earner family was associated with a 6.9 increase on the anxiety scale, and a 1.7 point drop on the maths score (borderline significance). This combines the positive effects of having an employed father with those of having an employed mother. Two out of four estimates thus suggest

adverse effects on child development in the workless household, while the other two estimates are more consistent with no effects. Our results on employment 'effects' are summarised in Box 4.1.

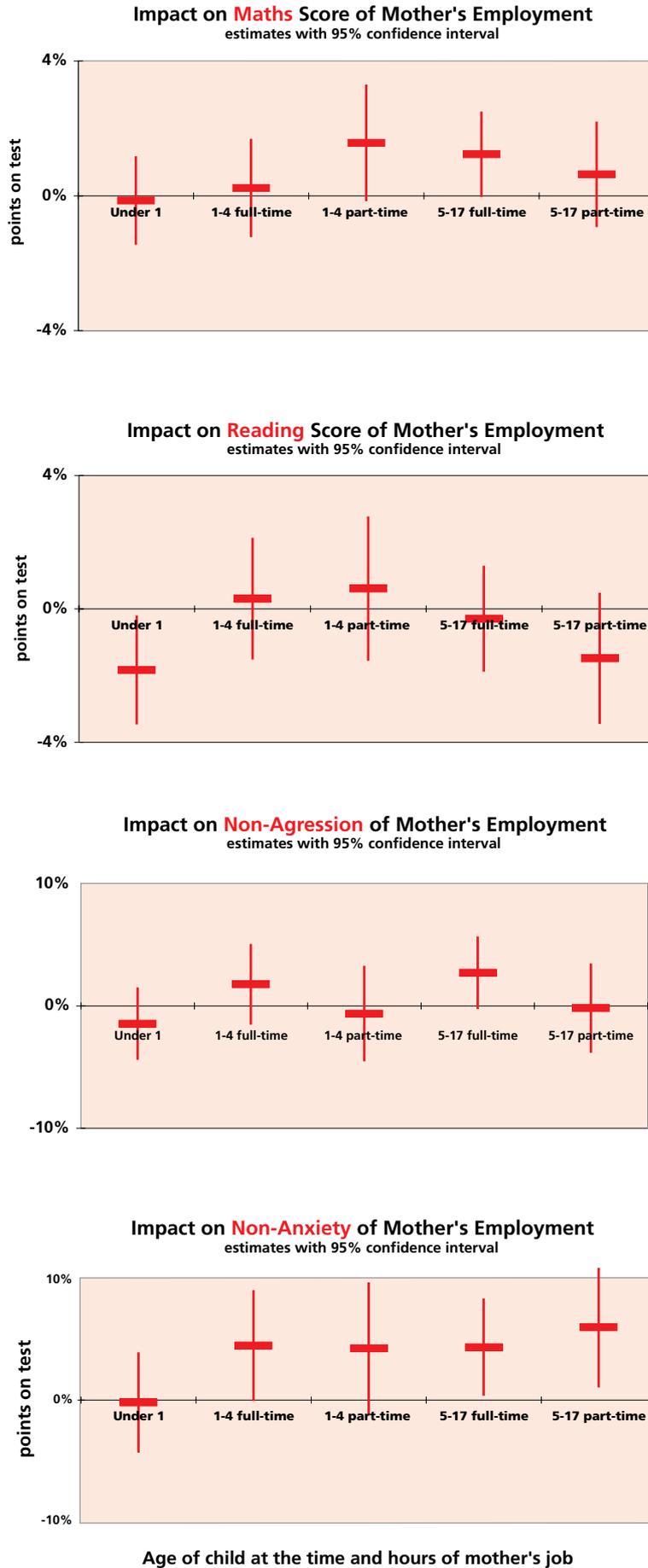
The estimates of employment effects - differences between children whose mothers' had jobs at the relevant stages and those whose mothers were then at home - are also shown in Figure 4.1. The estimated differences are plotted with their margins of error. The vertical lines around the central estimate describe the range within which the true estimate is likely to fall with a 95% degree of confidence. In other words there is only a 5% chance that the true average value of the relationship falls outside these limits. The shorter the vertical line, the smaller is the margin of error, or the better, we say, is the result determined. If the margin of error crosses the zero horizontal axis, the range of our estimates includes no difference between the two types of mother, and so the difference could go either way. It is

**Box 4.1: Effects on child development indicators, of maternal employment
controlling for Mother's Qualifications, test scores and economic circumstances**

OUTCOME	MATHS	READING	NON-AGRESSION	NON-ANXIETY
Child aged 0-4				
<i>Some employment</i>				
Mother's job history condensed (Table A4.2)				
First year of child's life	-0.1	-1.8	-1.5	-0.2
Child aged 1, 2, 3 and 4	0.4	0.2	0.8	+4.9
Detailed mother's job history (Table A4.1)				
First year of child's life				
Employed 12 months	-1.0	-2.5	-0.6	2.2
Some employment	-0.1	-1.4	-1.3	-0.3
Child aged 1, 2, 3 and 4				
Any job part-time	0.2	0.3	1.8	+3.7
Some full-time	1.6	0.6	-0.6	3.5
Child aged 5-17				
Current employment of each parent (Table A4.3)				
Mother's Employment vs no employment				
EMPLOYED PART TIME	0.6	-1.5	-0.2	+5.0
EMPLOYED FULLTIME	1.2	-0.3	2.7	+3.6
Father unemployed	-0.3	-0.1	-0.9	-0.7
Current employment of any parent (Table A4.4)				
Any Earner	1.7	-0.6	1.7	6.9

significant at 5%
 significant at 10%

Figure 4.1



only if the vertical line is clear above or below the line of zero difference that we can say there is a significant estimate, either positive or negative as the case may be.

The plot for maths shows three out of five estimates straddling the zero line - no significant difference from the non-employed, and two approaching significance on the positive side, from part-time employment which the child was aged 1-4, and from full-time employment at the time of the interview. The plot for reading shows the clear, significant, negative effect from employment before the child's first birthday (taken from Table A4.2), and all the rest encompassing zero. The coefficients for aggression behaviour are all fairly symmetrical around the zero effect line, while most of the estimates for non-anxiety lie on the positive side of the line, apart from the first year of life where the estimate itself is almost on zero. For each type of current employment the estimates are clear of the line, ie significantly different from zero.

These picture should serve to remind of the general drift of our findings - below age one, relationships tend to be zero or negative, over the age of one relationships are either non-existent or a bit more likely to be positive than negative. The indeterminacy of this picture is partly the result of imperfections in our measurement of the relevant variables. A particular test score may not always reflect what the same child would get on another day for example. We also have incomplete data the mother's employment and child care arrangements, as well as the possibility of errors in measurement of other variables. But there is also a good deal of underlying variation between families and children that we would never aspire to measure accurately. Few real people fit the model of the average very closely. Their idiosyncrasies mean that there will always be a need to adapt a general model to particular circumstance. The margins of error in Figure 4.1 are one illustration of the variability of our sample.

Other predictors of child development

Our models also controlled for the current economic circumstances of the family, and for the mother's

educational qualifications, and measures of some of her own cognitive test scores as a child. Housing tenure is used as a proxy for long-term poverty or at least low income over the long term, which our previous work found more strongly related to child scores than current income. These estimates were very similar in all of the models, they are summarised in Box 4.2, taking the estimates from Table A4.3

The associations between living in social housing (local authority or housing association) and child outcomes were significantly negative for three out of four outcomes. The negative effect on reading (around -4) is about twice the estimated effect of the mother being employed in the first year of life, for aggressive behaviour and poverty around 5 points and that for maths around 2 (slightly higher values in the model which does not include the current number of earners than the model looking at the mother's employment history before the child reached 5). There was however no sign of any association between the child displaying internalised behaviour problems and the family's housing/economic status (see the last column of Box 4.2).

