



Economic deprivation, maternal depression, parenting and children's cognitive and emotional development in early childhood¹

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Abstract

This study uses data from the UK Millennium Cohort Study to examine the extent to which economic circumstances in infancy and mother's mental well-being are associated with children's cognitive development and behaviour problems at age 3 years, and what part parenting behaviours and attitudes play in mediating these factors. The analyses derived from Structural Equation Modelling show that economic deprivation and maternal depression separately and collectively diminish the cognitive and emotional well-being of children, and part of this diminution emanates from less nurturing and engaged parenting by those with less economic and emotional resources.

Keywords: Poverty; maternal depression; parenting; cognitive development; behaviour problems; Structural Equation Modelling

Introduction

Several decades of social science research has shown that children growing up in deprived circumstances do not fare well and that where one starts from in life is a key, but not exclusive, determinant of life chances (Atkinson, Maynard and Trinder 1983; Duncan and Brooks-Gunn 1997; Heckman 2006). Moreover, there is ample evidence that children's cognitive and emotional competencies are affected by living in impoverished socio-economic environments (Shonkoff and Phillips 2000; NICHD 2005) and differences are already observable early in a child's life. For example, longitudinal studies in the UK and Australia have shown that differences in cognitive scores amongst children living in poverty are already to be seen in early childhood, even before

children start school, (Feinstein 2003) and poverty has been found to be associated with behaviour problems in children as young as age 5 (Bor et al. 1997).

Two perspectives or frameworks have been proposed to explain these findings which are frequently referred to as the family investment model and the family stress model (Conger and Elder 1994). The family investment model posits that income is associated with positive child development as it enables families to purchase the materials, experiences and services that benefit a child's development and well-being. From this perspective, low incomes adversely affect children by reducing the quantity and quality of investments in children, including time spent on child rearing. It is referred to as an investment model as it explains the income effects through the purchase of goods and services made by parents that can be used to invest in the human capital of their children (Becker 1981; Becker and Tomes 1986; Haveman and Wolfe 1994; Mayer 1997; Blau 1999). Although, this kind of economic theory provides a guide as to how low, or changes, in economic status might affect the level of material investments in children, it does not address how economic circumstances might affect the quality of parenting. In contrast the family stress model posits that low income influences a child's development through its impact on parental mental health which then influences parenting practices which in turn are associated with the child outcomes (Elder and Caspi 1988; Conger, Rueter and Conger 2000). Moreover, from the standpoint of a child, both the economic situation of their parents and their mental health could be regarded as parental resources that have the potential to affect their well-being.

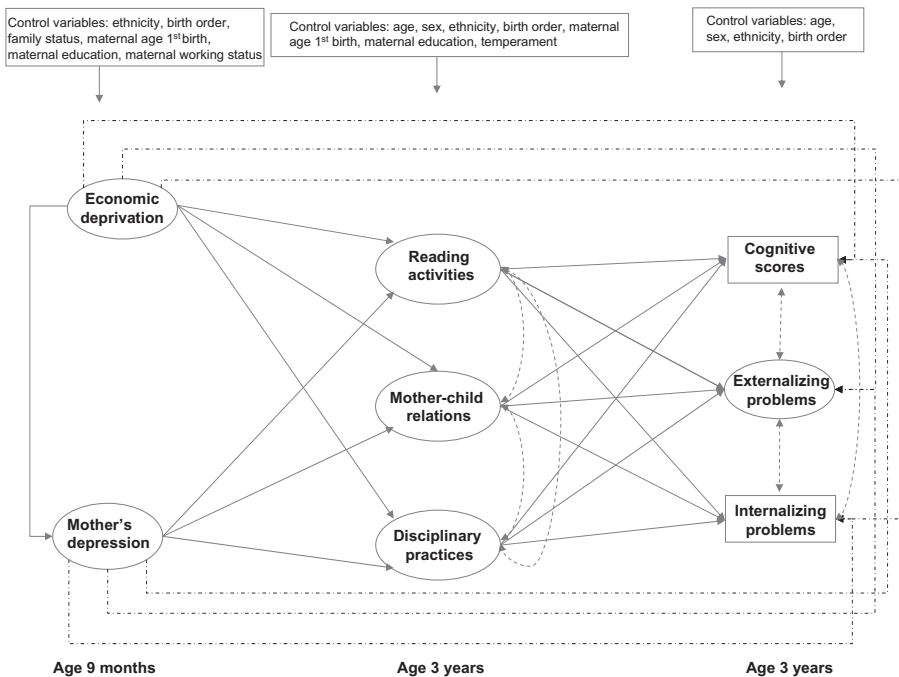
Research on child well-being is complicated by the fact that economic resources and the mental health of parents are not independent of each other. So for example, studies following on from the pioneering work by Brown and Harris (1978) have consistently shown associations between maternal depression and a range of socio-economic factors including low income, financial problems, receipt of benefits, housing tenure and manual social class (Reading and Reynolds 2001). The consensus that has emerged is that socio-economic deprivation, however measured, has a pervasive influence on maternal depression.

Other research reported in the psychological literature has shown that higher levels of maternal depression are associated with adverse outcomes in infancy and early childhood such as language and cognitive deficits and behavioural problems (Pettersen and Albers 2001). The evidence points to depressed mothers experiencing more difficulties in parenting. Compared with non-depressed mothers depressed women's parenting behaviour is characterized as being less responsive and less positive towards their children which has been linked with behaviour problems in children including externalizing behaviours of aggression and acting out (Fergusson and Lynskey 1993; Kim-Cohen et al. 2005) and internalizing disorders of withdrawal and anxiety (LaFreniere and

Dumas 1992). Another line of research has shown that socio-economic circumstances and maternal depression vary according to family type: lone-mother families are typically more financially impoverished than two-parent families (Millar and Ridge 2001) and lone mothers have higher rates of reported depression than partnered mothers (Brown and Moran 1997; Targosz et al. 2003).

