Pathways to 'off-time' motherhood in the United Kingdom: the timing and sequencing of childhood antecedents

M.Carmen Huerta, Wendy Sigle-Rushton

Abstract

A number of studies have examined the antecedents of early motherhood, and these provide good evidence that young mothers are more likely to come from poorer families, to have experienced family disruption and to have low educational attainment (Kiernan 1997; Hobcraft 1998; Hobcraft and Kiernan 1999). However, the experience, timing, and duration of these adverse childhood events are likely to be important. Using data from a 1970 cohort of British women, this paper builds on previous work and uses structural equation modelling (SEM) to consider the timing of events explicitly - in early childhood, pre-adolescence and adolescence. Our findings suggest that, regardless of when they are measured during childhood, educational achievement measures and socio-economic characteristics are linked to early childbearing. In contrast, behavioural attributes have a greater effect on young motherhood at older ages, particularly during adolescence. Our results also identify the pathways most strongly associated with early motherhood. Social class at birth highly influences the outcome of interest through its indirect relationship with risk factors later on, especially academic achievements.

1. Introduction

It is well recognised that the UK has the highest rates of early childbearing in Western Europe. Teenage birth rates in the UK are twice as high as in Germany, three times as high as in France, and four times as high as in Sweden (SEU 1999). In the light of this, in 1999 the UK government set a target of halving conception rates among under 18 year olds by 2010. However, recent data shows that progress has been slow[1]. Hence, increased efforts have to be done to understand and tackle this problem.

Previous research in industrialised countries has provided evidence of a strong link between early parenthood and childhood experiences. For example, young mothers are more likely to come from poorer families, to have experienced family disruption and to have low educational attainment (Kiernan 1997; Hobcraft 1998; Hobcraft and Kiernan 1999). Although these antecedents to young parenthood are well documented, little is known about the importance of the timing and duration

1 Between 1999 and 2004, conception rates among under 18 years old dropped 7.3 percent only (from 44.0 to 41.7 births per 1,000 women)(ONS 2006).

of adverse events. It is possible that poor educational outcomes at younger ages may be less strongly related with early motherhood than poor educational outcomes in adolescence when the transition to adulthood is being negotiated. Identifying stages in which individuals are more vulnerable to adverse experiences can help in designing more efficient policies for tackling off-time motherhood.

The aim of this paper is to examine further the link between childhood antecedents and early motherhood. We are particularly interested in the extent to which links are stronger or weak at different points in time. Using data from a cohort of British women born in 1970, we assess the development stages - early childhood, pre-adolescent, or adolescent years - in which children are most vulnerable to adverse events; and examine the pathways through which different childhood characteristics influence early motherhood. In the next section, we set the background of this research by reviewing the literature on early motherhood and highlight why it is that issues of timing might be important. In Section 3, we provide information on the data, the variables and the methodology used in our analysis. In Section 4, we present our results, and the final section discusses the conclusions drawn from this study.

2. Background

Numerous studies have shown that childhood disadvantage is associated with a higher risk of early childbearing (Kiernan 1997; Hobcraft 1998; Hobcraft and Kiernan 1999; Ermisch and Pevalin 2003; Sigle-Rushton 2004; Sigle-Rushton 2005; Woodward et al. 2006), which is, in turn, associated with disadvantage later in life. Young mothers are more likely to lack economic resources, to have restricted employment opportunities, to have limited academic achievements, and to report poor mental health (Furstenberg et al. 1987; Hotz et al. 1997; Hobcraft and Kiernan 1999; Moffitt and Team 2002; Sigle-Rushton 2004). What is more, research suggests that early motherhood has a negative effect not only on mothers' future outcomes but also on those of their children (Furstenberg et al. 1987; Maynard 1997; Moffitt and Team 2002).

Although many studies of young mothers limit their analysis to teenaged motherhood, previous research has shown that entering motherhood in the early

twenties is also associated with a higher risk of experiencing adverse outcomes later in life (Hobcraft and Kiernan 1999; Woodward et al. 2006). Furthermore, following the trend of most western societies, first birth timing was postponed among the cohort born in 1970. Estimates using the BCS70 data provide evidence of this shift of fertility towards older ages. While the median age at first birth among the cohort members' mothers was of 22 years, among the women in our sample around 50 percent had their first child until the age of 29. Thus, amongst the women in the BCS70 sample, childbearing in both the teenaged years and early twenties is arguably off-time, i.e. early relative to social norms and expectations.