Mother's qualifications were similarly significantly positively related to maths and reading tests, and negatively to aggressive-type behaviour problems, but not related to worried or withdrawn behaviour. Other things (including the mother's ability measured in childhood) being equal, an increase in one qualification level (O-level to A level, or no qualifications to some, for example) would raise test scores by about one point. Going from no qualifications to a degree would raise maths and reading scores by about 5 points, and reduce the aggression score by about 8 points. The mother's own ability score, as tested while she was 11 is a very powerful predictor of her offspring's maths, reading and aggressive behaviour, but again not of anxiety, which does not seem to be transmitted by inheritance or by current circumstances. The intergenerational link of ability (and reading) score from mother to child is significant, but amounts to very much less than replication.

We also controlled for the child's age, sex and the number of older siblings. Girls were systematically slightly better at reading and worse at maths than boys, more inclined to anxiety, and less inclined to aggressive behaviours. Children appear to be at a mild disadvantage in maths, reading and aggressive behaviour if they have older siblings. But on the other hand, the score for internalised behavioural problems is again different. It seems to be a case of 'the more the merrier'. The bigger the existing family when the child arrived, the better adjusted on this count does he or she appear to be when observed as a school child. One interpretation is that the company of older siblings helps the child adjust to other children, another suggestion is that mothers who have already had one or more children are less anxious themselves than with their first child.

The models which include information on father's employment also make allowance for whether the child was living with a lone mother, two natural parents or a two-parent family with a step-father at the time. The differences between family types was small to negligible after we had taken account of the family's status on the housing and labour markets, except that the children of

lone mothers (but not those in step families) showed lower scores in reading (2.6 points - in Table A4.4) and more aggressive behaviour (6.1 points). We had already seen an adverse relationship for children of lone parents on the aggressive elements of behaviour, in previous work (Verropoulou et al forthcoming), but the negative link with reading is better determined than our previous estimates where we treated divorced and single lone mothers separately. These findings are also generally consistent with other literature which finds family structure effects are generally more important for behavioural outcomes than cognitive attainment, at least when the family's economic resources are taken into account (MacLanahan 1997).

Standardised beta estimates

So far we have discussed the results in terms of the regression coefficients, but it may also be useful to consider the beta coefficients which adjust for the differing variabilities of the outcome and predictor variables, by expressing the effects in terms of standard deviations. Looking down the columns of Tables A4.1-4.4 the beta terms are relatively small for maternal employment variables, especially where they are not

Box 4.2: Estimated effects on child development indicators, of factors other than parental employment

OUTCOME	MATHS	READING	NON-AGRESSION	NON-ANXIETY
<i>Current employment of parent also controlled</i>				
Girl	-0.98	2.03	8.17	-4.70
Older Siblings	-0.76	-1.60	-2.34	3.04
Mother's reading at 7	0.04	0.09	0.01	-0.03
Mother's ability at 11	0.11	0.15	0.11	0.05
Mother's qualifications	0.80	0.99	1.61	-0.31
Poverty proxy (social housing)	-2.21	-3.92	-4.14	1.20
<i>Family Structure</i>				
Step father	-1.44	-1.66	-2.90	-1.78
Lone Mother	-1.40	-2.43	-6.54	-2.52

 significant at 5% positive
 significant at 5% negative
 significant at 10% negative

statistically significant, in comparison with most of the demographic and socio-economic predictors. The significant negative effect on reading of mother's employment in the first year of life (Table A 4.2) has a beta value of -3.4, which is well below (ie closer to zero) any of the betas on socio-economic variables for reading (-8.3 on social housing for example). It is of the same order of magnitude as the average reading lag in boys behind girls.

In the same terms, the positive effects of avoiding anxiety where the mother is employed during the child's ages 1 through 4 (Table A4.2) has a beta value of 8.7. This is a more important influence, on this outcome, than the socio economic variables, which are not significant in this model, but of comparable magnitude to the impact of the child's gender and (standardised) number of older siblings. In the models of current employment, the beta coefficients are very small where the term is not significant, under 3 where the estimate is significant at 10% but not 5%, but in the case of the anxiety score the beta coefficient rises to 8.8 or 5.2 when the mother is employed part- or full-time respectively, or 8.0 when the presence of any earner is included instead. Again, for this outcome, anxiety, the employment variables are stronger predictors than the socio-economic ones, but not than the demographic ones. The current employment models also show the influence of family structure. The significant betas for being in a lone mother family are -3.6 on reading and -8.0 on aggression.

Perhaps the best use of these betas is to make comparisons between the various socio-economic terms: mother's qualifications and childhood test scores and current housing tenure, our proxy for current poverty. For three out of the four outcomes (excluding anxiety) the patterns are very similar in all models. The most important predictor is the mother's ability score at age 11, betas around 10 for maths and reading, and around 8 for aggression. Mother's qualifications take second place in some of the models with beta around 5, bringing out the importance of a factor which seems superficially small in the raw coefficients. The impact of living in

social housing is greater in the models of pre-school employment than for current employment where the absence of current earner shares its role as a poverty indicator. In the former models the beta is -6 for maths, -8 for reading and -10 for aggression.

Analysis of the Unexplained

Another reminder of how much variation remains unexplained is in the analysis of the unexplained component given at the foot of each table in Appendix 4. Looking diagonally across their lower panels, it can be seen that the unexplained variances attributed to children are greater than those attributed to mothers. The pattern of covariances, and the implied correlations between unexplained errors in the four equations is almost identical in all four Tables A1-4. There is a strong and significant association between the otherwise unexplained scores at reading and maths for both mothers and children. In other words, families whose children tend to do particularly well (or poorly) at maths also tend to do well (or poorly) at reading. The correlation at the family level is 0.75. Allowing for this, individual children who tend to do well in one subject tend to do well in both, with a correlation coefficient of 0.46 at the child level. There are significant covariances between aggressive behaviour and maths and reading for children (but not families). The associations between non-aggression and maths are 0.21 for families and 0.15 for children, and between non-aggression and reading, 0.33 and 0.16 for families and children respectively. Anxiety is not significantly associated with cognitive skills at either level. Anxiety and Aggression are strongly associated in families but not (by construction) in children.

The smaller unexplained element for mothers compared to children may be due to our success in finding information about mothers, in terms of their early test scores. Tables A4.5 to A4.9 in Appendix 4 show the results of models which do not include these terms or housing tenure. The inclusion of these socio-economic variables explains less than one percent of the variation among children's scores that can be attributed to the

children themselves. But as concerns the variation attributed to mothers, the inclusion of these variables in the models explains as much as 44 percent of the variation in their reading scores and 32 percent of the variation in the maths score, though only 12 percent of the variation in aggressive behaviour and almost none of the variation in anxiety.

One reason to include these socio-economic terms, and especially those which described the mother's attainments and ability was to purge any positive association between child outcomes and maternal employment of the spurious effect of third factors. If

they were important, including these terms could turn positive or insignificant terms into significant negative ones. What we found, comparing the models without all four socio-economic terms with the final models presented above was that some positive (beneficial) relationships were reduced in size and significance. We also found that including these terms raised the significance of the negative signs on employment in the first year. This suggests that some positive association can be attributed to more successful women tending to have both jobs and successful children, which also tends to mask a negative process for less exceptional cases who go out to work when their children are very young.

5: Results for young people born in 1970

We now turn to the sample of children who were born rather longer ago, and have hence had time to reveal any longer term effects of being brought up by a 'working mother'. These are the members of the 1970 birth cohort, who have been tracked (so far) up to age 26 in 1996. We start by looking at their tests at age 10, both for comparison with the Second Generation children and as a prelude to including these tests in some of our analyses of outcomes in early adulthood: teenage motherhood, unemployment and qualifications.

