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Abstract

The age of mothers when they give birth to their first child is increasingly socially polarised in the UK. Early motherhood typically occurs among women from disadvantaged backgrounds, in contrast to women with later first births, who are more likely to come from advantaged backgrounds. This paper compares their children's development, in terms of cognition and behaviour at age five, using the Millennium Cohort. Much of the difference between the children of young and older mothers is attributable either to their mothers' social origins or inequalities apparent at the age nine months survey, which may also have had earlier origins. The developmental penalty left to be attributed to the mother's age *per se* is, at most, modest.

1. Introduction

Britain still has a larger proportion of very young women becoming mothers than many comparable Western European countries. This is despite government initiatives aimed at reducing teenage motherhood. A further feature is that the timing of motherhood in the UK has become increasingly socially polarised over time. Early mothers typically come from disadvantaged backgrounds. Women who have had more favoured origins and have taken up educational and career opportunities tend to delay having children (if they have children at all). Therefore, a child born to a mother who was young when she first became a parent has already inherited a disadvantaged start in life. In this paper we investigate whether having a young mother compounds this disadvantage. From a longer-term perspective, if the daughter of a young mother is likely to become one herself, there is an intergenerational cycle in the accumulation of disadvantage.

It was this association between disadvantaged family backgrounds and poor life chances for mother and child, more than mere moral panic, that helped motivate the 1997-2010 Labour government to tackle teenage pregnancy. The campaign was led by the Cabinet Office at the heart of central government (Social Exclusion Unit, 1999). It was complemented by the broader strategy to combat child poverty. Initiatives like Sure Start and the child care strategy, as well as the tax credits system, benefited families with teenage mothers and other families with relatively young mothers, or those who had their first child when young. While the coalition government of 2010 continues to express concern about inequalities in child wellbeing, policy to deter teenage motherhood is being decentralised and submerged in public expenditure cuts.

The age at which a woman first becomes a mother provides an intriguing perspective on inequality in social reproduction. We do not have enough information to model either its determinants or consequences rigorously in our data set. We are primarily concerned to describe, or put bounds on, its impact on child development. We attempt to do this by distinguishing prior circumstances as predictors of birth timing and the mediating role of social disadvantage after childbearing. The outcomes we consider are cognitive and behavioural scores of the child at age five. This is an important benchmark, as it is the age at which children in the UK enter primary school. Any divergence at this stage in children's development is likely to be reflected in their educational progress in the following years. It also gives some clues as to the consequences for children's human capital formation when motherhood is deferred into the twenties or thirties, or indeed the consequences of a resurgence of early childbearing that may accompany economic recession.

The paper proceeds as follows: section 2 provides a literature review, section 3 presents our model, section 4 introduces the data, section 5 presents our results and section 6 concludes.

2. Literature review

The timing of motherhood, early or late, may be the outcome of a deliberate strategy or it may be unintended: early because of unplanned pregnancy, or late because of unplanned infertility or unanticipated absence of a suitable partner. Probably each type of account applies to some individuals. Early motherhood may constitute a rational choice in the face of limited alternative prospects in education or employment. Alternatively it may result from a lack of planning and poor information (Wellings et al. 1996, Allen and Bourke Dowling 1998). In either event, any difference in outcomes for families started early and late is certainly not chosen by the child. Whatever its cause, young age at motherhood could be viewed as a signal of disadvantage on a number of fronts, including consequences for the children (Pevalin 2003). Conversely, having a mother who delayed childbearing, whether deliberately or not, may be an advantage, if the delay has enabled her to accumulate relevant economic, psychological or social resources from which the child benefits.

Teenage motherhood is typically associated with a prior disadvantaged family background for the young woman before the birth of her child. Therefore teenage motherhood may not be a problem itself, but rather the signal of disadvantaged circumstances that lead to its occurrence (Bonnell 2004, Kneale 2009). Many studies, reviewed below, have found that given the poorer prior life course of most teenage mothers, the disadvantaged family situation often experienced by their offspring is likely to be, at least in part, a product of the mother's inauspicious origins rather than just a direct consequence of her age.

Despite a general trend towards later motherhood internationally, early childbearing remained relatively common in the UK compared to other Western European countries (Chandola et al. 2002, Frejka and Sardon 2006). This remained the case even as teenage motherhood rates in the UK fell over the first decade of the millennium. The UK is also distinctive for its socio-economic differentials (Rendall et al 2005, Rendall et al. 2009). Least advantaged women still tend to have children earlier and the most advantaged have increasingly deferred childbearing. Kiernan (1997) and Kneale (2009) both note that the social distinctiveness of young motherhood does not end at age 20, but extends well into the early twenties.

Studies showing socio-economic variation in the timing of motherhood include Buxton et al. (2005), Kiernan and Diamond (1983), Kiernan (1997), Ermisch and Pevalin (2003a), Rendall and Smallwood (2003), and Kneale and Joshi (2008). In particular, teenage motherhood is associated with exclusion from both employment and education (Bynner and Parsons 1999, SEU 1999), and later motherhood with a career track (Miller 2009b). Research attempting to disentangle the causes and consequences of early motherhood suggests that early motherhood is a marker rather than a driver of labour market disadvantages (Beets et al. 2011). Work by Ermisch and Pevalin (2003b, 2005) on the British birth cohort of 1970 used evidence on miscarriages to provide an instrument for birth timing, to suggest that a teen birth had little independent effect on a woman's qualifications, employment or earnings when she is 30 years old. Similar conclusions are

reached, somewhat more cautiously, by Goodman, Kaplan and Walker (2004) who also applied an instrumental variable technique to the same dataset.

Research on sisters for the US (Geronimus and Korenman 1992) and twins for the UK (Hawkes 2003) also shows that early motherhood is strongly associated with poor family background. The apparent 'effects' of entering motherhood early on household income and educational attainment are much smaller once controlling for antecedent factors. However Ermisch and Pevalin (2003b, 2005) do find that the lower employment and educational attainment of any partner present when a teen mother reaches 30 can be attributed to an adverse outcome of early motherhood in the 'marriage' market. Futing Liao (2003) finds another independent effect of early motherhood on a woman's mental health.

The first survey of the Millennium cohort showed a consistent association of age at motherhood with favourable values on a large range of variables, including education, partnership, employment, occupation, income, neighbourhood, housing, whether the cohort pregnancy was planned, infant feeding, mother's mental health and subjective wellbeing. The disadvantages of younger age at first birth apply mainly up to age 30. There was little evidence of advantages increasing for women who had postponed motherhood beyond their early 30s (Hawkes et al. 2004).