In this paper we use data from the UK Millennium Cohort Study to examine the extent to which economic circumstances in infancy and mother's mental well-being are associated with children's cognitive development and internalizing and externalizing behaviours at age 3 years, and what part parenting plays in mediating these factors. Our statistical model in pictorial form is shown in Figure I which includes the focal, mediating and outcome factors we will be considering in our analyses. Structural equation modelling methods are used to assess the extent to which these factors directly and indirectly affect a child's development. Additionally, given that children growing up in a lone-mother family are more likely than children living with both parents to be living in more economically impoverished circumstances and that lone mothers are more likely to suffer from depression, we also examine whether the pathways and mediators differ for these families. There is a great deal of research on child development, poverty, maternal depression and parenting behaviours but rarely has it been organized conceptually in the way proposed here. As far as

Figure I: Hypothesized pathways



we know this type of study has not been done for a British sample of children and even in the USA such studies are rare due to lack of appropriate data. Examples from the USA which have used a similar statistical approach include Guo and Harris's (2000) study of children's intellectual development using the NLSY; Linver et al.'s (Linver, Brooks-Gunn and Kohen 2002) study which examined cognitive development and child behaviour problems for a small sample of low birth weight premature infants; and the study by Gershoff et al. (2007) which used the first wave of data from the Early Childhood Longitudinal Study to examine the cognitive and emotional well-being of 6 year old children.

Data

The data for this study come from the Millennium Cohort Study (MCS), which is a large-scale survey of children born in the four constituent countries of the UK. The first sweep (MCS1) was carried out during 2001–2 and contained information on 18,819 babies in 18,533 families, collected from the parents when the babies were 9–11 months old. The sample design allowed for over-representation of families living in areas with high rates of child poverty and in areas with high proportions of ethnic minorities in England, and the three smaller countries of the UK. The families were followed up when the child was age 3 years (the majority of children were aged 3–9 months at interview) and the overall achieved response rate at this wave (MCS2) was 78 per cent of the target sample. Detailed information on the sampling strategy and response rates for the surveys can be found in Plewis et al. (2004) and Plewis and Ketende (2006). Full details on the survey, its origins, objectives, sampling and content of the surveys are contained in the documentation attached to the data deposited with the UK Data Archive at Essex University (UK Data Archive 2004 and 2006). In this study we use information from both waves which includes interview data mainly collected from the mother of the cohort children and cognitive tests administered to the cohort child. The total number of cases for whom we have information at both ages was 15,808. We further restricted the sample to one child per family for the 208 cases where there were twins or triplets, and only included children who could understand a story in English (1,359 excluded) and who lived with both their biological parents or in a lone mother family. This gave us a working sample of 13,877 children. Given the stratified nature of the sample, sampling weights were used in all the analyses.

Methods

Structural Equation Modelling (SEM) was used to examine the relationships between parental resources, which include both economic and psychological

well-being, parenting behaviours and child outcomes. For this type of analysis SEM offers several advantages over more traditional statistical approaches. Firstly, SEM allows the examination of associations between multiple outcomes instead of just estimating separate regressions for each single outcome (Kline 2005). Consequently, we were able to examine simultaneously the effect of parental resources on three parenting practices and the effect of these behaviours on three child outcomes. Secondly, SEM allows the measurement of latent variables that may better capture underlying constructs as compared with single variable observations (Kline 2005). In this study, we examine six constructs which are discussed in the next section (economic deprivation, mother's depression, parent's reading activities, mother-child relations, disciplinary practices, and externalizing problems). Thirdly, SEM allows the disaggregation of the total effect of the explanatory variables into direct effects (effects that go directly from one variable to another) and indirect effects (effects between two variables that are mediated by at least one intervening variable) (Bollen 1989). Here, our interest is in identifying mediating routes between parental resources and child outcomes. Fourthly, the SEM approach allows the testing of group differences, so in this study we are able to examine differences between lone-parent families and intact families. Structural Equation Modelling is a multivariate technique with two primary components: a measurement model and a structural model. The former consists of a factor analysis in which observed variables are explained by a smaller number of latent constructs and the latter provides estimates of the relationships between the different variables (latent and observed) in the model (Bollen 1989). The software Mplus was used to fit the SEM models (Muthén and Muthén 1998–2005).

Measurement of variables

Building on the extant research literature our analysis included three outcome variables (cognitive scores, and measures of externalizing and internalizing problems), two focal variables (economic resources and mother's depression), three mediators (parent's reading activities, the extent to which the mother has a positive relationship with her child, and type of disciplinary practices used by the mother), and a set of background control variables. As explained below we examined most of these variables via latent constructs, the exceptions being the child's cognitive scores and the extent to which they had internalizing problems.

Table I presents the results for the measurement component of our model (i.e. a confirmatory factor analysis). The first column displays the standardized parameter estimates, which represent the factor loadings between the latent constructs and the observed indicators. The second column shows the value of

Table I: Measurement model

	<i>Std. Est.</i>	<i>Std Est./SE</i>	<i>R</i> ²
Children's outcomes			
<i>Externalizing problems</i>			0.57
Conduct problems	0.76	0.0	
Inattention/ hyperactivity	0.60	31.9***	
<i>Internalizing problems</i>	1.00	0.0	0.08
<i>Bracken scores</i>	1.00	0.0	0.30
Parental resources			
<i>Economic deprivation</i>			0.62
Income poverty	0.87	0.0	
Housing tenure	0.78	40.7***	
Financial difficulties	0.55	34.8***	
Mother's depression			
Low or sad for 2 weeks since birth of child	0.83	0.0	0.17
Doctor diagnosed depression	0.71	36.3***	
Malaise score	0.84	36.6***	
Parenting constructs			
<i>Reading activities</i>			0.47
Mother often reads	0.67	0.0	
Family member reads	0.58	20.2***	
Family member takes to library	0.49	20.9***	
<i>Mother-child relations</i>			0.14
Warm, affectionate	0.71	0.0	
Child will seek comfort from me	0.55	23.9***	
Child values relationship with me	0.73	27.5***	
When praise child he/she beams with pride	0.64	27.1***	
Child spontaneously shares information with me	0.72	29.8***	
Easy to be in tune with child feelings	0.67	28.4***	
Child openly shares feelings/experiences	0.76	30.0***	
<i>Disciplinary practices</i>			0.06
Smack child	0.76	0.0	
Shout at child	0.61	24.0***	

Note: Statistical significance: *** $p < 0.001$

the parameter estimate divided by its standard error (i.e. a critical ratio²). From these values, it is clear that the measured variables exhibit strong and significant relationships with their latent constructs (factor loadings ranging between 0.49 and 0.87 with $p < 0.001$). The third column shows the R-square values which indicate how much of the variance is explained by the factor. The table in the Appendix provides information on the frequency distributions of the variables included in the models.