Maths and reading tests at age 10

These linear regressions analyse the scores obtained by the 1970 cohort on maths and reading tests when they were 10, in 1980, see table A5.1. There is no term for age in these analyses, since all the children were the same age. As in the Second Generation, girls were better at reading (by approximately the same factor), and worse at maths (the coefficient is slightly bigger).

Mothers' employment in their children's pre-school years (1970-1975) was not significantly related to either score.

The variables which were significant are those for social class at birth, those for each parent's education, and two indicators of poverty: receipt of free school meals and being in rented accommodation at age 5. These each have more or less the same impact on both maths and reading scores in the familiar direction. There is a gradient of social class effects, relative to social class I of 2.5 percentage points less for social class II to around 12 points less for children in social class V, unskilled. The impact of social disadvantage is increased if neither parent has stayed on at school. This lowers both scores by just under 5 percentage points, for having minimally educated fathers, with an additional impact for mothers who left school early of a similar magnitude, slightly more effect on reading than maths. The indicators of poverty have consistently significantly negative signs. Receipt of free school meals, which as a means tested benefit, indicates low income, were associated with lower

maths and reading scores of about 2 points. The rented accommodation indicator goes with lower maths and reading by about 4 points. This is very close to the impact of the variable on reading in the Second Generation, and somewhat larger in the case of maths.

Teenage motherhood

The logistic regression model of the odds of a girl born in 1970 becoming a mother before age 20 is shown in table A5.2. Again, there is no significant effect of the mother having been employed while the girl was under 5. The gradient by social class of origin runs up to odds of 4.7 for daughters of men in unskilled social class V. The odds of early childbearing are increased if either parent left school early by about 1.4 each. Free school meals are not significant, but rented accommodation is, raising the odds of teenage motherhood by a factor of 2. Good reading scores at 10 protect against subsequent teenage motherhood, but there is not a significant additional impact of having had a good maths score. Overall, this model gives a picture of teenage motherhood as strongly associated with social disadvantage in childhood, as is well known (Social Exclusion Unit 1999) but allowing for these does not reveal any association with mother's early employment.

Unemployment

Table A5.2 also shows two analyses of fortunes on the labour market in early adulthood. The outcome is having reported at least one spell of unemployment lasting over 4 months, between school leaving and age 26. The way questions were asked on the postal questionnaire does not offer much flexibility in identifying those with a substantial employment interruption. We analyse males and females separately, because of the possible different patterns of employment discontinuity. Women's employment interruptions for domestic reasons are not counted here.

Once again, mother's employment makes no statistically significant contribution to the explanation. Childhood

poverty (free school meals and tenure at age 5) are significant predictors, but fewer of the social class of origin terms are significant than in the previous models (even though test scores are not included in this model). Furthermore parental school leaving only features in the flags for missing data - signifying, among other things, that there was no father present at birth. Except for the odds ratio on free school meals, the significant terms are slightly higher for women than for men. Odds of substantial unemployment for daughters of social class V are, for example, 2.1 times greater than daughters of social class I, for sons, the odds ratio is 1.8. For rented accommodation at 5, the odds ratios relative to owners are 1.6 for women and 1.2 for men.

Educational Qualifications

Table A5.3 shows linear regressions of the qualification level attained by age 26, of the men and women born in 1970. In this case, there is a significant association between mothers' early employment and their offspring's later achievements, but it is not very large. Women attain 10 percent less of a grade if their mothers had been employed before they were 5, and men 12 percent of a grade less. In other words, they are on average about one tenth less likely to advance one rung of the qualifications ladder, such as the step between GCSE and A level, or A level and a non-degree higher education. This result remains when we omitted the test scores at age 10 from the equation. It is very similar to the results of Ermisch and Fransconi (forthcoming) using BHPS data.

The other terms in these equations are also significant, and for the most part of greater magnitude, particularly the earlier maths and reading tests. Social class of origin shows in the social gradient running to $-.9$ and $-.8$ for women and men respectively, whose fathers had been born in social class V (relative to class I). Each parent having left school at the minimum age reduces scores by 34 to 55 percentage points of a grade.

The negative effect on qualifications of pre-school employment by the mother is possibly consistent with the negative effect on reading on school age children that

was detected in the NCDS second generation, if it is generated by the mothers who started work the first year after the birth in 1970. We cannot clearly distinguish 1970 mothers who were employed in the first twelve months, unfortunately. The best differentiation that is possible is between mothers whose pre-school employment was near-continuous, and those who had some of the period out of employment, though we don't know exactly when. Investigations suggested that it was the latter group (who were probably less likely to have been employed in the first year) which showed the stronger negative association, so it is likely that these results are picking up the same negative association between employment of mothers between ages 1 and 5 on eventual educational attainment, as found by Ermisch and Fransconi (forthcoming). However the negative effects are not large, relative to some of the other estimates. If the mother's employment kept the family off Free School Meals, the model suggest that the net outcome for the children would be more than compensated.

If this is so, these results differ mildly from those on the 1958 Second Generation over the impact of maternal employment when children are aged 1-4. If there is a difference between the 1970 cohort and the NCDS Second Generation in this respect, it could be explained by one of the following considerations. The mother's employment was observed at different dates (1970-5) versus (1974-1990). In the earlier years the combining of childrearing and employment may (perhaps) have been more stressful, as it was less the norm. BCS70 has a more representative social profile than the children of young mothers in NCDS 2nd Generation. This would be an explanation if the negative relationship was particularly found among families where the mother was over 28. The samples are not completely comparable because of differences in the variables included. Finally it could be that the age at which outcomes are taken makes a difference. There could be 'sleeper' effects on educational attainment, which do not show up in intermediate tests (as they didn't on the age 10 test of BCS70). The qualities of self-confidence and determination that are needed

to succeed in the race for qualifications may be more psychologically demanding than any of the childhood tests or ratings we have used.

Conclusion

These analyses of the children born 4 to 16 years before the children analysed in chapter 4 show again the strong influence of socio-economic background on academic attainment, during schooling and after its end. These are also apparent in labour market outcomes and early

motherhood. The search for delayed effects of maternal employment drew a blank as far as the last two items were concerned, but we did find some indication that qualifications were slightly lower for those young people whose mothers had been in employment in their pre-school years. If this represents an educational handicap it was not present at age 10, and it might not have helped for the mothers to have stayed at home if this reduced family income.

6: Conclusions

The question is of the ways in which children may suffer, or gain, at what age, from the very fact of having an employed mother. Another issue is how far children gain from the money brought into the family by the mother as well as the father. A third issue is what is happening to the children while the mother is at her job: who else is taking what sort of care of them?

In our NCDS sample of Second Generation children, mostly born in the 1980s, mother's employment while a child is under 1 shows limited signs of association with at least one sort of problem later on. At other ages under 5, there is no evidence for a negative effect (though not necessarily proof that there is none). At the ages between 5 and 17 at which these children were observed, there are some signs of positive associations, possibly benefits. In the sample of children born earlier, in 1970, outcomes at 10 were not significantly related to whether the mother had a job before they were 5. Nor were two outcomes in early adulthood, substantial unemployment and teenage motherhood. However there was some confirmation for the idea of delayed, or 'sleeper', effects in that children whose mothers had been employed in their preschool years were, other things being equal, slightly, but significantly, less likely to get good qualifications. The other things which are being held equal include family poverty and social class, whose effect is more important than maternal employment.

The pattern within the NCDS results is not simple or systematic across the board. Reading was significantly negatively related to mother's employment in the first year, but not to employment later on. It was systematically related to the mother's ability and qualifications, number of siblings and home ownership. Maths was also related to those variables, but not, significantly, to mother's employment at any stage. The same pattern applies to aggressive behaviour. Behaviour free of worry and unhappiness showed several positive associations with mother's employment, no relationship whatsoever with our indicators of the family's resources

and the mother's human capital, and an intriguing capacity to thrive or survive with older siblings. One might speculate that it is in this respect particularly, that children benefit from wider social contact, as they do from older siblings.