Life course models focus on the pathways through which early experiences influence early motherhood. These models emphasize that disadvantageous conditions during childhood can have lasting effects on future outcomes. Moreover, experiencing persistent disadvantage may lead to a transmission of unfavourable conditions over the life course and across generations. Nevertheless, it is important to underline that early experiences do not *determine* future outcomes, but they do increase or decrease the likelihood of having positive or negative repercussions later in life.

A developmental or life course perspective also underscores that the timing of events is likely to be important. Early experiences are of vital importance for the intellectual, emotional and physical development of the individual (Shonkoff and Philips 2000). Adverse experiences at young ages can have significant and enduring consequences in adolescence and adulthood, and disadvantage at this life stage may be especially detrimental (Duncan and Brooks-Gunn 1997; Hobcraft 1998; Hobcraft and Kiernan 1999; Martorell 1999a; Hobcraft 2000; Glewwe et al. 2001; Hobcraft 2002; Feinstein 2003; Hobcraft 2003; Case et al. 2004; Sigle-Rushton 2004). For example, empirical evidence suggests that socio-economic adversity experienced during early childhood has a more detrimental effect than if it was experienced at any subsequent stage of life (Haveman and Wolfe 1995; Duncan and Brooks-Gunn 1997; Bynner 1999; Hobcraft and Kiernan 1999; Shonkoff and Philips 2000).

What happens early is of vital importance, but what happens at older ages is also likely to matter because the individual is continuously influenced by the interaction of nature and nurture (Shonkoff and Philips 2000). Experiencing disadvantage during middle childhood can also undermine children's future attainments. An article by Feinstein (1998) shows that academic and non-academic abilities at age 10 have an important influence on subsequent developmental success. Although this paper shows that the incidence of adverse experiences at age 10 is relevant for future outcomes, it does not assess whether middle childhood abilities are as powerful as attributes in early childhood.

On the other hand, adolescence is a critical developmental stage because it is a period during which important transitions to adulthood are taking place. Individuals move out of compulsory education and, into employment or further education, decisions which have long-term consequences. In addition, family and peer relationships are undergoing change, and for some, sexual activity is initiated. Experiences during this stage can reinforce or alter an individual's life trajectories.

A few previous studies have assessed the timing of events as they relate to subsequent outcomes using data from the NCDS and BCS70 British cohorts (Schoon 2002; Schoon et al. 2002; Schoon et al. 2003; Schoon 2006). These show that risk effects – socioeconomic adversity, academic attainment, psychological well-being – have a cumulative and enduring effect over time. Schoon (2006) argues that although early adversity has an unquestionable detrimental effect in future outcomes, the whole life course is important for shaping individual's development. That is, individual adjustment is a dynamic process.

Although previous research has examined the timing and intensity of childhood disadvantage, to date, none have examined early motherhood as an outcome. Because young motherhood is one of the channels through which social exclusion is transmitted over time, this is an important omission. In what follows, we address this gap in the literature. Using a life course approach we examine pathways to young motherhood. We estimate the cumulative effects of different childhood characteristics and trajectories, and identify those developmental stages in which children are most vulnerable to adverse events.

3. Data, Methods and Measurement of Variables:

3.1 Data

This paper uses data of the 1970 British Cohort Study (BCS70), a longitudinal study of all children born in Great Britain in the first week of April 1970. The first round of data collection was carried out soon after birth and successive interviews were conducted at age 5, 10, 16, 26 and 30[2] (Ekinsmyth et al. 1992; Plewis et al. 2004). The information collected at most surveys was gathered from face to face interviews to parents, school teachers, health visitors, and cohort members. The exception was the follow-up survey at age 26, which was carried out through the postal service. For this reason, the quality of data of this sweep is poorer than the rest. Hence, for our outcome variable we use instead the information collected at age 30.

The total number of female cohort members with information in at least one wave of data collection is 8,978[3]. At the last round (i.e. at age 30), the response rate (number of interviewed cases divided by the total sample) was of around 70%. However, only 40% of the total sample was interviewed at all sweeps. Moreover, the proportion of cases with complete information at all rounds is lower than 40% because of item non-response or don't know answers. In particular, data at age 16 presents a good deal of missing information because a teacher strike coincided with the period of data collection.