Outcome measures

At the three-year-old interview the children's stage of cognitive development was assessed via six tests of the *Bracken Basic Concept Scale* (BBCS) administered to the children which assessed comprehension of: colours, letters, numbers, sizes, comparisons of objects and shapes which provide an indication

of the child's readiness for formal schooling (Bracken 2002). The raw scores from these tests were added up, normalized and grouped into 5 categories: very delayed, delayed, average, advanced, and very advanced. For example, 11 per cent of children had scores in the delayed and very delayed categories.

Behavioural adjustment was also assessed at age 3 with the Strengths and Difficulties Questionnaire (Goodman 1997), a 25 item behavioural screening questionnaire on 5 different dimensions of children's behaviour: conduct problems, inattention/hyperactivity, emotional symptoms, peer problems, and pro-social behaviour. Each attribute was rated by the mother using a scale from 0 to 2 (not true, somewhat true, and certainly true). Responses were summed up to provide a total score for each dimension. In this study, we examined the externalizing and internalizing dimensions of the children's behaviour, the former includes the responses to the sections on conduct problems and inattention/hyperactivity, and the latter responses to the section on emotional symptoms. The attributes measuring externalizing behaviour were for conduct problems: often fights, often has temper/tantrums, generally obedient, argumentative with adults, can be spiteful to others; inattention-hyperactivity: restless/overactive, constantly fidgeting, easily distracted, can stop and think out before acting, sees tasks through to end. Emotional symptoms included: often unhappy, often complains of headaches, many worries, nervous or clingy, many fears.

Amongst the children in this sample, the average score for conduct problems at age 3 was 2.6, with inattention problems 3.9, and with emotional problems 1.3 (range between 0 and 10) and these continuous measures were used in the SEM models. However, as guide to the extent of these problems we calculated the proportion of children with high scores on each behavioural problem using the cut-off points recommended by Goodman (Goodman 1997) as 4 or more on the conduct problem scale, 7 or more on the inattention-hyperactivity scale and 5 or more on the emotional symptom scale. On these calculations mothers report 30 per cent of children with conduct problems, 13 per cent with inattention problems, and 3 per cent with internalizing problems.

Conduct problems and inattention/hyperactivity were combined using confirmatory factor analysis to provide an externalizing problems construct. The goodness of fit measures showed that conduct problems and inattention/hyperactivity were sufficiently related to reliably form the externalizing problems latent variable. The standardized parameter estimates for conduct problems ($\beta = 0.76$, $p < 0.001$) and inattention/hyperactivity ($\beta = 0.60$, $p < 0.001$) (shown in Table I) indicate that these variables are good measures of the behavioural construct. On the other hand, the summary measure of emotional symptoms was used as a single indicator for assessing internalizing problems.

It should be noted that there is an important difference in the way the information was collected for our two outcome measures: the cognitive scores were derived from tests administered to the child whereas the behaviour

assessments came from mothers' reports. Hence, mothers' depression may be correlated with our measures of children's behaviour in that depressed mothers may report more difficulties than a non-depressed mother. However, a research review of a range of studies by Richters (1992) has indicated that there is no clear evidence that mothers report's negatively distort or provide biased reports of their children's behaviours. None the less, we try to take into account this potential association by including indicators of mothers' mental health measured at an earlier point in time (at the first wave when the children were age 9 months) rather than mother's depression measured at age 3 years, notwithstanding that a subset of the mothers were depressed on both occasions.

Focal variables

Economic deprivation

The economic deprivation construct included three measures from information collected when the child was age 9 months namely: income-poverty, financial difficulties and housing tenure. For the measure of *income-poverty* we identified the cohort members who were living in poverty with an indicator variable that had a value of 1 if the family's income was below the conventional poverty line (i.e. below 60 per cent of national median income before housing costs) and 0 otherwise. We used a dichotomous variable³ instead of a continuous measure as there is some evidence that the association between income and children's cognitive development is nonlinear (Duncan and Brooks-Gunn 1997). In this sample, 23 per cent of cohort members were classified as living below this poverty line. For *financial difficulties*, we identified families with financial constraints using parents' self-assessment reports. We constructed a binary variable with a value of 1 if family's financial situation was considered to be 'quite difficult' or 'very difficult' and 0 otherwise. Our estimates indicate that 9 per cent of children in our sample were growing up in a family that reported having financial difficulties. For *housing tenure*, we divided the children living in 'publicly subsidized housing' from those living in other types of housing (including owner occupation, buying and private renting). Fourteen per cent of the children lived in social housing. The measurement model for this construct suggested that the observed variables used for assessing parent's economic deprivation were reliable measures of the underlying construct with the value of the standardized parameters ranging from 0.55 to 0.87 ($p < 0.001$) (see Table I).

Mother's depression

The construct for mother's depression was derived from three items of information collected at the first sweep of the survey when the children were

around 9 months old which included: information on whether the mother reported postnatal depression; whether the mother had been diagnosed with depression by a doctor and a summary variable derived from a short form with 9 items from the Rutter Malaise Inventory (Kelly et al. 2004). According to these measures, 32 per cent of mothers suffered from postnatal depression, 24 per cent had been diagnosed with depression by a doctor, and 15 per cent had a malaise score of at least 4 points. The measurement model showed that these three measures formed a reliable latent construct. The standardized loadings were strong and significant (as shown in Table I), with values ranging from 0.71 to 0.84 ($p < 0.001$).