Not only have we measured different ways in which children may respond to the chances and challenges of growing up, there is also a great deal of variability among people - children, parents, carers - that we have not measured, beyond detecting a statistical penumbra of uncertainty around the relationships we are trying to detect. Children and families in our sample are not all falling into one neat line. If it is necessary to remind policy makers that people are diverse, this study could also be used to illustrate the point.

No statistical or experimental research can ever prove what would be best for a particular child. What these results do is to remind us of how very diverse children and families are. That makes it difficult to fit statistical models of a uniform process to everybody. If there were systematic long-term disadvantages to most children whose mothers had been in the labour market when they were small, we would probably have found more sign of it. For the children still at school in 1991 there is some sign that one outcome (reading) may be impaired somewhat in some children. It is likely, though we could not measure it, that poor quality day care plays a part in this process. Indeed children (or at least those who are not the most resilient) may suffer from poor care, irrespective of whether this comes from inside or outside the home, and irrespective of the mother's employment. The evidence suggests that family poverty impairs a child's prospects. Mother's employment helps to keep children out of poverty, and does not appear to do much harm, in general.

The evidence presented here does point particularly at the vulnerability of young babies. Longer, better paid and more flexible maternity leave would be one way to

address this. It might also be addressed in some other ways: by increasing the time of fathers available to children in the first year of life, or also by ensuring high standards of out of home care, or some combination of such measures.

Secondly, the evidence on employment of mothers when the child is older should not be used to exhort all families to send mothers out to work, or all mothers to stay at home. An increasing number of families are choosing a dual earner arrangement. This research gives them no grounds to worry that they are jeopardising their children's development thereby. On the other hand, those families who choose to have the mother at home, and may have made this choice to suit their children, are probably in a better position to judge than a statistician which mothers should stay at home and for how long. Families are diverse and policies to support them should support diversity. If the statistical models cannot detect uniformity, it may not be a good idea for policy to try to impose it.

This report is not the last word on the subject, and it is important to pursue the questions still unanswered. With the existing data a little more could be done, for example to relate reports of breastfeeding to the mother's

employment and child outcomes in NCDS, and further exploration of the qualifications data in BCS70. But the biggest gain would be with new data. The children of NCDS have only been tested once. It would be immensely valuable to follow them up again, if only to repeat the 1991 investigation. It would also be very valuable to collect data on the children of the 1970 cohort. Although the adults in both these cohorts are currently being re-interviewed, there are no funded plans to repeat the Second Generation study. Whether or not that ever happens, we have shown the usefulness of the data we have been able to use, relating child outcomes to parental circumstances. We have not had enough information to show which other factors play a role in determining children's progress. It would be useful to know about the time fathers spend with their children, the quality of care outside the family, the school, the employment conditions on such matters as leaves and flexible hours, or how mothers who have jobs may nevertheless be successful parents. If we understood better whether the positive and negative relationships detected in our data represent causal processes and how they might operate, we would be in a better position to identify a range of options for limiting damage and improving the quality of family life.

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Appendix to Chapter 1

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Appendix to Chapter 2

Table A2.1: Defining Aggressive behaviour and Anxiety

AGRESSION:	
BPI (4 to 7 years)	
Item at the questionnaire:	
4 Cheats or tells lies	
7 Has difficulty concentrating/paying attention	
9 Bullies or is cruel to others	
10 Disobedient at home	
15 Not liked by other children	
17 Restless or overly active	
22 Breaks things deliberately	
27 Disobedient at school	
Rutter (aged 8 or more)	
Item at the questionnaire:	
1 Very restless	
2 Squirmy, fidgety child	
3 Often destroys own or others' belongings	
4 Frequently fights/quarrelsome	
5 Not much liked by other children	
13 Often disobedient	
14 Can't settle to anything for more than a few moments	
17 Often tells lies	
18 Bullies other children	
ANXIETY:	
BPI (4 to 7 years)	
Item at the questionnaire:	
5 Too fearful or anxious	
20 Unhappy, sad or depressed	
32 Worries too much	
Rutter (aged 8 or more)	
Item at the questionnaire:	
6 Often worried	
9 Often appears miserable/unhappy	
11 Frequently sucks thumb/finger	
15 Tends to be fearful/afraid of new things	
16 Fussy or over-particular	
The scores were created as the unweighted sum of the individual items	

Table A2.2. Variable distributions: Children aged 5-17, NCDS Second Generation

	Mean	Std Dev
Outcome Variables (%)		
PIAT Math Score	47.9	19.9
PIAT Reading Recognition	51.4	23.8
External behavioural adjustment (non-aggr.) ^a	67.9	24.6
Internal behavioural adjustment (non-anx.) ^a	69.0	28.0
Baseline Predictors (child level)		
Child's age in months	108.9	38.2
Child's sex: female (%)	50.7	50.0
Child's Birth Order	1.65	0.91
Child Level Predictors (%)		
Mother's Employment History		
First year of child's life		
No known employment	55.8	49.7
Employed throughout	14.3	35.0
Some employment	12.8	33.3
Employment missing	17.1	37.6
Child aged 1 to 4		
No known employment	40.1	49.0
Any job part-time	26.0	43.9
Some full-time employment	19.5	39.6
Employment missing	14.4	35.2
Family status at interview		
Lone: mother currently alone	11.8	32.3
Step: child with a step-father	14.2	34.9
Intact: child lives with both natural parents	74.0	43.9
Family level predictors		
Mother's Current Employment (%)		
Out of work	37.8	48.5
Employed full-time	20.4	40.3
Employed part-time	41.8	49.3
Father's Current Employment (%)		
Out of work	9.3	29.1
Employed	78.1	41.4
Father absent	12.6	33.2
No earner (%)	11.6	32.0
Mother's educational attainment ^b	1.93	1.37
Social housing (%)	27.2	44.5
Mother's reading score at 7 (%)	80.1	20.6
Mother's general ability at 11 (%)	54.3	18.1
Maximum no. of cases	1,730	

a. Mother's report on child behaviour, see Appendix 2.1.

b. Mother's highest educational or vocational qualification.: 0 = none to 5 = degree

c. Data present on at least one dependent variable. N of non-missing cases for each one:

Maths: 1,506 Reading: 1,520 External Behaviour:1,570 Internal Behaviour: 1,579

Table A2.3. Variable distributions: All Cohort Members aged 26, BCS70

	Mean	Std Dev
Outcome Variables		
Maths Score at 10 a (%)	63.5	16.5
Reading Score at 10 a (%)	65.4	18.3
Teenage Motherhood (%)	5.9	23.5
Highest academic qualifications (male) ^b	2.5	1.6
Highest academic qualifications (female) ^b	2.5	1.5
Substantial unemployment (males) (%)	34.7	47.6
Substantial unemployment (females) (%)	26.9	44.3
Predictors (%)		
Child's sex: female	54.4	49.8
Mother's Employment when child pre-school age		
No known employment	36.7	48.2
Some employment	44.7	49.7
Father's social class at birth		
I	5.7	23.2
II	20.9	40.7
III Non-Manual	8.2	27.5
III Manual	32.9	47.0
IV	8.7	28.2
V	2.3	14.8
Father's age at leaving school		
After 15	33.2	47.1
Before/at 15	55.3	49.7
Mother's age at leaving school		
After 15	34.0	47.4
Before/at 15	57.4	49.4
Free school meals		
Yes	3.1	17.4
No	35.4	47.8
Rented accommodation at age 5		
Rented	27.2	44.5
Not-rented	54.6	49.8
Maximum no. of cases	9,003	

a. The maths and reading test scores range from 0 to 100

b. Highest educational qualification: 0 = none to 5 = degree

Appendix 3: Multi-Level Modelling

We used the software written by Goldstein, MLn, to recognise and exploit the hierarchical nature of the data in the NCDS Second generation. Since we have four scores per child, these data are said to be at the lowest level of a hierarchy, nested in a child, who is in turn nested in the family, represented by the mother, who may have more than one child in the study.