Of the 5,790 women interviewed at age 30, 1,235 (21.3%) reported having had a live birth before age 23. We excluded 63 women who became mothers before the age of 17 because we wanted to ensure that the explanatory variables collected at age 16 precede the outcome variable. This restriction lead to a final working sample of 5,727 women, of whom 1,172 (20.5%) reported having become mothers by age 22. Although not shown here, estimates including the youngest mothers are very similar to those presented here.

2 In 2004 there was an additional follow-up of the BCS70 cohort. These data have not been publicly released at the time of writing.

3 This figure includes stillbirths (111 cases) and the immigrant cases that were born abroad during the same week of April 1970 and that were incorporated into the sample at consecutive waves (699 cases).

3.2 Methods

We carried out our analysis in two stages. First, we estimated a series of logistic regressions in order to have an initial insight into the influence of risk factors on early motherhood by age of the cohort member, and to identify the covariates to include in the second stage of our analysis. Next, we used structural equation modelling (SEM) to examine whether or not the timing of events is important, and to investigate the pathways associated with early motherhood.

3.2.1 Logistic Regressions

We began by estimating a logistic regression that included information from the three waves of data collection. In order to identify (or eliminate) the significant (non-significant) predictors in this model, we estimated our logistic regression employing stepwise backwards elimination[4]. For this analysis, we constructed a set of dummy variables for each control variable. That is, we included indicators for whether the cohort member was classified into the most disadvantaged category or not (with a value of 1 and 0, correspondingly). Individuals with missing information were coded with zero, and a dummy variable for missing data was included for each of the explanatory variables. This strategy allowed us to include as many cases as possible and to obtain some information regarding the cases with missing values.

Though not shown here, we estimated this model without the dummy variables for age 16 to assess whether the amount of missing data at this sweep introduced some bias into our estimates. However, the significance of the independent variables and the conclusions withdrawn from both approaches are very similar. Thus, we preferred using the model with data from the 3 waves of data collections.

3.2.2 Structural Equation Modelling

In the second stage of our analysis, we employed structural equation modelling (SEM) to model explicitly the incidence and timing of childhood events; to identify the development stages in which children are most vulnerable to adverse events;

4 This was done using the software Stata, which employs a combination of the forward entry and the backward removal methods. The algorithm begins fitting a full model and then progressively removes the least significant term that meets the critical value for exclusion. At the same time, it includes any excluded variable that later meets the criteria for inclusion. In this study, we used an exclusion criterion of 0.05 for removal and of 0.01 for re-entry.

and to understand the pathways through which different childhood characteristics influence early motherhood.

SEM models allow researchers to estimate simultaneously a series of interrelated dependent relationships. These models have 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 underlying latent constructs (or unobserved variables). The second component describes the relationships between the latent variables themselves and between the latent variables and the independent observed variables (Bollen 1989).

Models for categorical data are fitted using Asymptotic Distribution Free (ADF) methods such as Weighted Least Squares (WLS). These methods provide asymptotically efficient parameter estimates, but they have some practical limitations: the sample size needs to be large (at least 500 to 1,000 cases) (Hox and Bechger 2002), and a maximum of about 25 variables can be included (Bollen and Long 1993). In practice there are often problems with more than 25 variables, especially when these are categorical. The last constraint required us to be selective in our choice of explanatory variables.

An advantage of SEM models is that one can disaggregate the total effect of the explanatory variables into direct effects (those that go directly from one variable to another) and indirect effects (those between two variables that are mediated by at least one intervening variable) (Bollen 1989). This provides a better understanding of the relationships between variables. For example, in our study, we are able to assess whether the effect of educational attainments on early motherhood is mainly due to its direct effect on the outcome variable or if the indirect effects (e.g. through behaviour and temperament) also have an important contribution to the overall effect of this variable.