Mediating factors: parenting measures

Three measures of parenting were included in the models: reading activities; whether the mother had a positive relationship with her child and whether she used harsh disciplinary practices.

Reading activities

The reading activities construct was derived from three items on the family's involvement in reading activities at age 3 namely: i) how often the mother reads to the child, ii) whether another family member reads to the child and iii) whether a family member takes the child to a library. The first variable was treated as a categorical variable with responses ranging from 1 (never) to 6 (every day). The second and third variables were treated as binary with a value of 1 if the parents or another family member engaged in reading activities with the child and 0 otherwise. In our sample, 63 per cent of the mothers reported reading daily to their children, 87 per cent of the children had a family member who also read to her/him, and 45 per cent of the children had been taken to the library by a member of the family. The estimates from the measurement model again showed (Table I) that these variables provided a reasonable reading activities construct with the standardized parameter estimates ranging from $\beta = 0.49$ to $\beta = 0.67$ (with $p < 0.001$).

Mother-child relations

The mother-child relations construct was derived from the Pianta scale, an inventory used to assess aspects of the mother-child relationships which includes 7 questions which indicate whether the mother has a positive approach to her child and 8 that indicate a negative approach (Pianta 1995). The information was collected from mother's reports at the age 3 wave, with responses rated using a 5 point Likert scale (from definitely does not apply to definitely applies). The positive dimension is used in our analysis and was

derived from responses to the following items: a) has an affectionate and warm relationship; b) child seeks comfort from her/his mother; c) child values relationship with her/his mother; d) when praised the child beams with pride; e) child spontaneously shares information with her/his mother; f) it is easy to be in tune with the child's feelings; g) child openly shares feelings/experiences. Almost one in two of the mothers assessed their relationship with their child as being very positive in that the proportion of mothers answering 'definitely applies' to all the items was 48 per cent. The measurement model for this construct revealed that the loadings of all items used to assess *mother-child relations* were strong and statistically significant (shown in Table I), with standardized parameter estimates ranging between 0.55 to 0.76 $p < 0.001$.

Disciplinary practices

The latent variable on disciplinary practices was measured using information also collected at the age 3 which included two items on smacking and shouting taken from the conflict tactic scale: (Straus et al. 1998) which were 'How often do you smack him/her' and 'shout at the child if they are naughty'. The possible responses were: never, rarely, once a month once a week or more or daily. The standardized parameter estimates were respectively $\beta = 0.61$ and $\beta = 0.76$ (with $p < 0.001$) for smacking and shouting (see Table I). As a guide to the prevalence of these behaviours 9 per cent of mothers reported smacking their child at least once a week and 17 per cent reported shouting at the child every day.

Background controls

The background controls included a set of demographic characteristics of the child including their sex, age in months at the three year old interview, birth order and ethnic group. We also took into account the family status at birth, in terms of whether the child was born into a two parent family or a lone parent family and the age of the mother at the time of the birth; as well mother's level of educational attainment and her working status at 9 months. A measure of the child's behaviour and temperament at age 9 months derived from the Carey Infant Temperament Scale (Carey and McDevitt 1977) was also included in order to take some account of the possibility of a reciprocal effect between parenting practices and children's behaviour at age 3.

Missing values

In fitting the Structural Equation Models, missing information was taken into account using the Maximum Likelihood (ML) method provided by MPLUS (Muthén and Muthén 1998–2005). The ML technique assumes data are missing at random for continuous, binary, and categorical variables. Moreover, when

using weighted least squares estimators (WLSMV) for categorical data (as we do in this study), the model is estimated conditioned on the covariates. That is, Mplus employs list wise deletion on cases with missing information on covariates. When fitting our models, the software excluded 2,016 cases with missing data (due to item non-response or don't know answers) on ethnicity, birth order, mother's age at first birth, mother's education, and the three measures of child temperament at 9 months. Most cases with missing data were attributable to the children's temperament variables (1,393 cases). To avoid deleting these cases we used the Mplus option to specify the variances of the temperament measures to have a standard normal distribution. We found that the results with and without controlling for missing values on temperament were very similar. Hence, our preferred model was the one with the larger sample size.

Hypothesized model

Figure I illustrates our hypotheses on the potential relationships between our focal, mediating and outcome variables and constructs. Latent variables are represented in ovals, observed variables in boxes, direct paths in solid lines, except for the direct paths between economic deprivation and maternal depression and the child outcomes which are represented with dotted lines, and correlations between variables with double arrows.

From a family investment perspective we hypothesize that the influence of parental resources (as measured using economic deprivation and mother's depression at age 9 months) has an indirect effect on children's development at age 3 (i.e. cognitive scores, externalizing and internalizing behavioural problems) mainly through its influence on parenting behaviours (i.e. reading related activities, having positive parent-child relations and disciplinary practices). Additionally, we examine whether parental resources influence child outcomes through other mechanisms not covered in our analysis by including a direct path between parental resources and child outcomes (see dotted lines in Figure I).

On the other hand, from a family stress perspective, we hypothesize that economic deprivation has an impact on parenting behaviours through its influence on mother's emotional well-being. To examine this potential mediating effect the model includes a direct path between economic deprivation and maternal depression.

This model also takes into account possible correlations between the three parenting behaviours. We assume that parents who read more to their children may also have more positive relationships with their offspring, and that they may also be less likely to use more severe disciplinary practices. Similarly, it is hypothesized that there may be a concurrent association between the three

child outcomes such that children with poorer behavioural adjustment might also have poorer cognitive performance.