There are implications of these associations not only for the mother but also for the next generation. As the established British birth cohort studies of 1958 and 1970 have shown (Gregg et al. 1999; Hobcraft and Kiernan 1999; Feinstein 2003; Blanden et al. 2005), being born into an advantaged or disadvantaged family may affect the experience of childhood and prospects in later life. Berrington , Diamond, Ingham et al. (2005), looking at the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort, found that children with teenage mothers did not differ from those with older mothers in their language development, social development, gross or fine motor skills or pro-social behaviour in the pre-school years. They were more likely however to have accidents and behavioural problems. In studies of the US, Geronimus et al. (1994), using data on cousins whose mothers are identical twins, find little effect of the age of the mother on a range of cognitive and behavioural outcomes. Hofferth and Reid (2002), using data from the US National Longitudinal Survey of Youth (NLSY) and the Panel Study of Income Dynamics (PSID) found differences for those with younger mothers in a range of cognitive and behavioural measures. However only the behavioural difficulties score and one of the cognitive measures remained significant once the change over time was considered. Turley (2003), also looking at NLSY 1979 cohort and their children, was inclined to conclude that the problem for children of teenage mothers was their mother's background rather than her age. Miller (2009a) was less convinced. Miller also looked at first born children to the NLSY79, but after more years of observation and using biological instrumental variables. These allow for the possibility that women who choose early or late motherhood may have unobserved qualities that affect both their choice of timing and their effectiveness in nurturing. She found a causal effect of delaying age at first birth significantly improving two out of three cognitive scores, not unlike her OLS estimates. Finally, being born to a mother who had her first child in her teens or early twenties is emerging as an increasingly distinctive feature of the intergenerational transmission of disadvantage. However the literature is not clear as to how far age of

childbearing is a driver of children's progress in its own right, as well as a marker of other influences on family resources and child development.

3. Model

We estimate the following production function for child outcomes:

child outcome = f(mother's age at first live birth, design variables, developmental controls, antecedent variables, circumstances around cohort child's first year).

where the following are contained within each set:

- child outcomes: three cognitive assessments and one score of behavioural adjustment at age five
- mother's age at first live birth: a categorical variable in broad classes of the age at which the cohort child's mother had her first child, contrasting three sets of later mothers with teenagers
- design variables: allowing for the disproportionately stratified design of the initial MCS survey
- developmental controls: characteristics of the child that may affect the interpretation of outcome variables.
- antecedent variables that describe circumstances obtained in the mother's life before, or almost certainly before, she became a mother
- circumstances around cohort child's first year: all observed once the cohort child was born.

Given the lack of information in our dataset to purge age at motherhood of possible unexplained endogeneity, we make the weak assumption that it can be treated as pre-determined and note the possibility of bias in our interpretation of results. Details of all these variables are set out in section 4. The main results shown are those estimated for first born children only. In this case the circumstances in the child's first year of life are also those of the first year of motherhood. We have also estimated the models including all orders of birth, but for the later born cohort children, the data available is on the first year of the child's life, not the first year of motherhood. We found that the relationships fitted to the first born sample by age at motherhood are similar in the bigger sample of all birth orders. We show some results to support this claim as model 4 in the regressions reported in the appendices.

4. Data and descriptive statistics

This model is estimated using the MCS. The MCS is the fourth birth cohort study in the UK, consisting of around 19,000 children born in the UK between September 2000 and January 2002 (Hansen 2010, Hansenet al. 2010). Their families have been interviewed four times, up to 2008: first when the children were nine months, then at three, five and seven years of age. This paper uses the first three sweeps. The MCS over-sampled in areas with high child poverty rates, large proportions of ethnic minorities and in Wales, Scotland and Northern Ireland (Plewis 2007). All of the analysis presented was undertaken correcting for the survey design in terms of stratification and clustering using the STATA survey commands.

4.1 Definition of dependent variables

Cognitive assessments on five-year-old children were taken from the three elements of the British Ability Scales (Elliott, 1996). Naming Vocabulary involves asking the child to name items pictured in a booklet, and measures spoken vocabulary and expressive language. The Picture Similarities assessment measures problem solving ability. The child is asked to place a picture card against the one most similar in concept among a set of four other pictures. Finally, the Pattern Construction task, copying and constructing patterns with a set of coloured tiles and cubes, measures certain non-verbal skills. These assessments were administered directly to the child by interviewers who were not professional psychologists, but were specially trained. The analysis of all the cognitive scores was done in terms of T-scores derived from the BAS manual and deposited in the data set at the UK data archive. These provide age-adjusted scores, standardised to an external reference population with a mean of 50 and a standard deviation of 10. One standard deviation, of 10 points, represents about 34 percentiles either way in the reference population distribution. One T-score point represents around four percentiles in the reference population, if starting at the median.

Behavioural adjustment was measured by the Total Difficulties Scale from the Strengths and Difficulties Questionnaires (Goodman 1997). This was assessed by a self-completed report by the parent, usually the mother. The questionnaire consists of 25 questions altogether, but five items tapping pro-social behaviour are not included in the tally of difficulties. The four subscales included cover emotional symptoms (for example nervousness/ worry), conduct problems (such as aggression), hyperactivity and problems with peers. The raw score counts each of 20 items as 2 if the informant says a problem is ‘certainly true’, 1 if it is ‘somewhat true’ and 0 otherwise. The raw score thus runs from 0 to 40, and the relatively rare scores of 17 or more are used to screen for clinically relevant disorders. In this paper the score is treated as continuous and transformed into a T-score, internally standardised with SD set to 10.

Table 1 presents the descriptive statistics for the whole sample using a fine-grained definition of the age of entry to motherhood calculated using child level data. Note that for the behaviour problems scale a lower score is ‘better’, whereas cognitive skills rise with the score. The upper panel of Table 1 shows first births by mother’s age at first birth as well as weighted means and standard errors for the four child outcomes of interest

and maternal education. The second panel shows the same results for all the other, subsequent births, also organised by the age at which their mothers had their first child, rather than their cohort birth. There are very few cases of mothers aged under 16 or over 40. Patterns by age at motherhood in the child outcome measures and in maternal education are similar, whether the first birth was the cohort child or earlier. In all cases the children's score is more favourable for those mothers who had been over 30 rather than under 20, or indeed under 25, at their first birth. The 25 to 29 group have intermediate scores generally closer to those 30 and over rather than under 25. There are not great differences between groups over 30 (as also reported in Hawkes et al. 2004). Among the first borns there is a gap of nearly nine points on the Naming Vocabulary T-score between the 30 to 34 and the 16 to 19 age at motherhood groups. For the other two cognitive scores, the gap is around four points, and for Total Difficulties T-score the gap is six points. There is also an advantage on mothers' education, three quarters of those becoming mothers in their 30s having more than minimum schooling compared to one quarter of the teen mothers. To allow for non-linearity in the relationship between outcomes and age at motherhood, we proceed with four groups of age at first birth: under 20, 20 to 24, 25 to 29, and 30 and over. We have found a similar non-linear pattern for maternal outcomes (Hawkes 2008, Hawkes et al. 2004).

We have noted that the later-born children of women who were young at their first birth share comparable test scores to children who are the first child of young mothers in 2000-01. The mothers who were currently over 25 also showed a very similar pattern in their own education according to their age at first birth. Thus these descriptive statistics confirm that, on average, later-born children of women who first become mothers at a young age perform significantly less well in terms of both cognitive and behavioural development. The next section uses regression analysis to see whether these differences in child outcomes at age five can be accounted for by potential covariates such as what we know about the mother's earlier life and other indicators of the family situation in the child's first year.

4.2 Definitions of control variables

The design variables are a set of dummy variables to represent each of the nine strata of the MCS survey design (minority ethnic areas in England, plus disadvantaged and advantaged areas in each of the four UK countries).