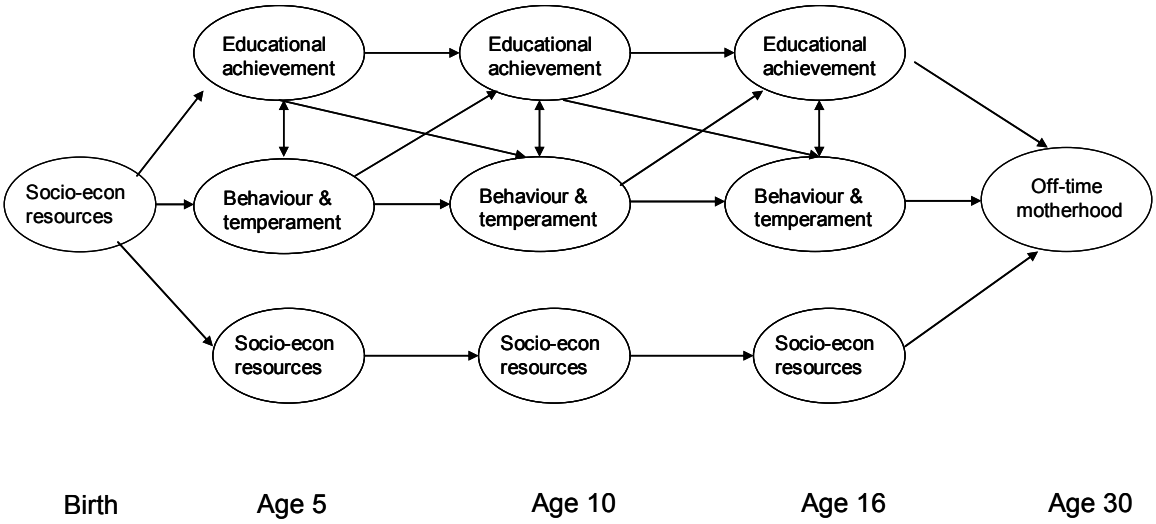
Using results from the previous analytical stages as a guide, we specified a model in which the onset of early motherhood is influenced by three latent constructs: educational achievement, behaviour and temperament, and socio-economic resources. More specifically, we grouped the independent variables into three latent constructs:

- Educational achievement
    - at age 5: vocabulary test and copying designs test;
    - at age 10: reading test and mathematics test;
    - at age 16: vocabulary test and spelling test;
- Behaviour and temperament
    - at ages 5, 10 and 16: aggression and restlessness;
- Socio-economic resources
    - at birth: social class;
    - at age 5: social class and housing tenure;
    - at age 10: social class, housing tenure and free meals;
    - at age 16: social class, housing tenure and financial difficulties.

Figure 1 illustrates the hypothesised interrelationships. We assume that there is a relationship between the same measures over time, such that early experiences increase (or decrease) the likelihood of later ones. For example, we assume that poor educational achievement at age 5 increases the likelihood of poor educational achievement at age 10, and, subsequently, poor educational achievement at age 10 influences that observed at age 16. We also hypothesised a cross-lagged effect between educational achievement and behavioural attitudes, and assessed whether, at each age, there is a concurrent relationship between educational attainments and behaviour. In addition, the model examines the influence of socio-economic resources on early motherhood by taking into account the conditions prevailing at birth. We assumed that socio-economic characteristics at birth have a direct effect on the three latent constructs observed during early childhood (i.e on educational achievement, behavioural attitudes, and socio-economic resources at age 5).

It is necessary to underline that the latent variables in our model influence early motherhood through a set of intermediate variables that we are unable to examine the proximate determinants of fertility (Davis and Blake 1956). The factors we examine operate through the proximate determinants to affect fertility outcomes. However, even after accounting for these intermediate variables, one has to be careful when interpreting associations, since their influence on early motherhood takes place through a complex interplay of mechanisms which our model does not consider.

Figure 1.



We used several different statistical tests to assess goodness of fit and followed the recommended guidelines on the cut-off values for good fitting models. These include: the chi-square test (with a P >0.05), the Comparative Fit Index (CFI with a value >0.95), the Root Mean Square Error of Approximation (RMSEA <= 0.05), and the Weighted Root Mean Square Residual (WRMR with a value close to 1.0) (Muthén 1998-2004; Yu 2002). The chi-square test measures the discrepancy between the sample covariance matrix[5] and the predicted covariance matrix of the model. The other goodness of fit indicators adjust the chi-square test for the size of the sample, the number of variables, and its distribution, indicating approximate fit. They are recommended when the model does not follow a normal distribution or when the sample size is large (Bollen and Long 1993).

3.3 Measurement of Variables

Outcome Variable

Following previous work by Hobcraft and Kiernan's (1999), we define *off-time motherhood*: as having had the first birth by age 22. Our estimates show that only 21 percent of the cohort members in our sample had a child by age 22 (see Table 1 in the Appendix). Hence, as argued before, it is likely that among the women in our sample not only teenage mothers are a vulnerable group, but also those who entered motherhood at a younger age than that of the norm.