Finally, the model includes control variables to take into account possible differences in individual characteristics. Economic deprivation and mother's depression includes controls for ethnicity, birth order, mother's age at first birth, marital status at the time of the birth and mother's educational level. Parenting behaviours includes: sex and age of the child, ethnicity, mother's age at first birth, birth order, and behaviour and temperament at age 9 months. The child outcomes include: sex, age, ethnicity, mother's age at first birth and birth order.

Results

The analysis was carried out in three stages. Firstly, we examined the direct and indirect influence of economic deprivation and mother's depression on children's cognitive and behavioural outcomes. Secondly, we assessed whether parenting behaviours had a mediating effect between parental resources and children's outcomes. At this stage we also identified the level of importance of the different parenting practices for each of the outcomes. Thirdly, we fitted separate models for children living in two parent biological families and lone parent families to see if there were differences between these two sets of families.

The results are presented as follows: Figure II shows the path diagrams that describe the decomposition effects of our model and it is noteworthy that most of the paths we consider are statistically significant and the parameter estimates, with one exception, have the expected sign. Table II shows the total effect of economic deprivation and mother's depression on the three outcomes, disaggregated into its direct and indirect components; Table III and IV display the differences in the relationships according to family status. Table II to IV show the standardized parameter estimates and the value of the parameter estimate divided by its standard error. The standardized parameter estimates can be interpreted as the mean response in standard deviation units (SD) of the dependent variable for a one standard deviation change of the explanatory variable, holding constant other variables in the model.

Before going on to discuss the results, we explain how the three types of effects shown in Table II were estimated. For example, the total effect of economic deprivation on cognitive scores ($\beta = -0.26$) is the sum of its direct effect ($\beta = -0.10$) and its indirect effects ($\beta = -0.16$). The total indirect effect is estimated by adding up all the specific indirect effects between economic deprivation and cognitive scores. For example, the specific indirect effect via reading activities is ($-0.34 \times 0.42 = -0.14$ plus the effect via mother's depression $0.50 \times -0.05 \times 0.42 = -0.02$). Following a similar procedure one can estimate the

Table II: Direct, indirect and total effects of economic deprivation and mother's depression on child outcomes

	Cognitive scores		Externalizing problems		Internalizing problems	
	Std. Est.	St Es./S.E.	Std. Est.	St Es./S.E.	Std. Est.	St Es./S.E.
Economic deprivation						
Total	-0.26	-14.6***	0.37	17.0***	0.18	11.6***
Total direct	-0.10	-3.9***	0.21	8.6***	0.10	5.0***
Total indirect	-0.16	-9.3***	0.16	7.9***	0.08	6.2***
Via Reading activities	-0.15	-9.9***	0.03	3.1***	-0.01	-1.0
Via Positive relations	-0.02	-3.9***	0.06	7.4***	0.04	6.8***
Via Disciplinary practices	0.00	1.3	0.02	1.9	0.00	0.7
Via Mother's depression	-0.01	-0.8	0.11	10.1***	0.07	7.8***
Mother's depression						
Total	-0.01	-0.8	0.22	12.0***	0.13	8.7***
Total direct	0.01	0.7	0.10	5.7***	0.10	6.6***
Total indirect	-0.02	-2.6*	0.12	9.6***	0.03	6.9***
Via Reading activities	-0.02	-2.3*	0.00	1.9	0.00	-0.9
Via Positive relations	-0.01	-3.5***	0.04	5.8***	0.02	5.6***
Via Disciplinary practices	0.01	1.7	0.08	7.9***	0.01	3.8***

Note: Statistical significance: * $p < 0.05$; *** $p < 0.001$. These estimates include control variables.

specific indirect effects via other parenting constructs and via maternal depression to obtain the total indirect effect. Effect size refers to the strength of the association between variables. As a guide, Cohen (1992), defined effect-size based on general psychological research as small if they were of the order of 0.10, medium if of the order of 0.30, and large if they were 0.50 or greater.

We also used several statistical tests to assess the model's goodness of fit and followed the recommended guidelines on the cut-off values for good fitting models. These included: the Comparative Fit Index (CFI with a value > 0.95), the Tucker and Lewis Index (TLI with a value > 0.95) and the Root Mean Square Error of Approximation (RMSEA with a value ≤ 0.05) (Muthén and Muthén 1998–2005; Yu 2002). The estimated model meets the previous guidelines reasonably well (RMSEA = 0.028, CFI = 0.89, TLI = 0.90), indicating that the model fits the data well.

Paths from parental resources to children's outcomes

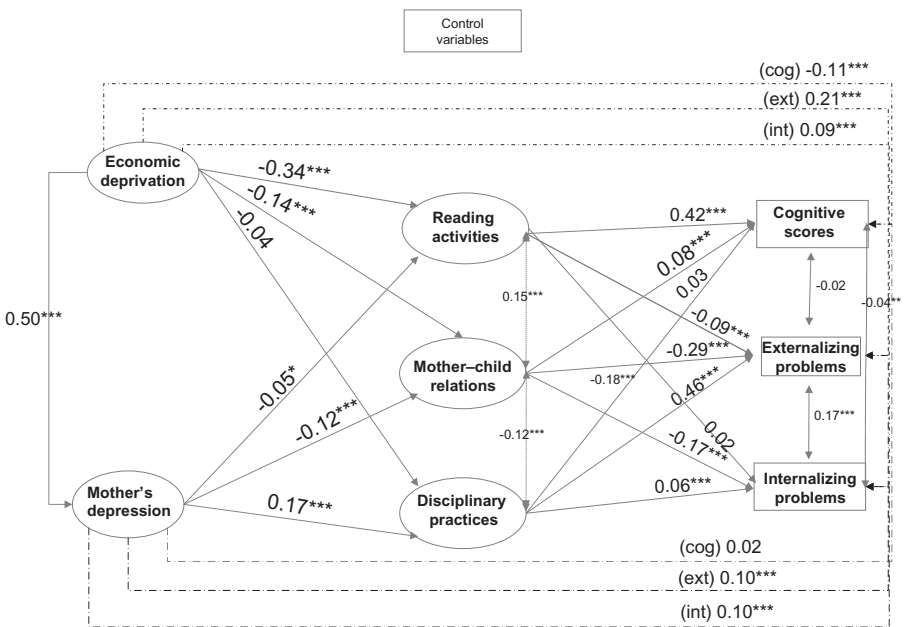
Table II shows that children living in economically deprived families are less likely to exhibit advanced cognitive skills at age 3 years (-0.26 standard deviation units, SD^4 hereafter) and have higher risks of experiencing externalizing ($0.37 SD$) and internalizing behavioural problems ($0.18 SD$). The magnitude of these estimates indicates that the total effect of economic deprivation on child

outcomes is of a moderate size with the largest effect to be seen for externalizing problems, followed by cognitive performance. All the estimates in this table and subsequent tables take into account the background characteristics of these families.