The developmental indicators adjust the outcome variables for the child's gender, birth weight (which is not, in these data, correlated with age at motherhood), whether the child was one of a set of twins or triplets, and where relevant, whether first born.

The 'antecedent' variables include: country of origin for the mother and her parents, mother's ethnicity, whether she left school at the minimum school leaving age, whether the mother's parents separated before she was 18 years old, if the mother was raised outside of the family home at any point in childhood and the mother's father's occupational social class when she was age 14. We also experimented with the occupational class of the mother's mother, but this added little to the explanatory power of the model.

Table 1: Descriptive Statistics for Maternal Education and Child Outcome Variables by Mother's Age at First Birth, Millennium Cohort

First Births Only										
		Woman's education	Child's Cognitive Outcomes T-scores						Behavioural Outcome T-scores	
Age at First Birth	Distribution of women by Age at First Birth	Proportion of mothers who left school at the compulsory school leaving age	BAS Picture Similarities Mean	Std.Err.	BAS Naming Vocabulary Mean	Std.Err.	BAS Pattern Construction Mean	Std.Err.	SDQ Total Difficulties Mean	Std.Err.
Under 16	0.004	0.898	59.0	2.6	53.1	2.2	50.0	3.4	51.6	2.1
16-19	0.113	0.754	53.2	0.7	51.5	0.5	48.8	0.6	53.7	0.5
20-24	0.173	0.453	54.5	0.4	54.1	0.4	50.3	0.4	51.8	0.5
25-29	0.301	0.303	56.9	0.4	58.6	0.3	52.6	0.3	48.7	0.3
30-34	0.291	0.262	57.4	0.3	60.2	0.4	53.2	0.4	47.7	0.3
35-39	0.108	0.237	57.1	0.5	59.9	0.6	52.4	0.5	46.7	0.5
Over 40	0.010	0.131	57.4	2.0	57.8	1.6	52.1	1.3	48.3	1.5
Sample size	4841	4841	4795		4807		4741		3857	
Subsequent Birth Orders										
		Woman's education	Child's Cognitive Outcomes T-scores						Behavioural Outcome T-scores	
Age at First Birth	Distribution of women by Age at First Birth	Proportion of mothers who left school at the compulsory school leaving age	BAS Picture Similarities Mean	Std.Err.	BAS Naming Vocabulary Mean	Std.Err.	BAS Pattern Construction Mean	Std.Err.	SDQ Total Difficulties Mean	Std.Err.
Under 16	0.007	0.783	54.6	1.6	49.5	2.0	45.2	0.9	52.8	2.7
16-19	0.162	0.778	53.9	0.4	50.8	0.3	49.0	0.4	52.7	0.4
20-24	0.275	0.553	54.2	0.3	52.7	0.3	50.4	0.3	50.1	0.3
25-29	0.330	0.374	56.6	0.3	56.2	0.3	52.3	0.3	47.5	0.3
30-34	0.191	0.240	57.7	0.4	57.9	0.4	53.4	0.4	46.6	0.3
35-39	0.034	0.216	56.0	0.6	57.5	0.9	54.3	0.8	47.5	0.7
Over 40	0.001	0.045	62.2	1.7	64.3	3.2	59.1	3.5	49.0	2.5
Sample size	6528	6528	6464		6466		6375		5135	

Notes: reported are weighted means and (weighted standard errors)

Strictly speaking leaving school at the minimum age may not be antecedent to a first birth for the small number who had their first child before age 16. The information on parental occupation and countries of birth was added to the study at the second sweep, but there is a limit to the amount of information that has been collected retrospectively. It cannot be as detailed as in some data sets that have followed women from childhood.

The measures of circumstances in the child's first year include: languages spoken in the home, presence of a father figure, housing tenure, mother's qualifications, household income and maternal depression in first year of life, and whether mother's employment at that time is full- or part-time. For most cases, the highest qualification attained could also be thought of as an antecedent variable, insofar as most women had completed their education before conceiving their first child. There are some women for whom the arrival of a first child could have curtailed the acquisition of further qualifications, making the role of this variable in the causal chain more ambiguous. We therefore classify it among variables that might be jointly determined with the arrival of a first child. It could be argued that the stratification variables on area type represent circumstances around the cohort child's first year, but they are included in all models to allow for the sample design. The descriptive statistics for these control variables are presented in Appendix E.

5. Results

Table 2 summarises the coefficients of primary interest estimated, for three models each, of the four outcome variables on the firstborn sample. The full regression results can be found in Appendices A to D and include the results for the extended sample including subsequent births.

5.1 Estimates of cognitive models

For Naming Vocabulary, Model 1, with age of first motherhood information only in addition to the design and development control terms, explains 11 per cent of the variance and estimates a lead in T-score of eight points for those who became mothers at age 30 or over compared to women who had become mothers before age 20, not much reduced from the raw gap seen in Table 1. This gap of 0.8 of a standard deviation is equivalent to around 30 percentiles at the median in the British Ability Scales reference population.[1] The inclusion of the 'antecedent terms' in Model 2 adds to the proportion of variance explained overall and reduces the vocabulary learning gap by age of mother to 6.5 points. The effects detected, as shown in Appendix A, include an advantage to having a mother born in the UK, disadvantages to coming from some ethnic minority groups (notably the combined group of Pakistanis and Bangladeshis with a disadvantage of eight points (roughly 30 percentiles) relative to the children of white mothers, of having left school no later than the compulsory age, and some advantage to the woman having had a father present at age 14 with other than the lowest level of occupation. This set of predictors served to modify the disadvantage associated with being sampled in a

[1] Estimates are translated into percentiles of the BAS reference population by interpolation from the tables given the in the BAS scoring manual.

Table 2: Coefficients on Mother's age at first birth relative to under 20

Model		1		2		3	
Child outcome at age 5		Design and development controls		As Model 1 + Clearly Antecedent factors		As Model 2 + Circumstances in Child's first year	
Measured in tenths of SDs in population		Coeff	t test	Coeff	t test	Coeff	t test
Naming Vocabulary	20-24	2.67	4.51	2.25	3.75	1.37	2.20
	25-29	6.70	12.31	5.35	9.32	3.30	5.29
	30+	8.04	13.94	6.58	10.71	4.06	6.25
Sample size 4807							
% of Model 1 coeff	20-24			84.16%		51.40%	
	25-29			79.88%		49.28%	
	30+			81.83%		50.50%	
R squared			0.11		0.16		0.20
Pattern Construction	20-24	1.53	2.30	1.32	1.95	0.71	0.99
	25-29	3.47	5.36	2.69	3.99	1.51	2.00
	30+	3.86	5.77	3.02	4.39	1.46	1.85
Sample size 4741							
% of Model 1 coeff	20-24			85.97%		46.54%	
	25-29			77.54%		43.40%	
	30+			78.38%		37.94%	
R squared			0.04	0.06		0.07	
Picture Similarities	20-24	1.21	1.79	0.89	1.26	0.52	0.70
	25-29	3.58	5.15	2.84	4.01	1.86	2.40
	30+	4.14	5.79	3.26	4.42	1.78	2.21
Sample size 4795							
% of Model 1 coeff	20-24			73.56%		42.69%	
	25-29			79.36%		51.97%	
	30+			78.67%		43.14%	
R squared			0.03	0.04		0.05	
Total Difficulties	20-24	-1.82	-2.97	-1.00	-1.51	0.36	0.52
	25-29	-4.59	-7.24	-3.31	-4.73	-0.74	-0.93
	30+	-5.71	-9.15	-4.30	-6.23	-1.50	-1.93
Sample size 3857							
% of Model 1 coeff	20-24			54.94%		-19.76%	
	25-29			72.01%		16.20%	
	30+			75.44%		26.21%	
R squared			0.07		0.09		0.17

disadvantage or minority ethnic area, but not the advantage attaching to the child being a girl (around 0.8 points, circa three percentiles).