5 The sample covariance matrix is estimated from the empirical data and it is used to fit the model to the data and to test the model.

Explanatory Variables

We examined a wide range of explanatory variables that previous studies have identified as being significantly associated with young motherhood. These included variables from multiple domains: demographic characteristics, socio-economic background, academic performance, emotional well-being. The covariates included in our logistic regression model were grouped into indicator variables similar to those used by Sigle-Rushton (2005). For this stage of the analysis, we included indicator variables for identifying those cases with *missing* information. On the other hand, for the SEM models, the explanatory variables were grouped hierarchically into categories, based upon the methods used by Hobcraft (1998). This categorisation is described in more detail below.

The demographic characteristics considered include the age of the cohort member's mother when she had her first birth and family structure. We controlled for mother's age at first birth because previous studies have suggested that there is an intergenerational link, such that the daughters of young mothers are more likely to become young mothers themselves (Kiernan 1997; Barber 2001; Ermisch and Pevalin 2003; Woodward et al. 2006). We identified those respondents whose mother had an early birth with an indicator of 1 if she had her first child before age *20.* Family structure was measured, at each age, identifying those cohort members who were living with *both natural parents*, with *one parent* because of death or divorce, and with neither parent in a *foster family*. We also identified those with missing information on family structure.

A range of measures of socio-economic background were included in the first part of our analysis. These include mother's age at leaving school, father's social class, housing tenure, receipt of free school meals (at age 10) and financial hardship (at age 16). We identified those cohort members whose mother left school at or before the minimum age for completion of compulsory studies with an indicator of 1 if mother's school-leaving age was equal to 15. The social class of the cohort member's father[6], collected at ages 0, 5, 10 and 16, is measured using the following occupational class categories: *semi-skilled and unskilled manual*, *skilled manual*, and *non-manual*. For the logistic regression model, we used a dummy

6 It should be noted that this information belongs to the resident father figure – may not be the natural father or the same man at each age.

variable that equals 1 if the father was working in a semi-skilled or skilled manual occupational class. We included two indicators of family poverty: receipt of free school meals (at age 10) and self-assessed financial difficulties (at age 16). Finally, we used information on housing tenure at each age, identifying those who lived in *local authority housing,* and *other* types of housing (including owner occupation, buying and private renting). An additional dummy variable identified those with missing information.

We controlled for academic achievement by using results from achievement tests administered at ages 5, 10 and 16. The content of these tests differed between waves because their appropriateness varies according to age. At age 5, we used the information gathered from a vocabulary test and a copying designs test. At age 10, we used data from a reading test and a mathematics test. And, at age 16, we used information from a vocabulary test and a spelling test. Each test score was standardised to have a mean of zero and a variance of one. For each age, the two standardised scores were added and then categorised according to their quartile distribution[7]. Those in the lowest quartile were classified as achieving *low level* scores, those in the middle two quartiles as obtaining *middle level* scores, and those in the top quartile as having *high level* scores. For the logistic regression, the category with the lowest scores was defined as the reference category, which was set as equal to 0. As with other covariates, this one also includes a dummy variable for *missing* information.

Measures of the cohort member's temperament and behaviour at each age were constructed using information collected from the cohort member's parent. Following Hobcraft (1998) and Sigle-Rushton (2004), at age 5, 10 and 16, we grouped 12 items into three behavioural measures: aggression, anxiety and restlessness. The first measure was constructed using parental reports on the extent to which their child: 1) frequently fights with other children, 2) is irritable, quick to fly off the handle, 3) often destroys own or others belongings, 4) is often disobedient, and 5) bullies other children. Anxiety was constructed based on reports that the cohort member: 1) often worries, 2) is miserable, unhappy, tearful, depressed, and 3) is fearful or afraid of new situations. Restlessness was

7 The standardisation of the test scores as well as the partition of the distribution into quartiles was carried out using information only of the female cohort members.

constructed using reports that the child: 1) is squirmy or fidgety, 2) has twitches or mannerisms, 3) cannot settle down to anything, and 4) is very restless. Each item was coded 0 for items that did not describe the cohort member's behaviour, 1 if the item somewhat described her behaviour, and 2 if the item certainly described her behaviour [8].