Algebraically, consider the simplest multivariate multilevel model specification where y_{ijk} is the outcome score, i , for an individual child, j , in family k . No explanatory variables are included, but a set of dummy variables (z_{ijk} 's) indicates which response measure is present at level 1.

We have an equation

$$y_{ijk} = b_{01}z_{1jk} + b_{02}z_{2jk} + b_{03}z_{3jk} + n_{1k} + n_{2k} + n_{3k} + u_{1jk} + u_{2jk} + u_{3jk} \quad (1)$$

which is equivalent to specifying three simple variance component models, one for each outcome, in a single formulation. The added appeal of the specification is that we are able to model the relationships between the outcomes as well as contrast the effect of controlling for the characteristics of the child and family. Associated with each intercept term (the b_0 's) are two random terms, one capturing between family residuals (the n_k 's) and another measuring residuals within families for each child (the u_{jk} 's). These define the covariance matrices at the child and family level. At the family level we have

$$\begin{aligned} \text{var}(n_{1k}) &= s^2_{v1}, \text{var}(n_{2k}) = s^2_{v2}, \text{var}(n_{3k}) = s^2_{v3} \\ &\text{and,} \\ \text{cov}(n_{1k}, n_{2k}) &= s^2_{v12}, \text{cov}(n_{1k}, n_{3k}) = s^2_{v13}, \text{cov} \\ &(n_{2k}, n_{3k}) = s^2_{v23}. \end{aligned}$$

Similarly, at the child level, $\text{var}(u_{1k}) = s^2_{u1}$ and so on. The covariances at the family level record whether families whose children have poor math scores are also those in which children have poor reading scores and poor emotional adjustment. Similarly, the covariances at the individual level, estimate whether individual children who

do poorly in reading also do poorly in maths and are judged to be poorly adjusted behaviourally by their mothers. Another important feature of these models is that the estimates are statistically efficient even when some of the children's outcomes are missing. We therefore reduce losses to our sample from incomplete data by adopting a method that allows cases to be included if up to two dependent variables are missing.

The inclusion of any additional child or family level characteristics as explanatory variables is straightforward. Algebraically, this is a natural extension of equation (1) where each new regression coefficient is multiplied by a dummy variable. Extending the model to include a child's age, x , we have:

$$\begin{aligned} y_{ijk} = & b_{01}z_{1ijk} + b_{02}z_{2ijk} + b_{03}z_{3ijk} + b_{11}z_{1ijk}x_{jk} + \\ & b_{12}z_{2ijk}x_{jk} + b_{13}z_{3ijk}x_{jk} + \\ & n_{1k} + n_{2k} + n_{3k} + u_{1jk} + u_{2jk} + u_{3jk} \quad (2) \end{aligned}$$

By systematically introducing explanatory variables we are able to assess not only the association of child and family characteristics with the three outcomes, but also their impact on the covariance structure. Both of the models described in equation (1) and (2) assume constant variance at levels 2 and 3.

Appendix 4: Regression results, 2nd Generation NCDS

Table A4.1: Detailed maternal employment history when child under 5: Estimated effects on child development at ages 5-17.

Table A4.2: Early maternal employment summary: estimated effects on child development indicators at ages 5-17.

Table A4.3: Current parental employment, details: Estimated effects on child development indicators at ages 5-17.

Table A4.4: Workless families: estimated effects on child development indicators of summary current parental employment.

Table A4.5: Detailed maternal employment history when child under 5: Estimated effects on child development at ages 5-17, no controls for housing tenure, mother's qualifications or mother's ability.

Table A4.6: Early maternal employment summary: estimated effects on child development indicators at ages 5-17, no controls for housing tenure, mother's qualifications or mother's ability.

Table A4.7: Current parental employment, details: Estimated effects on child development indicators at ages 5-17, no controls for housing tenure, mother's qualifications or mother's ability

Table A4.8 Workless families: estimated effects on child development indicators of summary current parental employment, no controls for housing tenure, mother's qualifications or mother's ability.

Table A4.9: Reduction in variance within families when mother's qualifications and test scores and tenure are included in the models.

Estimates significant at 5% shaded

Table A4.1: Detailed maternal employment history when child under 5: estimated effects on child development at ages 5-17

multivariate multi-level model
b's and β 's are multiplied by 100 t = test of significance
controlling for mother's qualifications, test scores and economic circumstances

	MATHS			READING			NON-AGGRESSION			NON-ANXIETY		
	b	β	t	b	β	t	b	β	t	b	β	t
Constant	-20.03		-10.49	-30.99		-12.94	49.71		11.75	70.90		14.76
Age	0.56	99.55	58.96	0.64	95.73	54.05	0.07	11.43	3.96	-0.10	-13.02	-4.44
Age Squared ($\div 100$)	-0.33	-25.78	-17.35	-0.35	-22.33	-14.35	0.04	2.31	0.96	0.26	14.48	5.82
Girl	-0.98	-2.46	-1.94	1.94	4.05	3.05	8.10	16.49	7.12	-4.55	-8.14	-3.39
No of older siblings	-0.82	-3.66	-2.59	-1.81	-6.70	-4.53	-2.72	-10.08	-3.87	3.01	9.84	3.70
First year of child's life												
Employed throughout	-0.97	-1.68	-1.06	-2.45	-3.54	-2.13	-0.57	-0.81	-0.27	2.19	2.75	0.91
Some employment	-0.09	-0.16	-0.11	-1.43	-1.98	-1.37	-1.25	-1.70	-0.67	-0.34	-0.40	-0.15
Employment missing	-0.81	-1.53	-0.76	-0.14	-0.22	-0.10	0.67	1.01	0.29	4.32	5.71	1.59
Child aged 1, 2, 3 and 4												
Any job part-time	0.23	0.50	0.32	0.30	0.55	0.33	1.75	3.15	1.07	3.73	5.87	1.96
Some full-time	1.57	3.09	1.82	0.60	1.00	0.56	-0.65	-1.06	-0.33	3.54	5.06	1.56
Employment missing	1.18	2.12	1.03	0.35	0.53	0.24	0.28	0.39	0.11	-3.81	-4.66	-1.27
Mother's qualifications	0.84	5.64	3.31	1.03	5.84	3.25	1.64	9.22	2.85	-0.33	-1.62	-0.50
Mother's reading at 7	4.01	4.13	2.36	8.99	7.77	4.21	3.27	2.65	0.81	-3.04	-2.18	-0.67
Mother's general ability at 11	10.83	9.74	5.22	14.55	11.00	5.59	10.01	7.30	2.08	5.21	3.35	0.95
Social Housing	-2.51	-5.66	-3.72	-4.36	-8.21	-5.15	-5.55	-9.97	-3.47	0.63	0.99	0.35
cov(m,agr) cov(m,anx)												
cov(r,agr) cov(r,anx)												
cov(agr,anx)												
UNEXPLAINED ELEMENTS												
($\div 100$)												
mother												
variance s.e												
0.23 0.04												
cov (m,r)												
variance s.e												
0.18 0.04												
0.36 0.07												
0.13 0.09												
1.61 0.23												
1.41 0.19												
1.48 0.30												
child												
variance s.e												
0.76 0.04												
0.44 0.04												
1.21 0.07												
0.25 0.07												
0.35 0.09												
3.81 0.22												
0.10 0.19												
5.88 0.33												
-2Loglikelihood	-5152.26											

Table A4.2: Early maternal employment summary: estimated effects on child development at ages 5-17

multivariate multi-level model
b's and β 's are multiplied by 100 t = test of significance
controlling for mother's qualifications, test scores and economic circumstances