The full Model 3, including indicators of the family circumstances in the child's first year, reduces the differential in the child's score associated with later motherhood, to a margin of four points (approximately 10 percentiles at the median) for mothers having their first birth after 30, which while significantly different from teenage motherhood is increasingly close to the estimates for children whose mothers had their first child between the ages of 25 and 29. The factors that are most powerful in accounting for closing this gap are languages other than English in the home at nine months and the mother having postgraduate qualifications, each implying a differential approaching six points (0.6 of a standard deviation) though in opposite directions. Terms recording the family income at the first survey and the related features of a partner being present and employed were all significantly associated with this outcome in the child, although with smaller coefficients. The woman's own employment reported at the nine month survey, whether full- or part-time, did not appear to be significantly related to Naming Vocabulary at age five, nor did her state of mental health, as gauged by a malaise inventory. The additional terms in Model 3 served to moderate many terms in Model 2 as well as age at motherhood, though not all (for example, the term for the woman having been in non-family care as a child increased in size and significance). Similar patterns to Model 3 are found when all birth orders are included in Model 4, though the larger sample size supports significant estimates on more terms, and show a significant advantage to being a first born child.

The profile of results for the other two cognitive assessments, the non-verbal Pattern Construction and the reasoning puzzles of Picture Similarities, was broadly similar, with the extra explanatory factors of Models 2 and 3 attenuating the estimated age at motherhood effects, but these were each smaller in the first place (Model 1) and the amount of variation attributable to any of the models was less, as apparent in the R-squared terms, rising from 0.04 to 0.07 for pattern construction and 0.03 to 0.05 for Picture Similarities. In each case the gap between mothers under 20 and over 30 of around four points in Model 1 dwindled to less than two points (and for the Pattern Construction to statistical insignificance) in Model 3.

In the analysis of Pattern Construction (Appendix B), this outcome seems sensitive to fewer antecedent variables, notably the Pakistani/Bangladeshi, mixed and black ethnic groups, and leaving school at the minimum age, or to a (grand) father having been in one of the top two occupational groups. Among the terms introduced in Model 3, it is only relatively high levels of the woman's qualification and relatively high levels of family income that are significantly associated with the child's score on Pattern Construction. Low birth weight appears as a consistent disadvantage, lowering this score across the board by around two points. The lead of girls over boys was around 1.2 points in all three models. In the extended sample there did not appear to be any advantage of being first born, at least given the other terms included.

The models of the Picture Similarities assessment are shown in Appendix C. The significant predictors of poor results in Model 2 are just the woman having minimal schooling, and belonging to the Pakistani/Bangladeshi ethnic groups. In Model 3 there are again significant terms for the woman's qualifications and family income. Neither the

earning status of the mother or her partner is significant for the sample of first borns. Low birth weight appears as a consistent disadvantage, lowering this score across the board by about one point. The lead of girls over boys was around 1.3 points in all three models (five percentiles), and the disadvantages of living in the ethnic and disadvantaged areas is accounted for by family circumstance at the first survey. Both strata in Northern Ireland displayed a significant lead throughout on Picture Similarities, which might be connected with the earlier age children start school in Northern Ireland, though it is not clear why this wouldn't show up in the other cognitive tests (Sullivan et al. 2010). The model estimated for all birth orders revealed significant (positive) estimates for mother's employment, but no independent differential for being first born.

5.2 Behavioural development

The scores on the four subscales of the Strengths and Difficulties inventory (Goodman 1997) have also been transformed into T-scores, with mean = 50 and SD = 10. These scores are available for around 200 fewer cases because of item non-response. In contrast to the cognitive scores, a higher mark is unfavourable, signifying more problems, and/ or greater severity among those reported. The age at motherhood gradient for behavioural difficulties is four points in Model 1, falling to 1.35 in Model 3, at which point there is no statistically significant difference between the two groups over 25, but still a small margin for both of them over those younger at motherhood. The R-squareds reflect a degree of success in explaining variation between that of the Naming Vocabulary model and the other two cognitive models (namely 0.07 rising to 0.17).

As shown in Appendix D, the antecedent factors significantly related to behaviour problems are the mother having had minimal schooling, having been in care and having had no father the home when she was 14, particularly in higher levels of occupation. Notably, there are no significant differences by ethnic origin. Model 3 attenuates these terms, reinforcing the explanation with the woman's qualifications, home ownership and family income (being inversely related to the child's behaviour problems). Neither parent's employment in the child's first year appears to be related to behaviour, but the mother's malaise in the first year (more likely in those not employed) was mildly predictive of the five-year-old's behaviour difficulties. Girls had consistently fewer behaviour difficulties (by around two points) and first -born children consistently more (around one point). Those who had been low birth weight babies had higher behaviour difficulties scores (two points dropping to 1.3 in Model 3). The number of disadvantaged strata with significantly higher behaviour scores than the non-disadvantaged areas of England fell from Model 1 to Model 2, and these potential 'neighbourhood' effects disappeared in Model 3, presumably due to the economic status of the individual families having been introduced, albeit some four years before the outcomes were observed.

5.3 The combined picture

Overall the four indicators of child development do show systematic patterning by mother's age at her first birth involving considerable leaps around the distribution. They also show sensitivity to what is known of the childhood and adolescence of the cohort's mothers and to socio-economic differences during the child's first year. The panels in Table 2 expressing the age at motherhood coefficients in Models 2 and 3 show that when both sets of explanatory variables have been introduced, about half of the age profile in the cognitive scores has been accounted for, and about three quarters of the gap in behaviour related to the age-of-mother. There remains some significant, or near significant, association of child outcomes with age at motherhood. The combined set of factors ('antecedent' and 'first year circumstances') still do not explain anything like all underlying the variation either. This leaves plenty of room for the operation of chance, child agency and other explanatory factors that we have not observed or included. We can also note that although the four outcomes generally move in the same direction as each block of variables is introduced, Naming Vocabulary and behaviour difficulties are generally more sensitive to age at motherhood and to these socio-economic indicators.

We can also note other ways in which the different measures of child development differ from each other. There are some predictor variables that are only significant for some outcomes. For example, the international immigration indicators are only significant for Naming Vocabulary. Language spoken in the home plausibly affects vocabulary too, but otherwise only Picture Similarities. The woman's malaise during the child's first year is linked to the behavioural outcomes at age five, but not the cognitive scores. The woman's entry into employment after the child's birth, which is positively associated with later entry to motherhood and negatively associated with malaise, showed the mixed and very minor coefficients that have emerged in other studies of maternal employment and child development (Gregg et al. 2005, Verropoulou and Joshi 2009, Cooksey et al. 2009, Hansen et al. 2009). A curiosity, rather than a robust or substantively significant result, is that the estimates for maternal employment on Pattern Construction are significant and positive.