At each wave, we added the scores of all items within each behavioural measurement and classified the total sum into three categories: low, medium and high. For aggression and restlessness, we coded the sum into the following groups: *low* (sum of 0 or 1), *medium* (sum of 2 or 3), *high* (sum 4 or more). The coding for the anxiety measure differed from the previous one because it included fewer items. The coding used for grouping the anxiety items was: *low* (sum of 0), *medium* (sum of 1 or 2), and *high* (sum 3 or more). For the logistic model, the group with the lowest scores for each of these measures was defined as the reference group with a value of 1 and 0 otherwise. In addition, the three measures included a dummy variable for *missing* information.

In addition, we controlled for the cohort member's emotional well-being using measures of malaise, self-esteem and locus of control. At age 16, the cohort members were administered a 24 item list of symptoms, the Malaise Inventory, designed by Rutter *et al* (1970) to identify individuals with a heightened risk of depression. Similarly to other studies, we classified women into two groups: those with *high risk* of depression (those with scores of 7 or more), and those with *low risk* of depression (those with scores lower than 7). Self-esteem was measured at ages 10 and 16 using the Lawrence self-esteem questionnaire (LAWSEQ) designed by Lawrence (1981). Higher score indicate higher levels of child's self-esteem. We standardised this variable so that it had a mean of zero and variance of one. We then created an identifier that was set equal to one for those cohort members whose scores placed them in the bottom quartile of the distribution of scores. The last psychological attribute, locus of control, was measured at ages 10 and 16 using the CAROLOC score. Again we identified those with bottom quartile scores. For each of the three measures, we also identified those with missing information.

8 At ages 5 and 16, behavioural items were measured using a scale that ranged from 0 to 2, with 0 as doesn't apply, 1 as somewhat applies, and 2 as certainly applies. At age 10, however, the behavioural scores were assessed using a different scale, ranging from 0 to 100. This scale was converted into 3 categories to make it as similar as possible as the scale used at other waves (certainly applies (67-100), somewhat applies (33-66), and doesn't apply (0-32)).

Finally, we included a measure of mother's malaise in our logistic regression analysis since other studies have shown that mother's mental health has an important influence on children's outcomes (Case et al. 2001; Stein et al. 2003; Burgess et al. 2004). Rutter's Malaise Inventory was administered to the cohort member's mother at all childhood waves. At each age, we identified those mothers at *high risk* of depression (those with at least 7 positive answers), at *low risk* of depression (those with scores lower than 7), and those with missing information.

Missing data

We control for the selectivity associated with missing data by including in our logistic regression indicators of missingness for each of the explanatory variables. This approach allowed us to identify the extent to which individuals without information differ from those with information and from those classified in the reference category. Additionally, for fitting our structural equation models, we used the method available in Mplus for handling missing information, i.e. maximum likelihood estimation for missing data. It is important to mention that we estimated our SEM models for the sample with complete data and conclusions do not differ much from the previous ones.

4. Results

4.1 Logistic Regressions

Table 1 displays the results from a stepwise logistic regression including variables from the three developmental stages of interest. This table includes odd ratios, standard errors and the level of significance of each parameter. In this paper, the odds ratios represent the change in odds of becoming mothers by age 22 in relation to those of women in the reference category. These findings indicate which variables (and which time periods) are significantly associated with early motherhood. When measures taken at more than one point in time were retained, we carried out t-tests on the equality of coefficients. The p-values from these tests are shown in Table 1 using an arrow between the parameters that are being compared.

The first thing to notice is that all the socio-economic characteristics included in this model are statistically significant. Moreover, except for housing tenure, their

association with young motherhood is significant at ages 5, 10 and 16. Additionally, the t-tests for equality of coefficients indicate that the odds of these covariates do not differ by age. This suggests that socio-economic resources have an important and continuous influence on determining this outcome across the developmental stages under study.

Similarly, our results for academic performance show that this background variable has a persistent and significant influence on having a child at an early age. The odds ratios indicate that, while growing up, women with low academic performance have higher odds of becoming early mothers than women with better educational achievements (odds of 1.41:1.0 at age 16). The odd ratios increase with age, but the t-tests for equality of coefficients indicate that the differences over time are not statistically significant.

In contrast, few of the behavioural measures were retained. Only aggression, restlessness, locus of control and mother's malaise score are retained as significant predictors, and only at ages 10 or/and 16. The magnitude of the parameters as well as the p-values for the equality of coefficients suggest that the influence of the variables under this dimension increase with age.