	MATHS			READING			NON-AGGRESSION			NON-ANXIETY		
	b	β	t	b	β	t	b	β	t	b	β	t
Constant	-20.00		-10.68	-31.04		-13.24	50.32		12.10	71.30		15.11
Age	0.56	99.65	59.38	0.65	95.87	54.50	0.07	11.20	3.90	-0.10	-13.10	-4.50
Age Squared ($\div 100$)	-0.33	-25.68	-17.31	-0.35	-22.36	-14.40	0.03	2.14	0.89	0.26	14.63	5.88
Girl	-0.95	-2.37	-1.87	1.94	4.07	3.06	8.09	16.46	7.11	-4.60	-8.23	-3.43
No of older siblings	-0.83	-3.69	-2.63	-1.79	-6.64	-4.51	-2.67	-9.90	-3.82	2.95	9.63	3.63
Mother's Employment History												
Reference not employed												
Some employment:												
First year of child's life												
Child aged 1, 2, 3 and 4												
-0.14 -0.31 -0.22 -1.83 -3.38 -2.25 -1.46 -2.65 -1.00 -0.18 -0.28 -0.10												
0.37 0.92 0.62 0.24 0.50 0.33 0.84 1.70 0.63 4.88 8.71 3.15												
Mother's qualifications	0.83	5.57	3.28	1.03	5.82	3.25	1.67	9.36	2.91	-0.37	-1.85	-0.57
Mother's reading at 7	3.96	4.08	2.33	8.93	7.72	4.19	3.24	2.63	0.81	-2.95	-2.12	-0.65
Mother's general ability at 11	10.99	9.88	5.32	14.66	11.08	5.65	9.55	6.97	1.99	4.70	3.02	0.86
Social Housing	-2.56	-5.78	-3.80	-4.39	-8.27	-5.20	-5.58	-10.03	-3.49	0.64	1.00	0.35
ccov(m,anx)												
cov(r,anx)												
cov(agr,anx)												
UNEXPLAINED ELEMENTS												
($\div 100$)												
mother												
variance s.e												
0.23 0.04												
cov (m,r)												
variance s.e												
0.18 0.04												
0.36 0.07												
0.13 0.09												
1.62 0.23												
1.41 0.19												
1.47 0.30												
child												
variance s.e												
0.76 0.04												
0.44 0.04												
1.21 0.07												
0.24 0.07												
0.35 0.09												
3.80 0.22												
0.09 0.19												
5.89 0.33												
-2Loglikelihood	-5146.10											

Table A4.3: Current parental employment, details: estimated effects on child development indicators at ages 5-17

multivariate multi-level model
b's and β's are multiplied by 100 t = test of significance
controlling for mother's qualifications, test scores and economic circumstances

	MATHS			READING			NON-AGGRESSION			NON-ANXIETY			
	b	β	t	b	β	t	b	β	t	b	β	t	
Constant	-22.25		-10.65	-34.81		-13.24	41.38		8.83	69.27		13.01	
Age	0.57	100.43	57.42	0.66	97.52	53.06	0.09	13.52	4.47	-0.10	-14.17	-4.60	
Age Squared (÷100)	-0.33	-25.45	-17.23	-0.35	-22.42	-14.49	0.04	2.70	1.13	0.27	15.44	6.20	
Girl	-0.98	-2.45	-1.94	2.05	4.29	3.23	8.17	16.63	7.22	-4.70	-8.41	-3.51	
No of older siblings	-0.76	-3.37	-2.40	-1.60	-5.94	-4.02	-2.34	-8.67	-3.36	3.04	9.92	3.73	
Family Situation													
Reference: lone mother													
Step father	-0.04	-0.07	-0.04	0.77	1.15	0.56	3.64	5.15	1.39	0.74	0.92	0.25	
Intact	1.40	3.12	1.56	2.43	4.52	2.14	6.54	11.62	3.00	2.52	3.93	1.01	
Mother's Employment													
Reference: not employed													
Employed part time	0.63	1.57	0.81	-1.49	-3.08	-1.51	-0.20	-0.39	-0.11	4.99	8.81	2.41	
Employed full time	1.23	2.50	1.95	-0.30	-0.50	-0.38	2.70	4.47	1.85	3.62	5.24	2.18	
Father unemployed	-0.25	-0.12	-0.25	-0.14	-0.18	-0.11	-0.90	-1.05	-0.37	-0.71	-0.72	-0.26	
Mother's qualifications	0.80	5.39	3.19	0.99	5.58	3.13	1.61	9.04	2.83	-0.31	-1.55	-0.48	
Mother's reading at 7	3.89	4.00	2.29	9.18	7.94	4.29	2.48	2.01	0.62	-3.13	-2.25	-0.69	
Mother's general ability at 11	11.21	10.08	5.44	14.84	11.22	5.71	10.60	7.73	2.22	5.09	3.27	0.93	
Social Housing	-2.21	-4.99	-3.15	-3.92	-7.39	-4.44	-4.14	-7.44	-2.47	1.20	1.90	0.63	
UNEXPLAINED ELEMENTS (÷ 100)													
mother													
variance		0.22	0.04	cov (m,r)		variance		s.e		cov(m,agr)		cov(r,agr)	
				variance		s.e		variance		s.e		ccov(m,anx)	
				0.18		0.04		0.01		0.07		cov(r,anx)	
				0.37		0.07		0.11		0.09		cov(agr,anx)	
								1.57		0.23		variance	
												s.e	
												-0.10	
												0.08	
												-0.08	
												0.10	
												1.40	
												0.19	
												1.45	
												0.30	
												0.15	
												0.09	
												0.11	
												0.11	
												0.08	
												0.19	
												0.33	
												5.92	
												0.33	
-2Loglikelihood													
-5163.83													

Table A4.4: Workless families: estimated effects on child development indicators of summary current parental employment

multivariate multi-level model
b's and β's are multiplied by 100 t = test of significance
controlling for mother's qualifications, test scores and economic circumstances

OUTCOME	MATHS			READING			NON-AGGRESSION			NON-ANXIETY			
	b	β	t	b	β	t	b	β	t	b	β	t	
Constant	-20.02		-10.72	-32.25		-13.74	49.76		11.98	73.82		15.60	
Age	0.57	100.40	58.39	0.65	97.08	53.64	0.08	12.92	4.35	-0.10	-13.12	-4.35	
Age Squared (÷100)	-0.33	-25.52	-17.29	-0.35	-22.46	-14.51	0.04	2.39	1.00	0.27	15.42	6.20	
Girl	-0.97	-2.43	-1.92	2.01	4.22	3.18	8.15	16.59	7.19	-4.65	-8.31	-3.47	
No of older siblings	-0.75	-3.35	-2.40	-1.66	-6.16	-4.19	-2.43	-8.99	-3.49	3.25	10.62	4.01	
Family Situation													
Reference: intact													
Step father	-1.38	-2.45	-1.69	-1.73	-2.58	-1.69	-2.98	-4.22	-1.55	-1.34	-1.67	-0.61	
Lone mother	-0.88	-1.46	-0.94	-2.60	-3.58	-2.18	-6.08	-7.91	-2.67	-0.26	-0.29	-0.10	
Any earner	1.66	2.75	1.69	-0.58	-0.80	-0.47	1.67	2.20	0.71	6.91	8.03	2.57	
Mother's qualifications	0.80	5.41	3.22	0.95	5.40	3.03	1.57	8.81	2.77	-0.24	-1.19	-0.37	
Mother's reading at 7	3.82	3.93	2.25	9.12	7.89	4.27	2.62	2.12	0.65	-3.56	-2.55	-0.78	
Mother's general ability at 11	11.09	9.97	5.38	14.76	11.16	5.68	10.37	7.57	2.17	4.73	3.05	0.87	
Social Housing	-2.08	-4.71	-3.00	-3.89	-7.32	-4.43	-3.98	-7.15	-2.39	1.58	2.49	0.83	
UNEXPLAINED ELEMENTS (÷ 100)													
mother													
variance		0.23	0.04	cov (m,r)		variance		s.e		cov(m,agr)		cov(r,agr)	
				variance		s.e		variance		s.e		ccov(m,anx)	
				0.18		0.04		0.01		0.07		cov(r,anx)	
				0.37		0.07		0.11		0.09		cov(agr,anx)	
								1.56		0.23		variance	
												s.e	
												-0.11	
												0.08	
												-0.08	
												0.10	
												1.38	
												0.19	
												1.48	
												0.30	
												0.15	
												0.09	
												0.11	
												0.11	
												0.10	
												0.19	
												5.89	
												0.33	
-2 Loglikelihood													
-5154.60													