6. Conclusion

The child outcomes considered here vary by the age at which their mothers had their first child, up to the early thirties. The degree of sensitivity varies with outcome. The verbal cognitive scale showed greatest systematic variation, followed by the behaviour score, with smaller differentials for the other two cognitive scores. The results of regression analysis suggest that the inclusion of the additional independent variables moderates these associations but they do not explain them completely. About one quarter of the difference between young and older mothers is accounted for by factors rooted in the cohort child's mother's own family of origin that we are able to observe. This applies to all four outcomes and, more or less, to the contrast between mothers above and below age 25, as well as the clearer contrast between those over 30 and under 20.

The antecedent factors as measured (ethnicity, social class, family disruption and early school leaving) could not (or are unlikely to) have been caused by early motherhood. So, we argue, one quarter forms a lower bound to our estimate of the intergenerational element in the apparent developmental penalty facing the children of young mothers. The battery of factors measured in the cohort child's first year, related to both age at motherhood and child outcomes, account for around another quarter to one half of the age at motherhood terms. These may reflect pre-existing influences, but could be the result of the timing of childbearing itself affecting child development.

The most important elements here are the woman's qualifications and family income, variations in which are not likely to be mainly caused by fertility events. At least in the case of qualifications, we cite literature supporting this assertion. This leaves a residual unexplained differential, about half of the unadjusted 'delayed motherhood premium', that could reflect the impact on child outcomes of the age at which the mother had her first child, in other words, a premium in child development associated with maturity on entry to motherhood, not to mention the woman's accumulation of human and material assets as she delays entry to motherhood. However our data suggests this premium does not continue to accumulate much beyond age 30. On the other hand, it might reflect unmeasured factors that run in families, or the qualities of school or other services the mother encountered in her early years. So we are left with a broad range of the possible consequences for child outcomes of postponing motherhood up to the early thirties. They could account for half to three quarters of the difference between late and early mothers, or none of it.

In short, delaying childbearing beyond age 30 does not appear to be associated with a developmental gain for the children, but postponement of motherhood from teen years into the twenties is associated with modest advantages in terms of child development. This is after we have allowed, as far as we are able, for the disadvantaged origins of the youngest mothers, but we are not able to prove that the association is causal. This evidence is consistent with, though not proof of, the hypothesis that early motherhood compounds disadvantage in one generation into the next – to a modest rather than a major extent.

In either case this does suggest that government policies that successfully discourage early motherhood would have some, probably modest, further benefit for the development of the next generation. The same applies to economic conditions that make it seem more or less worthwhile to avoid early childbearing. Conversely, if more women become mothers very young, there are likely to be adverse effects for both children and mothers. For whatever reason, the children of mothers who have not delayed childbearing are at risk of delays in their own development. Early years interventions, schools and health services, need to be sensitive to the difficulties facing young mothers among other categories of families less likely to be able to give their children a good start unassisted.

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Appendix A: Analysis of Naming Vocabulary score of child at age 5

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As Model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
BAS Naming Vocabulary T-score	Coef.	t	Coef.	t	Coef.	t	Coef.	t
Age at first motherhood (ref<20)								
20-24	2.67	4.51	2.25	3.75	1.37	2.20	0.84	2.39
25-29	6.70	12.31	5.35	9.32	3.30	5.29	2.36	6.49
30+	8.04	13.94	6.58	10.71	4.06	6.25	2.95	7.57
Antecedent factors								
Woman's mother born in the UK			0.19	0.21	-0.41	-0.50	0.24	0.47
Woman's father born in UK			0.77	0.82	0.48	0.53	-0.14	-0.27
Woman herself born in UK			2.70	3.23	1.47	1.85	0.74	1.64
Left school at minimum age			-2.55	-7.17	-1.05	-2.90	-0.97	-3.50
Woman's ethnic group (ref= white)								
mixed			0.29	0.18	-0.30	-0.21	-0.97	-1.06
Indian			-2.41	-1.42	0.80	0.54	-0.30	-0.32
Pakistani and Bangladeshi			-8.33	-5.38	-3.05	-2.13	-3.66	-3.74
black or black British			-6.24	-4.57	-5.80	-3.71	-4.31	-5.11
other ethnic group			-6.02	-2.83	-3.12	-1.72	-2.71	-2.20
Woman's parents separated before age 18			-1.20	-2.88	-1.05	-2.55	-0.12	-0.48
Spent some of childhood not in family home			0.79	1.60	0.75	1.55	0.76	2.47
Occupation of woman's father when she was 14, (ref = father not employed or absent)								
Managers and senior officials			2.07	3.09	1.40	2.17	1.60	3.92
Professional occupations			2.70	3.78	1.73	2.50	1.75	3.94
Associate professional and technical occupations			1.40	1.86	0.81	1.08	1.01	2.06
Administrative and secretarial occupations			2.10	2.59	1.32	1.62	1.47	2.37
Skilled trades occupations			0.93	1.56	0.66	1.18	0.87	2.45
Personal service occupations			2.85	1.93	3.13	2.29	2.50	2.59
Sales and customer service occupations			2.85	1.94	2.88	2.05	1.91	1.90
Process, plant and machine operatives			0.95	1.43	0.71	1.16	0.71	1.92
Elementary occupation			0.22	0.27	0.14	0.18	0.77	1.78

Appendix A: Analysis of Naming Vocabulary score of child at age 5 (continued)

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As Model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
Circumstances in Child's first year	Coef.	t	Coef.	t	Coef.	t	Coef.	t
English only spoken at home					7.25	8.39	5.94	10.08
Partner present at sweep 1					-0.20	-0.29	-1.04	-2.12
Owner occupier					-0.32	-0.64	0.55	1.86
Highest qualification of woman (ref none)								
nvq level 1					2.22	2.65	1.25	2.46
nvq level 2					2.89	4.04	2.32	5.23
nvq level 3					3.44	4.81	2.57	4.85
nvq level 4					5.59	7.21	4.38	8.35
nvq level 5					6.69	6.48	5.69	7.46
overseas /other qual only					2.88	1.87	0.09	0.10
Family net income pa (ref = under £10400)								
£10400 - £20800 pa					2.05	3.08	1.22	3.39
£20800 - £31200 pa					2.67	3.31	2.13	4.55
£31200 - £52000 pa					3.83	4.19	2.61	5.51
£52000 + pa					2.87	3.02	3.32	4.94
Malaise score					-0.04	-0.37	-0.04	-0.60
Partner employed					-0.49	-0.73	1.12	2.70
Woman employed (ref none by 9 mths)								
full time					-0.42	-0.83	-0.42	-1.37
part time					-0.09	-0.22	-0.05	-0.20
Design and Development controls								
Stratum (ref = non disadvantaged England)								
England - disadvantaged	-1.23	-2.41	-0.28	-0.62	0.20	0.45	-0.31	-1.01
England - ethnic	-8.95	-7.71	-3.13	-3.08	-1.33	-1.43	-1.21	-1.82
Wales - non-disadvantaged	-1.09	-1.97	-1.18	-2.25	-0.73	-1.50	-0.99	-2.71
Wales - disadvantaged	-2.01	-3.82	-1.69	-3.24	-0.61	-1.14	-1.14	-3.12
Scotland - non-disadvantaged	1.54	1.96	1.36	1.84	0.98	1.33	0.46	0.92
Scotland - disadvantaged	-0.89	-1.27	-0.64	-1.02	-0.41	-0.67	0.19	0.44
Northern Ireland - non-disadvantaged	1.33	1.09	1.00	0.83	1.17	0.97	0.29	0.36
Northern Ireland - disadvantaged	-0.43	-0.55	-0.34	-0.45	0.46	0.60	0.08	0.12
Twin/triplet indicator	-2.32	-2.05	-2.87	-2.45	-2.51	-2.23	-1.71	-2.16
Low birth weight dummy	-0.98	-1.49	-0.91	-1.39	-0.84	-1.38	-0.37	-0.80
Female child	0.80	2.26	0.77	2.25	0.73	2.23	0.71	3.34
Cohort child is the first born							2.03	9.45
Constant	52.15	89.99	49.65	47.84	40.77	29.25	41.43	47.77
R Squared	0.111		0.161		0.199		0.201	
Observations	4807		4807		4807		11273	