The paths linking maternal depression with child outcomes suggest that children with a depressed mother tend to experience more behavioural difficulties than their peers whose mother is not depressed (0.22 SD for externalizing problems and 0.13 SD for internalizing problems) and that mother's depression is more strongly associated with externalizing problems than with internalizing problems. In contrast, the estimates indicate that mother's emotional well-being is not associated with children's cognitive performance (-0.01 SD, non-significant).

We had also hypothesized that the effect of economic hardship on children's outcomes could take place through its association with mother's depression. Figure II shows that the direct path between economic deprivation and mother's depression is positive and statistically significant (0.50 SD), corroborating the findings of others that lack of economic resources is associated with an increased risk of maternal depression. Additionally, Table II presents the specific indirect effect of economic deprivation on child outcomes via maternal depression. It is clear that mother's depression is not a mechanism through

Figure II: *Estimated Pathways*



Note: Statistical significance: * p < 0.05, ** p < 0.01 *** p < 0.001
 Measures of fit: CFI = 0.89, TLI = 0.90, RMSEA = 0.028

which economic hardship influences children's cognitive performance. On the other hand, part of the economic deprivation influence on children's behavioural problems is mediated by mother's depression (30 per cent of the total effect of economic deprivation on externalizing problems (0.11/0.37) and 37 per cent of the total effect of economic deprivation on internalizing problems (0.07/0.18)).

Mediating role of parenting behaviours

We now examine the extent to which parenting behaviours play a mediating role between parental resources and children's development. We had hypothesized (Figure I) that the influence of economic deprivation on child development takes place through a direct effect on child outcomes and through an indirect effect via mother's mental health and parenting behaviours. It was also hypothesized that the influence of mother's depression on child development takes place through a direct effect on child outcomes and through an indirect effect via parenting behaviours.

Table II shows the direct and indirect effects of economic deprivation on cognitive development are both significant ($-0.10 SD$ and $-0.16 SD$, respectively). Moreover, the indirect effects of economic deprivation via parenting behaviours represent more than half ($-0.16/-0.26$) of the total effect of economic hardship on cognitive performance and that reading activities is the main contributor to this relationship ($-0.15 SD$). Similarly, the decomposition of the total effect of economic deprivation on the behaviour outcomes shows that both direct and indirect effects are statistically significant. Our estimates indicate that around 40 per cent of the total effect of economic deprivation on externalizing problems and on internalizing problems (0.16/0.37 and 0.08/0.18, respectively) is explained by the mediating role of parenting practices. These findings suggest that part of the influence of economic deprivation on children's cognitive and behavioural development takes place through parenting practices, but it is also clear that economic adversity is associated with child development through other mechanisms than those specified in our model.

Likewise, estimates in Table II show that the direct and indirect effects of maternal depression on externalizing (0.10 SD and 0.12 SD , respectively) and internalizing problems (0.10 SD and 0.03 SD , respectively) are relatively small although statistically significant. Additionally, we can see that parenting behaviours partly account for the relationship between mother's depression and children's behavioural adjustment, particularly in relation to externalizing problems (around 60 per cent of the total effect (0.12/0.22)).

The strength of the pathways shown in Figure II suggests that the influence of parental resources on parenting behaviours varies according to the type of parenting construct. Economic deprivation has a moderate association with

parent's reading activities ($-0.34 SD$), and a smaller but still statistically significant association with whether the mother reports a positive relationship with her child ($-0.14 SD$), but there is no association with whether she uses harsher disciplinary practices ($-0.04 SD$ non-significant). With respect to maternal depression the model indicates that mothers who are depressed use harsher disciplinary practices ($0.17 SD$), have a less positive relationship with their children ($-0.12 SD$), and spend somewhat less time on reading activities ($-0.05 SD$). These results support our hypotheses about the relationship between maternal depression and parenting behaviours with the rider that some of the coefficients are relatively small.

Paths from parenting practices to children's outcomes

With regard to the influence of the parenting behaviours on the three child outcomes, it is clear, and perhaps not surprising, that parent's reading activities had the strongest association with children's cognitive development (Figure II). The estimate for this association was $0.42 SD$. The path from reading activities to externalizing problems was smaller at $-0.09 SD$ but still statistically significant. This suggests that parent's involvement in reading activities is also associated with less conduct and hyperactivity problems amongst their children. In contrast, the parameter estimate for the path between reading activities and internalizing problems indicates no statistical association between this parenting practice and children's emotional problems ($0.02 SD$, non-significant).

Turning to mother-child relations and the child outcomes, the strongest link was found with the behavioural outcomes, especially externalizing problems. The paths associated with these outcomes are highly significant and of moderate size ($-0.29 SD$ for externalizing problems and $-0.17 SD$ for internalizing problems), indicating that a positive relationship between mother and child is related to fewer conduct/inattention problems and to fewer emotional difficulties. A positive relationship between the mother and child is also related to higher cognitive scores, as indicated by the parameter estimate of $0.08 SD$.

It is clear from our model that harsher disciplinary practices have a statistically significant association with behavioural problems but they are not associated with how well a child is doing on the cognitive tests. The magnitude of the coefficients indicates that harsher disciplinary practices are quite strongly related to children's externalizing problems ($0.46 SD$) but much more weakly related to internalizing problems ($0.06 SD$).