Table A4.5: Detailed maternal employment history when child under 5: estimated effects on child development at ages 5-17, no controls for housing tenure, mother's qualifications or mother's ability

		b= impact on score out of 100				t = test of significance			
		Full maternal employment history when child under 5							
OUTCOME	MATHS		READING		NON-AGGRESSION		NON-ANXIETY		
	b	t	b	t	b	t	b	t	
Constant	-5.54	-4.00	-8.3	-4.67	66.00	23.61	70.5	22.49	
Age	0.53	56.04	0.6	49.37	0.03	1.62	-0.09	-4.57	
Age Squared ($\div 100$)	-0.33	-16.90	-0.35	-13.82	0.03	0.86	0.26	5.79	
Girl	-1.14	-2.19	1.70	2.55	8.03	6.98	-4.62	-3.45	
No of older siblings	-1.55	-4.85	-2.90	-7.03	-3.95	-5.74	3.08	3.92	
First year of child's life									
Employed throughout	-0.99	-1.04	-2.51	-2.04	-0.16	-0.08	2.11	0.88	
Some employment	0.34	0.40	-0.76	-0.69	-0.47	-0.25	-0.32	-0.15	
Employment missing	-2.20	-2.01	-2.21	-1.59	-0.69	-0.29	4.35	1.61	
Child aged 1, 2, 3 and 4									
Any job part-time	0.99	1.32	1.43	1.48	3.01	1.83	3.50	1.86	
Some full-time	2.52	2.81	2.01	1.75	0.65	0.33	3.39	1.50	
Employment missing	1.33	1.12	0.54	0.36	0.48	0.18	-3.87	-1.29	
UNEXPLAINED ELEMENTS ($\div 100$)		variance	s.e	cov (m,r)	s.e	cov(m,agr)	s.e	ccov(m,anx)	s.e
mother		0.34	0.05	0.35	0.05	0.16	0.08	cov(r,anx)	0.09
				0.64	0.08	0.35	0.10	cov(agr,anx)	0.11
						1.82	0.24		0.20
child		0.77	0.05	0.44	0.04	0.25	0.07		1.46
				1.20	0.07	0.35	0.09		0.14
						3.81	0.22		0.08
									0.07
									0.19
									5.90
									0.33
-2Loglikelihood		-4898.10							

Table A4.6: Early maternal employment summary: estimated effects on child development indicators at ages 5-17, no controls for housing tenure, mother's qualifications or mother's ability

		b= impact on score out of 100				t = test of significance			
		Full maternal employment history when child under 5							
OUTCOME	MATHS		READING		NON-AGGRESSION		NON-ANXIETY		
	b	t	b	t	b	t	b	t	
Constant	-5.65	-4.12	-8.69	-4.91	66.2	23.96	70.47	22.74	
Age	0.53	56.39	0.60	49.67	0.03	1.53	-0.09	-4.59	
Age Squared ($\div 100$)	-0.33	-16.89	-0.35	-13.91	0.03	0.77	0.26	5.86	
Girl	-1.14	-2.19	1.65	2.49	8.00	6.96	-4.67	-3.49	
No of older siblings	-1.59	-4.98	-2.93	-7.12	-3.92	-5.72	3.04	3.88	
Mother 's Employment History									
Reference not employed									
Some employment									
First year of child's life	0.43	0.64	-0.97	-1.13	-0.53	-0.36	-0.22	-0.13	
Child aged 1, 2, 3 and 4	1.13	1.85	1.37	1.75	2.02	1.51	4.67	3.04	
UNEXPLAINED ELEMENTS ($\div 100$)		variance	s.e	cov (m,r)	s.e	cov(m,agr)	s.e	ccov(m,anx)	s.e
mother		0.34	0.05	0.36	0.05	0.16	0.08	cov(r,anx)	0.09
				0.64	0.08	0.35	0.10	cov(agr,anx)	0.11
						1.83	0.24		0.20
child		0.77	0.05	0.44	0.04	0.25	0.07		1.45
				1.20	0.07	0.35	0.09		0.14
						3.81	0.22		0.08
									0.07
									0.19
									5.92
									0.33
-2Loglikelihood		-4890.73							

Table A4.7: Current parental employment, details: estimated effects on child development indicators at ages 5-17, no controls for housing tenure, mother's qualifications or mother's ability

OUTCOME	b= impact on score out of 100				t= test of significance			
	Current maternal employment and whether father unemployed							
	MATHS		READING		NON-AGGRESSION		NON-ANXIETY	
	b	t	b	t	b	t	b	t
Constant	-8.46	-5.04	-13.36	-6.14	55.48	15.78	69.23	17.46
Age	0.53	54.44	0.61	48.37	0.05	2.42	-0.10	-4.69
Age Squared ($\div 100$)	-0.33	-16.64	-0.35	-13.80	0.04	1.16	0.27	6.15
Girl	-1.23	-2.37	1.67	2.52	7.98	6.99	-4.77	-3.56
No of older siblings	-1.47	-4.60	-2.65	-6.44	-3.41	-4.99	3.13	3.97
Family Situation								
Reference: lone mother								
Step father	1.21	1.06	2.87	1.92	5.52	2.11	0.41	0.14
Intact	2.51	2.70	4.36	3.59	8.75	4.13	1.89	0.79
Mother's Employment								
Reference: not employed								
Employed part time	2.00	2.42	0.56	0.52	1.53	0.84	4.76	2.33
Employed full time	1.52	2.26	0.12	0.14	3.03	2.04	3.59	2.16
Father unemployed	-1.83	-1.73	-2.79	-2.01	-3.57	-1.48	-0.25	-0.09
UNEXPLAINED ELEMENTS								
($\div 100$)								
	variance	s.e	cov (m,r)		cov(m,agr)		ccov(m,anx)	
mother	0.33	0.05	variance	s.e	cov(r,agr)		cov(r,anx)	
			0.34	0.05	0.13	0.08	cov(agr,anx)	
			0.63	0.08	0.30	0.10	variance	s.e
					1.73	0.23	-0.09	0.09
							-0.06	0.11
child	0.77	0.05	0.44	0.04	0.25	0.07	1.41	0.20
			1.19	0.07	0.35	0.09	1.44	0.30
					3.81	0.22	0.14	0.09
							0.09	0.11
							0.06	0.19
							5.93	0.33

Table A4.8 Workless families: estimated effects on child development indicators of summary current parental employment, no controls for housing tenure, mother's qualifications or mother's qualifications or mother's ability