Appendix B: Analysis of Pattern Construction scores of child, age 5

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As Model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
BAS Pattern Construction T-score	Coef.	t	Coef.	t	Coef.	t	Coef.	t
Age at first motherhood (ref <20)								
20-24	1.53	2.30	1.32	1.95	0.71	0.99	0.49	1.27
25-29	3.47	5.36	2.69	3.99	1.51	2.00	1.18	2.88
30+	3.86	5.77	3.02	4.39	1.46	1.85	1.44	3.25
Antecedent factors								
Woman's mother born in the UK			0.12	0.15	0.14	0.17	0.48	0.93
Woman's father born in UK			-0.14	-0.17	-0.19	-0.23	-0.53	-1.16
Woman herself born in UK			-0.12	-0.17	-0.53	-0.80	-0.60	-1.33
Left school at minimum age			-0.97	-2.80	-0.11	-0.30	-0.46	-1.95
Woman's ethnic group (ref= white)								
mixed			-4.76	-2.09	-4.86	-2.13	-4.20	-2.92
Indian			0.08	0.07	0.58	0.44	0.66	0.79
Pakistani and Bangladeshi			-4.04	-3.72	-2.95	-2.63	-1.66	-2.48
black or black British			-3.68	-3.25	-3.41	-3.02	-1.98	-2.51
other ethnic group			-0.78	-0.67	0.10	0.10	1.35	1.51
Woman's parents separated before age 18			-0.21	-0.56	-0.11	-0.29	0.18	0.72
Spent some of childhood not in family home			-0.80	-1.86	-0.89	-2.01	-0.41	-1.36
Occupation of woman's father when she was 14, (ref = father not employed or absent)								
Managers and senior officials			1.18	1.90	0.77	1.24	0.56	1.39
Professional occupations			1.27	1.98	0.74	1.17	0.59	1.29
Associate professional and technical occupations			-0.09	-0.13	-0.39	-0.55	-0.10	-0.22
Administrative and secretarial occupations			0.07	0.09	-0.31	-0.39	0.00	0.00
Skilled trades occupations			0.49	0.84	0.27	0.46	0.07	0.19
Personal service occupations			0.82	0.64	0.86	0.70	0.93	0.96
Sales and customer service occupations			2.02	1.65	2.08	1.73	1.08	1.05
Process, plant and machine operatives			-0.57	-0.90	-0.74	-1.18	-0.04	-0.10
Elementary occupation			-1.14	-1.55	-1.12	-1.55	-0.88	-1.69

Appendix B: Analysis of Pattern Construction scores of child, age 5 (continued)

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
Circumstances in Child's first year	Coef.	t	Coef.	t	Coef.	t	Coef.	t
English only spoken at home					1.31	1.77	1.41	2.94
Partner present at sweep 1					1.52	1.73	0.63	1.23
Owner occupier					-0.08	-0.16	0.48	1.50
Highest qualification of woman (ref none)								
nvq level 1					0.17	0.18	0.29	0.53
nvq level 2					1.60	2.00	2.10	5.51
nvq level 3					2.38	2.75	2.18	4.94
nvq level 4					2.69	3.24	2.74	6.43
nvq level 5					2.34	2.00	2.77	4.40
overseas /other qual only					0.48	0.37	-0.34	-0.42
Family net income pa (ref = under £10400)								
£10400 - £20800 pa					0.55	0.80	0.40	1.01
£20800 - £31200 pa					0.95	1.27	0.73	1.80
£31200 - £52000 pa					1.88	2.38	1.48	3.13
£52000 + pa					2.54	2.64	2.35	4.41
Malaise score					-0.07	-0.65	-0.03	-0.54
Partner employed					-1.57	-1.66	-0.26	-0.51
Woman employed (ref none by 9 mths)								
full time					0.16	0.33	-0.32	-0.98
part time					0.16	0.37	0.01	0.03
Design and Development controls								
Stratum (ref = non disadvantaged England)								
England - disadvantaged	-0.93	-1.69	-0.49	-0.92	-0.22	-0.40	-0.54	-1.20
England - ethnic	-2.68	-3.58	-0.81	-1.05	-0.12	-0.16	-0.37	-0.80
Wales - non-disadvantaged	0.10	0.13	0.12	0.15	0.26	0.33	-0.48	-0.64
Wales - disadvantaged	-0.92	-1.29	-0.75	-1.05	-0.38	-0.55	-0.11	-0.19
Scotland - non-disadvantaged	-0.93	-0.94	-0.97	-1.00	-1.12	-1.17	-1.61	-1.87
Scotland - disadvantaged	-2.20	-3.26	-1.93	-2.90	-1.81	-2.66	-2.23	-4.42
Northern Ireland - non-disadvantaged	1.40	1.83	1.25	1.63	1.32	1.76	0.58	1.07
Northern Ireland - disadvantaged	0.60	0.68	0.62	0.70	1.14	1.26	0.36	0.53
Twin/triplet indicator	0.69	0.68	0.50	0.49	0.60	0.59	0.03	0.04
Low birth weight dummy	-2.30	-3.97	-2.18	-3.81	-2.09	-3.67	-2.06	-4.75
Female child	1.21	3.94	1.24	4.11	1.26	4.25	1.48	7.48
Cohort child is the first born							0.04	0.17
Constant	49.02	64.48	49.90	39.51	46.96	36.72	46.51	54.95
R Squared	0.038		0.055		0.068		0.074	
Observations	4741		4741		4741		11116	