Figure II also provides information on the associations between the cognitive and behavioural outcomes. After taking into account all the factors in our model we found that there was a small but significant correlation between internalizing and externalizing behaviours ($0.17 SD$). There is some evidence of a very small but significant negative correlation between cognitive

development and emotional problems ($-0.04 SD$) but there is no evidence amongst these young children of an association between cognitive development and conduct problems. This has been found not to be the case at older ages (Farkas 2003), which suggests that early interventions for enhancing children's cognitive skills may be easier to carry out than if left to later ages.

Family status differences

Children growing up in lone-mother families compared with children in two parent families are more likely to experience economic deprivation and to live with mothers who are depressed. In the MCS sample, 62 per cent of the lone-mother families were poor compared with 16 per cent of the two-parent families, and 35 per cent of the lone mothers had symptoms of depression compared with 23 per cent of the partnered mothers. It might be expected that the greater lack of parental resources in lone mother families might lead to an amplification of the estimates of the effects on child outcomes. Table III provides estimates of differences⁵ for the paths between parental resources and parenting behaviours according to these two types of families and Table IV gives estimates for the pathways from parenting behaviours to child outcomes. The final column in both tables provides a Chi-square difference test between the two types of families. From the values in this column we see that in only one instance is there a significant difference between the estimates for lone-mother and two-parent families. This was with respect to the extent to which the mother reported having a positive relationship with her child. In lone-mother families a less positive relationship was more strongly associated with

Table III: Differences in paths between parental resources and parenting behaviours by family status

	Lone-parent families		Intact families		Group differences
	Std. Est.	St Est./S.E.	Std. Est.	St Est./S.E.	p-value
Reading activities →					
Economic deprivation	-0.15	-2.4*	-0.24	-3.7***	0.84
Mother's depression	-0.08	-1.5	-0.05	-1.4	0.39
Mother-child relations →					
Economic deprivation	-0.09	-1.9*	-0.16	-3.0**	0.31
Mother's depression	-0.16	-3.9***	-0.11	-1.7	0.37
Disciplinary practices →					
Economic deprivation	-0.01	-0.1	-0.02	-0.6	0.92
Mother's depression	0.16	3.4***	0.17	1.9*	0.83
N=	2,244		11,009		

Note: Statistical significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
These estimates include control variables.

Table IV: Differences in paths between parenting behaviours and child outcomes by family status

	Lone-parent families		Intact families		Group differences
	Std. Est.	St Est./S.E.	Std. Est.	St Est./S.E.	p-value
Cognitive scores →					
Reading activities	0.46	5.5***	0.35	5.8***	0.44
Mother-child relations	0.10	2.0*	0.07	3.0**	0.13
Disciplinary practices	0.04	0.9	0.02	1.2	0.72
Externalizing problems →					
Reading activities	-0.10	-1.5*	-0.08	-2.7***	0.18
Mother-child relations	-0.37	-7.4***	-0.27	-4.4***	0.05
Disciplinary practices	0.42	7.8***	0.48	7.2***	0.48
Internalizing problems →					
Reading activities	0.06	1.0	0.01	0.4	0.91
Mother-child relations	-0.22	-5.1***	-0.16	-4.2***	0.31
Disciplinary practices	0.10	2.6**	0.06	3.0**	0.42
N=	2,244		11,009		

Note: Statistical significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
 These estimates include control variables.

externalizing problems than was the case where the child lived with both their parents. With this one exception, the estimates from the models shown in Table III and IV suggest that there is no strong evidence that the paths between parental resources, parenting behaviours and child outcomes differ between the two types of families. It would appear that similar mechanisms operate in both types of families.

Although there are no statistically significant differences in the paths between the two sets of families there is some consistent patterning as well as indications that the estimated effects may be somewhat greater in lone parent families than in two parent families. From Table III we see that economic hardship tends to have a smaller association with parenting behaviours (reading activities and positive relations) among children growing up in lone-parent families than among children growing up in intact families. This may be due in some part to the fact that lone-parent families are more homogenous in terms of economic circumstances than are intact families. In contrast, maternal depression has a slightly stronger negative association with parenting behaviours among children living in lone-parent families than among children living in intact families. Additionally, in Table IV there are suggestions of a fairly consistently stronger association between most parenting practices and child outcomes for children in the lone-mother group. For instance, parents' reading activities show a stronger positive association with cognitive development among children in lone-parent families and a positive relationship between mother and child has a greater protective effect against behavioural difficulties amongst children in lone-parent families. There is a larger negative association between positive mother-child relations and behavioural problems among

children in lone-mother families. Such differences suggest that a more positive relationship between mother and child makes a greater contribution to reducing behavioural difficulties amongst children in lone-parent families than in intact families.

Overview and conclusion

Although the adverse effects of poverty and maternal depression *per se* on children have been well documented by social scientists less is known about the mechanisms through which the effects of poverty and depression and their inter-relations affect children. In this study we have attempted to address this by elucidating some of the pathways by which economic deprivation and maternal depression might influence child outcomes and through the use of structural equation modelling examine a set of parenting practices that potentially might mediate the effects of economic disadvantage and maternal depression on a child's intellectual and behavioural development. The pathways examined in our model should not be taken to imply that there is a causal relationship between the factors or that the pathways are necessarily unidirectional. Our model is but one plausible simplification of reality in which we test the feasibility of a number of hypothesized pathways.