The output from this model also shows that among the demographic characteristics considered only mother's age at first birth is significant. Our estimates show that women whose mother had a child before the age of 20 have greater odds of becoming a young mother to those of the reference category (odds of 1.77:1.00). This finding suggests a substantive influence of this risk factor across generations, a result in line with other studies that have found strong evidence of an intergenerational transmission of age at first birth (Kiernan 1997; Barber 2001; Ermisch and Pevalin 2003; Woodward et al. 2006). On the contrary, the parameter estimates of family structure are dropped from the model. Initially, this result seemed quite unexpected because other studies have shown that women brought up in one parent families experience higher odds of young motherhood than those brought up with both natural parents (Kiernan 1992; Hobcraft 1998). However, research looking at more recent cohorts has observed that the association of family experiences is not significant in the presence of

other background characteristics (Ermisch and Pevalin 2003; Sigle-Rushton 2004).

Results from these models guided our choice of variables to use in the next section. We decided to include those significant predictors that were measured in the three waves of data collection in order to examine the timing at which they had a bigger impact on early motherhood. Hence, we included those repeated measures of socio-economic resources, educational attainments, and behavioural attributes that were retained in our previous model.

4.3 SEM models

Up to now, we have identified the childhood antecedents which are significantly associated with early motherhood and have attempted to distinguish the stages at which they have a greater effect. However, to better understand the influence of these predictors on our outcome variable, we need to model explicitly the pathways to off-time motherhood.

Results from our structural equation models are presented as follows: Table 2 shows the parameter estimates of the measurement model; Table 3 displays the findings of the structural component of the model; Figure 4 presents a path diagram that illustrates the effect decomposition; and Table 4 presents the estimates of the direct, indirect and total effects of the latent variables included in the model.

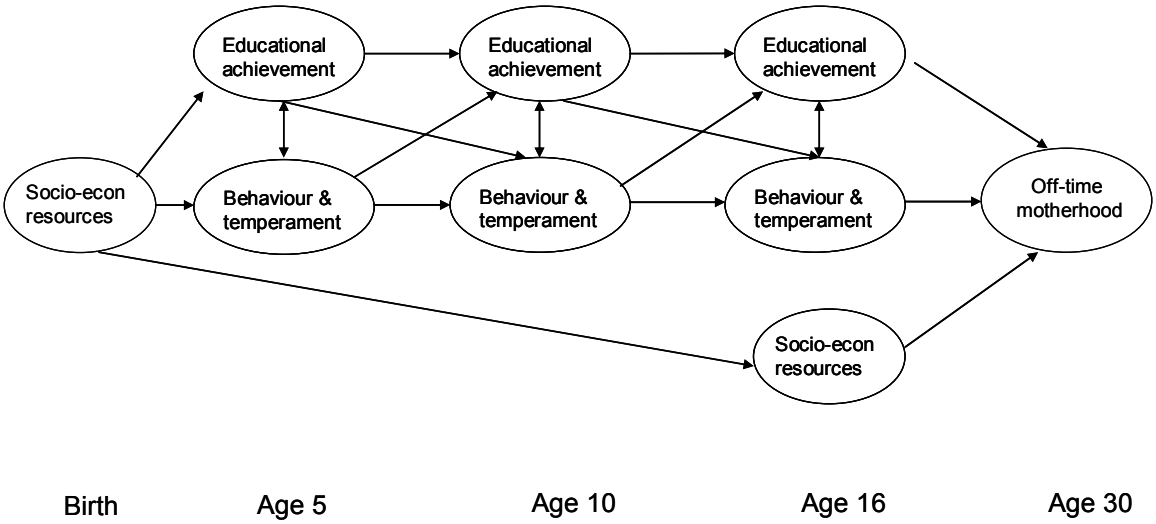
The information on Tables 2 and 3 provide the following output: columns labelled *StdYX* contain standardised parameter estimates[9]; columns under the heading *Est./S.E.* provide the value of the parameter estimate divided by its standard error (i.e. a critical ratio[10]); and the column labelled R-square provides a reliability measure of the relationship between the observed variable and the latent construct. The results presented here correspond to the models fitted using Mplus' maximum likelihood method for missing data.

9 These coefficients are standardised using the variances of the continuous latent variables and the variances of the outcome variable (Muthén and Muthén 1998-2005).

10This critical ratio is a significance test, which follows an approximately normal distribution. Hence, to asses 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).