Appendix C: Analysis of BAS Picture Similarities score at age 5

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As Model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
BAS Picture Similarities Construction T-score	Coef.	t	Coef.	t	Coef.	t	Coef.	t
Age at first motherhood (ref <20)								
20-24	1.21	1.79	0.89	1.26	0.52	0.70	-0.20	-0.46
25-29	3.58	5.15	2.84	4.01	1.86	2.40	1.32	2.85
30+	4.14	5.79	3.26	4.42	1.78	2.21	1.44	2.90
Antecedent factors								
Woman's mother born in the UK			0.24	0.27	0.41	0.45	0.00	-0.01
Woman's father born in UK			-0.41	-0.42	-0.35	-0.39	-0.52	-0.94
Woman herself born in UK			-0.52	-0.68	-0.92	-1.23	-0.35	-0.78
Left school at minimum age			-1.28	-3.45	-0.31	-0.79	-0.55	-1.90
Woman's ethnic group (ref= white)								
mixed			-2.19	-1.62	-2.26	-1.67	-1.18	-1.12
Indian			-2.17	-1.52	-1.84	-1.27	-0.91	-0.95
Pakistani and Bangladeshi			-2.97	-2.02	-1.82	-1.26	-1.44	-1.46
black or black British			-1.40	-1.21	-1.14	-0.97	-1.05	-1.11
other ethnic group			-1.48	-0.83	-0.63	-0.34	0.72	0.54
Woman's parents separated before age 18			-0.16	-0.36	-0.03	-0.07	-0.10	-0.37
Spent some of childhood not in family home			-0.13	-0.26	-0.28	-0.56	0.45	1.26
Occupation of woman's father when she was 14, (ref = father not employed or absent)								
Managers and senior officials			0.99	1.61	0.62	1.02	0.96	2.48
Professional occupations			1.20	1.68	0.56	0.80	0.68	1.45
Associate professional and technical occupations			0.08	0.10	-0.17	-0.22	0.98	2.02
Administrative and secretarial occupations			0.93	1.09	0.52	0.64	0.82	1.45
Skilled trades occupations			0.47	0.77	0.31	0.53	0.56	1.56
Personal service occupations			-0.30	-0.19	-0.10	-0.07	0.02	0.02
Sales and customer service occupations			-0.10	-0.07	-0.06	-0.04	-0.86	-0.92
Process, plant and machine operatives			0.25	0.40	0.18	0.29	0.34	0.87
Elementary occupation			0.12	0.16	0.21	0.27	0.20	0.43

Appendix C: Analysis of BAS Picture Similarities score at age 5 (continued)

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As Model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
Circumstances in Child's first year	Coef.	t	Coef.	t	Coef.	t	Coef.	t
English only spoken at home					0.98	1.30	0.63	1.04
Partner present at sweep 1					0.74	0.94	-0.33	-0.66
Owner occupier					-0.18	-0.39	-0.06	-0.20
Highest qualification of woman (ref none)								
nvq level 1					1.47	1.51	0.49	0.80
nvq level 2					1.16	1.47	1.20	2.76
nvq level 3					1.82	2.19	1.58	3.10
nvq level 4					2.81	3.43	2.01	3.89
nvq level 5					3.62	3.18	3.49	5.09
overseas /other qual only					0.99	0.80	0.00	0.00
Family net income pa (ref = under £10400)								
£10400 - £20800 pa					0.20	0.31	0.17	0.43
£20800 - £31200 pa					0.28	0.38	0.38	0.81
£31200 - £52000 pa					1.04	1.25	1.13	2.20
£52000 + pa					2.76	2.75	2.07	3.37
Malaise score					-0.11	-1.08	-0.04	-0.58
Partner employed					-0.81	-1.03	0.32	0.76
Woman employed (ref none by 9 mths)								
full time					0.73	1.35	0.81	2.52
part time					0.74	1.81	0.81	3.14
Design and Development controls								
Stratum (ref = non disadvantaged England)								
England - disadvantaged	0.35	0.61	0.66	1.18	0.89	1.60	0.76	1.62
England - ethnic	-0.43	-0.54	0.89	0.93	1.52	1.63	1.29	1.97
Wales - non-disadvantaged	1.60	2.14	1.55	2.05	1.64	2.13	0.78	1.26
Wales - disadvantaged	0.66	1.06	0.85	1.35	1.16	1.80	0.56	1.20
Scotland - non-disadvantaged	0.06	0.08	0.05	0.07	-0.11	-0.15	-0.61	-1.09
Scotland - disadvantaged	-1.79	-2.78	-1.62	-2.56	-1.54	-2.44	-0.87	-1.52
Northern Ireland - non-disadvantaged	2.90	2.11	2.77	2.00	2.79	2.02	2.99	3.91
Northern Ireland - disadvantaged	2.84	4.04	2.85	4.05	3.23	4.41	3.75	5.33
Twin/triplet indicator	-1.40	-1.16	-1.54	-1.27	-1.24	-1.04	-0.07	-0.08
Low birth weight dummy	-1.26	-1.82	-1.14	-1.63	-1.01	-1.51	-0.99	-2.13
Female child	1.29	3.33	1.29	3.43	1.29	3.40	1.01	4.13
Cohort child is the first born							0.01	0.02
Constant	52.63	65.48	53.93	43.97	51.15	36.83	51.97	56.79
R Squared	0.032		0.039		0.053		0.05	
Observations	4795		4795		4795		11259	

Appendix D: Analysis of Total Difficulties score of child at age 5

Model	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As Model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
SDQ total difficulties scale T-score	Coef.	t	Coef.	t	Coef.	t	Coef.	t
Age at first motherhood (ref<20)								
20-24	-1.82	-2.97	-1.00	-1.51	0.36	0.52	-0.38	-0.95
25-29	-4.59	-7.24	-3.31	-4.73	-0.74	-0.93	-1.19	-2.58
30+	-5.71	-9.15	-4.30	-6.23	-1.50	-1.93	-1.64	-3.59
Antecedent factors								
Woman's mother born in the UK			0.83	1.31	0.83	1.30	-0.32	-0.62
Woman's father born in UK			0.01	0.01	-0.21	-0.28	0.32	0.67
Woman herself born in UK			-0.68	-0.94	-0.13	-0.21	0.76	1.69
Left school at minimum age			1.19	3.00	0.00	0.00	0.45	1.82
Woman's ethnic group (ref= white)								
mixed			0.05	0.02	0.46	0.22	0.92	0.79
Indian			-0.23	-0.11	-1.42	-0.62	-1.30	-1.10
Pakistani and Bangladeshi			1.14	0.69	-0.78	-0.52	0.54	0.51
black or black British			1.74	0.96	1.60	0.94	-0.38	-0.47
other ethnic group			0.30	0.18	-0.02	-0.01	0.19	0.14
Woman's parents separated before age 18			0.88	1.96	0.60	1.45	-0.07	-0.26
Spent some of childhood not in family home			0.34	0.58	0.19	0.37	0.76	2.11
Occupation of woman's father when she was 14, (ref = father not employed or absent)								
Managers and senior officials			-1.73	-2.47	-1.09	-1.66	-1.12	-2.64
Professional occupations			-2.10	-2.97	-1.60	-2.35	-1.61	-3.54
Associate professional and technical occupations			-3.09	-4.16	-2.35	-3.20	-1.75	-3.32
Administrative and secretarial occupations			-2.64	-2.65	-2.03	-2.14	-1.58	-2.61
Skilled trades occupations			-1.80	-2.54	-1.10	-1.60	-0.78	-1.81
Personal service occupations			0.27	0.12	1.15	0.57	0.03	0.03
Sales and customer service occupations			-2.90	-2.53	-2.21	-1.93	-1.52	-1.63
Process, plant and machine operatives			-0.95	-1.26	-0.42	-0.60	-0.11	-0.24
Elementary occupation			-0.55	-0.69	-0.44	-0.59	-0.51	-0.96