An important limitation of our study is that, although we use data collected at age 9 months and age 3 years, the parenting factors which are potential mediators are measured at the same time as the child outcome measures. Moreover, our model assumes that parenting behaviours and attitudes affect children's behaviour, but it could be argued that the relationship operates in the opposite direction. In fact there is now a substantial body of evidence that children shape and contribute to their rearing environment, including influencing the parenting they receive (see Chapter 9 in Shonkoff and Phillips 2000 for a review). An example that is pertinent to our analyses is that associations have been shown between externalizing behaviour in children and reduced quality of parenting by mothers (McLeod, Kruttschnitt and Dornfield 1994). In order to take some account of the possible reciprocal effect between parenting practices and children's outcomes at age 3, we included measures of the child's temperament at age 9 months as a control. In due course, from later waves of data for the Millennium Cohort, we will be able to examine the longitudinal relationship between parenting practices and child outcomes rather the concurrent relationship, as in this study. Notwithstanding, that parenting behaviours can also change over time. Another limitation is that we were mainly reliant on mothers' reports of children's behaviours (but had an objective measure for cognitive development), as well as her parenting behaviours and attitudes. Optimally, some independent observations and measures would have added weight to our findings.

With these provisos in mind our analysis provided a number of insights and findings. With respect to cognitive development we found that the influence of economic disadvantage on a child's intellectual development was substantially mediated by the intervening mechanisms measured by the parenting factors. The direct path from economic deprivation to cognitive development in our model was somewhat weaker than the indirect pathway. This suggests that a greater focus on the intervening mechanisms that affect a child's intellectual development and potential educational achievement may be as important as the provision of say income benefits. Moreover, our various model specifications indicate that cognitively enhancing activities, such as reading to the child, may be particularly influential in mediating the effect of poor economic circumstances on intellectual development, with impoverishment associated with a fairly large negative effect on cognitive stimulating activities, and these types of activities in turn are associated with a fairly large positive effect on intellectual development. These findings are in line with the family investment perspective. Additionally, we found that economic disadvantage has a negative effect on the warmth of the relations between the mother and child, which in turn is important for a child's intellectual development. In contrast with economic circumstances the association between maternal depression and children's cognitive development was much weaker.

However, maternal depression was strongly associated with mother's reports of children's behaviour problems. Within the specification of our model the direct pathways from maternal depression to externalizing problems were almost as strong as the indirect ones, and for internalizing problems much of the effect was direct rather than through parenting practices. Further research is required to identify other mediators and/or processes that may underpin the direct estimates remaining in our model. Other potential mediators might include the extent of social and community support for depressed mothers or the extent of family or spousal conflict. Nevertheless, there were significant indirect pathways through parenting practices, with maternal depression being associated with a reduction in the mother's ability to engage positively with her child, which in turn was associated with the increased likelihood that the child exhibited conduct and emotional problems. Maternal depression was most noticeably associated with the use of harsh disciplinary practices (more frequent smacking and shouting) which in turn were very strongly related to conduct problems amongst the children. Furthermore, a substantial part of the effect of economic deprivation on child behaviour problems was mediated through the mother's depression: findings consistent with a family stress perspective. In lone-mother families the importance of maternal depression for children's well-being was somewhat more marked than was the case where both parents were living together.

In sum, at age three there are already visible and notable disparities in children's cognitive development and behavioural adjustment. Our analysis has shown that economic deprivation matters more for a child's cognitive development and mother's mental state for children's behavioural adjustment; but economic deprivation also engenders poorer maternal well-being, which in turn leads to a reduction in children's positive behaviours. Furthermore, this study has highlighted the importance of parental behaviours characterized by parental attitudes and discipline for children's externalizing behaviour and emotional well-being, and parental involvement characterized by active participation in activities such as reading that promote cognitive development. Our findings only relate to a narrow window in early childhood but what happens in these early years, without appropriate interventions, is likely to have far reaching legacies.

(Date accepted: June 2008)

Appendix

Table AI: *Distribution of outcome measures and focal variables*

	Per cent		Per cent
Children's outcomes at age 3			
Cognitive scores			
<i>Bracken Basic Concept Scales</i>			
Very delayed	1.3		
Delayed	9.3		
Average	61.1		
Advanced	23.0		
Very advanced	5.3		
		Behavioural adjustment	
		<i>Conduct problems</i>	
		Mean value (range 0–10)	2.6
		Scores >=4 (%)	29.6
		<i>Hyperactivity/ Inattention</i>	
		Mean value (range 0–10)	3.9
		Scores >=7 (%)	12.9
		<i>Emotional problems</i>	
		Mean value (range 0–10)	1.3
		Scores >=5 (%)	2.7
Focal variables			
Economic deprivation at 9 months			
<i>Income–poverty (< 60% of median)</i>			
Not poor	76.9		
Poor	23.1		
		Mother's depression at 9 months	
		<i>Low or sad for 2 wks since birth of child</i>	
		No	68.0
		Yes	32.0
		Doctor diagnosed depression	
		No	75.8
		Yes	24.2
		Malaise score	
		0: less than 4	84.7
		1: at least 4	15.3
Housing tenure			
Owner/Being bought/ Private	86.3		
Renting			
Local Authority	13.7		

Notes: Figures take into account sampling weights.

Notes

1. We would like to thank the ESRC and the Institute for Effective Education at the University of York for providing funding for this research. We also appreciated the feedback from seminar presentations given on this topic at Princeton University, the University of Pennsylvania, University College Dublin and the LSE.

2. This critical ratio is a significance test, which follows an approximately normal distribution. To assess the significance of a parameter, one compares the value of this ratio with the conventional cut-off points for statistical significance (e.g., for an alpha value of 0.05, ratios greater (or smaller) than 1.96 (–1.96) are significant).

3. The binary variables in our model were treated as categorical variables. Mplus uses WLSMV (weighted least squares estimator)

to estimate factor loadings with binary variables.

4. Table II shows the standardized coefficients (standardized betas) to allow the comparison of the relative importance of the variables included in our model. Their interpretation is similar to that of standardized regression coefficient, i.e. the dependent variable will increase by 1 SD (standard deviation) for each unit increase of the independent variable.

5. We tested the significance of parameters using a Chi-square difference test. This was executed by running a model for each separate parameter set to be equal across groups and another model where the parameter was set to be free across groups. The difference between the two models was assessed by a chi-square difference test.

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