OUTCOME	b= impact on score out of 100				t= test of significance				
	Any earner								
	MATHS		READING		NON-AGGRESSION		NON-ANXIETY		
	b	t	b	t	b	t	b	t	
Constant	-5.18	-3.98	-8.96	-5.32	65.91	25.17	72.68	24.55	
Age	0.54	55.44	0.61	48.96	0.04	2.41	-0.09	-4.36	
Age Squared ($\div 100$)	-0.33	-16.70	-0.35	-13.83	0.04	1.04	0.27	6.17	
Girl	-1.21	-2.33	1.65	2.49	7.99	6.99	-4.70	-3.51	
No of older siblings	-1.40	-4.40	-2.63	-6.40	-3.39	-4.96	3.36	4.26	
Family Situation									
Reference: intact									
Step father	-1.15	-1.34	-1.44	-1.30	-3.17	-1.64	-1.01	-0.46	
Lone mother	-0.99	-1.00	-2.95	-2.26	-6.75	-2.96	0.25	0.10	
Any earner	3.90	3.83	3.00	2.24	4.92	2.10	6.39	2.46	
UNEXPLAINED ELEMENTS									
($\div 100$)									
	variance	s.e	cov (m,r)		cov(m,agr)		ccov(m,anx)		
mother	0.33	0.05	variance	s.e	cov(r,agr)		cov(r,anx)		
			0.34	0.05	0.13	0.08	cov(agr,anx)		
			0.63	0.08	0.31	0.10	variance	s.e	
					1.73	0.23	-0.09	0.09	
							-0.06	0.11	
child	0.76	0.05	0.44	0.04	0.25	0.07	1.46	0.30	
			1.20	0.07	0.35	0.09	0.13	0.09	
					3.82	0.22	0.07	0.11	
							0.07	0.19	
							5.92	0.33	
-2Loglikelihood	-4918.60								

Table A4.9: Reduction in variance within families when mother's qualifications, test scores and tenure are included in the models

	Percentage reduction in variance	
	Mother level	Child level
1. Maternal employment when child under 5: detailed specification		
Maths	32.3	0.5
Reading	43.8	-0.9
Non-aggression	11.5	0.1
Non-anxiety	-1.5	0.5
2. Summary early maternal employment		
Maths	32.7	0.5
Reading	43.9	-1.0
Non-aggression	11.5	0.1
Non-anxiety	-1.6	0.5
3. Current parental employment: detailed specification		
Maths	33.3	1.3
Reading	41.3	-1.7
Non-aggression	9.2	0.3
Non-anxiety	-0.7	0.2
4. Current parental employment: workless family specification		
Maths	31.4	0.3
Reading	41.7	-1.0
Non-aggression	9.7	0.1
Non-anxiety	-1.1	0.4

Appendix to Chapter 5 *Estimates significant at 5% shaded*

Table A5.1: Estimated impact on maths and reading attainment at 10, 1970 Birth Cohort

	b's and β's multiplied by 100 t = test of significance					
	Maths at age 10			Reading at age 10		
	b	β	t	b	β	t
Constant	78.35		92.74	78.97		83.55
Girl	-2.46	-7.45	-6.60	1.74	4.72	4.17
Mother's employment history reference: no employment						
some employment	0.14	0.41	0.34	0.42	1.15	0.94
employment missing	-2.54	-5.14	-1.32	-3.53	-6.40	-1.64
Father's social class at birth reference: class I						
II	-2.56	-6.50	-2.95	-2.56	-5.83	-2.63
III Non-Manual	-3.56	-6.17	-3.54	-3.17	-4.94	-2.83
III Manual	-6.58	-19.22	-7.33	-6.33	-16.58	-6.30
IV	-8.27	-14.86	-7.99	-8.09	-13.07	-6.99
V	-12.59	-11.83	-8.54	-11.46	-9.63	-6.93
missing	-5.68	-12.12	-5.90	-5.47	-10.45	-5.06
Father left school before/at15 missing	-4.59	-13.63	-9.64	-4.89	-13.04	-9.18
missing	-5.87	-7.00	-5.38	-6.01	-6.41	-4.92
Mother left school before/at15 missing	-4.39	-12.89	-9.88	-5.68	-14.96	-11.41
missing	-4.11	-2.48	-1.98	-3.49	-1.86	-1.48
Free school meals missing	-4.54	-5.19	-4.36	-5.58	-5.73	-4.79
missing	-1.71	-5.18	-4.40	-2.09	-5.68	-4.81
Rented Accommodation missing	-3.86	-10.66	-8.49	-4.51	-11.19	-8.87
missing	0.06	0.11	0.03	1.21	2.16	0.55
	N=6,658			N=6,654		
Adj R ²	0.15			0.15		

Table A5.2: Estimated effects in young adults born in 1970
Logistic Regressions

	Teenage Motherhood*		Substantial Unemployment**			
	Odds Ratio	z	Women Odds Ratio	z	Men Odds Ratio	z
Mother's employment history reference: no employment						
some employment	1.09	0.69	0.95	-0.62	0.98	-0.25
employment missing	1.95	1.28	1.88	1.75	1.07	0.20
Father's social class at birth reference: class I						
II	1.96	1.26	1.23	1.14	0.97	-0.21
III Non-Manual	2.87	1.92	1.19	0.82	1.22	1.07
III Manual	2.87	2.01	1.43	1.95	1.38	1.92
IV	3.16	2.13	1.85	3.06	1.46	1.93
V	4.66	2.66	2.55	3.43	1.91	2.47
missing	3.09	2.14	1.36	1.68	1.33	1.67
Father left school before/at 15	1.42	2.17	1.07	0.75	1.08	0.88
missing	2.03	2.47	2.08	4.01	1.81	3.14
Mother left school before/at 15	1.35	2.01	1.11	1.28	1.06	0.66
missing	0.85	-0.49	0.70	-1.70	0.66	-1.96
Reading scores at 10	0.14	-4.08				
missing	0.36	-1.17				
Maths scores at 10	0.58	-0.95				
missing	2.65	1.12				
Free school meals	1.46	1.51	1.62	2.59	2.03	3.64
missing	0.95	-0.42	1.17	2.10	1.09	1.17
Rented Accommodation	2.00	5.29	1.57	5.53	1.23	2.49
missing	1.12	0.21	0.78	-0.67	1.14	0.38
	N=4612		N=4740		N=4028	
	* Women only		** Longest spell 16-26 at least 4 months			
-2loglikelihood	2493.4		5323		5086.4	

Table A5.3: Estimated effects on educational attainment at 26 (BCS70)

b= impact on educational attainment (measured as level of highest qualification)

	Women			Men		
	b	β	t	b	β	t
Constant	1.36		9.83	1.42		9.25
Mother's employment history reference: no employment						
some employment	-0.10	-0.04	-2.56	-0.12	-0.04	-2.54
employment missing	0.05	0.01	0.27	-0.32	-0.08	-1.45
Father's social class at birth reference: class I						
II	-0.35	-0.10	-4.13	-0.50	-0.13	-5.24
III Non-Manual	-0.52	-0.10	-5.21	-0.61	-0.11	-5.50
III Manual	-0.72	-0.23	-8.23	-0.71	-0.21	-7.11
IV	-0.63	-0.12	-6.12	-0.80	-0.14	-6.71
V	-0.92	-0.09	-5.90	-0.78	-0.07	-4.52
missing	-0.57	-0.16	-6.33	-0.62	-0.16	-6.08
Father left school before/at 15	-0.34	-0.12	-7.23	-0.35	-0.11	-6.19
missing	-0.25	-0.05	-2.27	-0.34	-0.07	-2.77
Mother left school before/at 15	-0.42	-0.14	-9.55	-0.55	-0.17	-10.40
missing	-0.20	-0.04	-1.60	0.13	0.02	0.87
Reading scores at 10	1.79	0.18	10.45	1.56	0.16	7.81
missing	0.04	0.01	0.12	0.18	0.05	0.57
Maths scores at 10	1.92	0.18	10.04	2.26	0.21	10.26
missing	-0.04	-0.01	-0.12	-0.17	-0.05	-0.51
Free school meals	-0.20	-0.02	-1.70	-0.31	-0.03	-2.32
missing	-0.14	-0.05	-3.56	-0.15	-0.05	-3.06
Rented Accommodation	-0.31	-0.09	-6.79	-0.29	-0.08	-5.42
missing	-0.16	-0.04	-0.77	0.17	0.04	0.77
	N=4598			N=3801		
Adj R ²	0.30			0.32		