Appendix D: Analysis of Total Difficulties score of child at age 5 (continued)

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
Circumstances in Child's first year	Coef.	t	Coef.	t	Coef.	t	Coef.	t
English only spoken at home					-1.01	-1.03	-0.60	-0.92
Partner present at sweep 1					-1.08	-1.25	-0.70	-1.09
Owner occupier					-0.31	-0.58	-1.32	-3.82
Highest qualification of woman (ref none)								
nvq level 1					-1.58	-1.31	-1.35	-1.94
nvq level 2					-3.17	-3.49	-2.16	-4.02
nvq level 3					-3.69	-3.62	-2.36	-3.82
nvq level 4					-4.77	-5.17	-3.15	-5.50
nvq level 5					-3.25	-2.70	-2.53	-3.30
overseas/other qual only					-2.45	-1.43	-1.34	-1.41
Family net income pa (ref = under £10400)								
£10400 - £20800 pa					-0.55	-0.80	-0.47	-1.10
£20800 - £31200 pa					-0.51	-0.63	-0.77	-1.60
£31200 - £52000 pa					-0.68	-0.80	-1.25	-2.49
£52000 + pa					-1.90	-2.01	-1.82	-3.25
Malaise score					1.52	12.84	1.29	16.33
Partner employed					0.27	0.36	-0.22	-0.41
Woman employed (ref none by 9 mths)								
full time					-0.57	-1.16	0.09	0.26
part time					-0.21	-0.52	0.25	0.99

Appendix D: Analysis of Total Difficulties score of child at age 5 (continued)

	1		2		3		4	
	Design and development controls		As Model 1 + Clearly Antecedent factors		As model 2 + Circumstances in Child's first year		As Model 3 for all birth orders	
Design and Development controls								
Stratum (ref = non disadvantaged England)								
England - disadvantaged	1.62	3.50	1.19	2.63	0.65	1.42	0.49	1.82
England - ethnic	2.54	3.63	2.12	2.55	1.02	1.28	1.03	1.89
Wales - non-disadvantaged	-0.21	-0.40	-0.38	-0.74	-0.78	-1.64	-0.48	-1.07
Wales - disadvantaged	1.05	2.06	0.57	1.10	-0.53	-1.02	-0.32	-0.86
Scotland - non-disadvantaged	0.03	0.05	-0.03	-0.06	-0.08	-0.14	-0.26	-0.80
Scotland - disadvantaged	1.14	1.77	0.74	1.19	0.00	0.00	-0.35	-0.81
Northern Ireland - non-disadvantaged	-0.66	-1.07	-0.71	-1.16	-0.99	-1.64	-0.77	-1.77
Northern Ireland - disadvantaged	-0.59	-0.89	-0.80	-1.22	-1.87	-2.80	-0.90	-2.03
Twin/triplet indicator	0.57	0.54	0.58	0.54	0.14	0.14	0.13	0.16
Low birth weight dummy	1.35	1.95	1.32	1.86	0.73	1.14	1.33	2.77
Female child	-2.18	-5.99	-2.09	-5.87	-2.01	-5.96	-2.07	-10.56
Cohort child is the first born							1.03	4.58
Constant	53.77	88.30	53.54	46.35	55.60	33.96	53.73	51.79
R Squared	0.074		0.090		0.170		0.157	
Observations	3857		3857		3857		8992	

Appendix E: Descriptive Statistics: Weighted data from Regression sample based on MCS3

	First Born		Subsequent Birth	
	mean	std.err.	mean	std.err
Antecedent factors				
Woman's mother born in the UK	0.879	0.009	0.867	0.011
Woman's father born in UK	0.886	0.010	0.860	0.011
Woman herself born in UK	0.928	0.007	0.917	0.007
Left school at minimum age	0.361	0.013	0.460	0.012
Woman's ethnic group (ref= white)				
mixed	0.007	0.001	0.006	0.001
Indian	0.015	0.003	0.016	0.003
Pakistani and Bangladeshi	0.019	0.004	0.028	0.005
black or black British	0.012	0.002	0.022	0.004
other ethnic group	0.010	0.002	0.009	0.002
Woman's parents separated before age 18	0.243	0.008	0.240	0.007
Spent some of childhood not in family home	0.129	0.007	0.142	0.006
Occupation of woman's father when she was 14, (ref = father not employed or absent)				
Managers and senior officials	0.182	0.007	0.176	0.006
Professional occupations	0.107	0.007	0.088	0.005
Associate professional and technical occupations	0.089	0.005	0.074	0.004
Administrative and secretarial occupations	0.040	0.004	0.034	0.003
Skilled trades occupations	0.232	0.008	0.247	0.007
Personal service occupations	0.013	0.002	0.013	0.002
Sales and customer service occupations	0.015	0.003	0.011	0.001
Process, plant and machine operatives	0.138	0.007	0.154	0.006
Elementary occupation	0.070	0.005	0.080	0.004
Circumstances in Child's first year				
English only spoken at home	0.937	0.007	0.928	0.007
Partner present at sweep 1	0.873	0.006	0.906	0.005
Owner occupier	0.708	0.011	0.704	0.011
Highest qualification of woman (ref none)				
nvq level 1	0.062	0.004	0.081	0.005
nvq level 2	0.268	0.010	0.312	0.010
nvq level 3	0.174	0.007	0.130	0.005
nvq level 4	0.377	0.013	0.322	0.011
nvq level 5	0.050	0.005	0.035	0.003
overseas /other qual only	0.013	0.002	0.019	0.002

Family net income pa (ref = under £10400)				
£10400 - £20800 pa	0.274	0.010	0.334	0.010
£20800 - £31200 pa	0.242	0.009	0.253	0.008
£31200 - £52000 pa	0.211	0.009	0.191	0.008
£52000 + pa	0.089	0.012	0.074	0.007
Malaise score	1.441	0.031	1.637	0.026
Partner employed	0.819	0.008	0.832	0.007
Woman employed (ref none by 9 mths)				
full time	0.243	0.008	0.141	0.007
part time	0.396	0.010	0.356	0.009
Design and Development controls				
Stratum (ref = non disadvantaged England)				
England - disadvantaged	0.244	0.016	0.242	0.016
England - ethnic	0.026	0.004	0.032	0.005
Wales - non-disadvantaged	0.028	0.004	0.029	0.005
Wales - disadvantaged	0.024	0.003	0.023	0.002
Scotland - non-disadvantaged	0.056	0.005	0.057	0.005
Scotland - disadvantaged	0.035	0.004	0.030	0.003
Northern Ireland - non-disadvantaged	0.018	0.002	0.019	0.002
Northern Ireland - disadvantaged	0.012	0.001	0.015	0.001
Twin/triplet indicator	0.033	0.004	0.023	0.003
Low birth weight dummy	0.087	0.005	0.058	0.004
Female child	0.486	0.008	0.497	0.008
Observations	4841		6528	

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