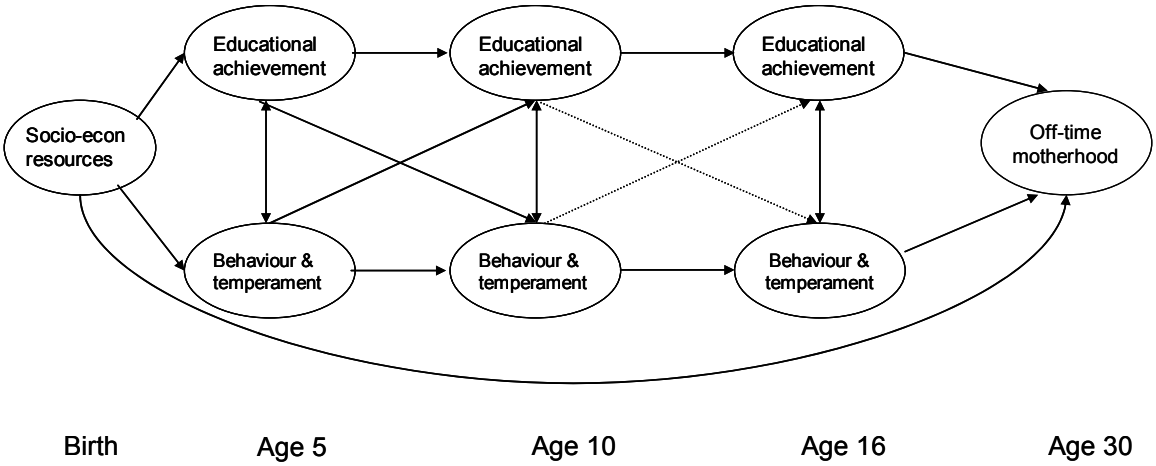
Our aim was to fit a model to explain the pathways displayed in Figure 1. However, the goodness of fit measures indicated that this initial model did not fit our data well (see Model 1 in Table 3). The output suggested that the socio-economic latent variables cannot be used simultaneously in the model. We redefined this latent variable using other measures (e.g. only housing tenure, only social class, both), but the latent constructs continued to pose problems. Thus, we specified a second model eliminating the latent variables for socio-economic resources at ages 5 and 10 (see Figure 2). This model specification assumes social class at birth has an indirect effect on early motherhood through educational achievement and behavioural attitudes at age 5 and through socio-economic resources at age 16.

Figure 2.



The results suggest that this revised model provides a better fit. Nevertheless, there is some evidence that this model does not fit the data very well (i.e. p-value for chi-square test <0.05 and WRMR >1.0). Hence, based upon a detailed assessment of the fit and on the theory behind these models, we modified Model 2 by eliminating the latent variable for socio-economic resources at age 16. This third model assumes that social class at birth has a direct association with early motherhood, but also indirect effects which operate via educational achievement and behaviour (see Figure 3).

Figure 3.



The size and significance of the parameters of Model 3 do not differ much from those obtained with Model 2. However, the goodness of fit indicators suggest that, amongst the models analysed, this one best describes our data. It is important to highlight that this does not mean that Model 3 is the correct model; it is simply one among many others with a good fit (Jöreskog 1993b).

Next, we discuss in greater detail the results obtained from our preferred model. We begin by explaining the estimates for the measurement model, presented in Table 2. The first column displays the standardised parameters (or factor loadings), which describe the reliability of the relation between the observed variables and the latent constructs. It can be seen that in all models the measures exhibit a strong and significant relationships with their latent constructs (factor loadings ranging between 0.56 and 0.87). It is worth noting that the parameter estimates for aggression and restlessness show a change in value with age, suggesting that these factors are better indicators of behavioural attributes with increasing age. In contrast, the corresponding estimates for test scores show a small peak at age 10. This output is used to verify that the observed variables in deed measure the latent construct. It is necessary to verify this part of the model fits adequately before assessing the output of the structural component.

Table 3 and Figure 4 present the estimates for the structural model. The first thing to point out is that, except for the cross-lagged effects between behaviour and educational achievement at ages 10 and 16, all paths are statistically

significant[11]. Moreover, all pathways follow the expected direction. For instance, our results show that coming from a higher social class increases the likelihood of obtaining higher educational achievements (positive effect), decreases the probability of having behavioural problems (negative effect), and reduces the risk of experiencing off-time motherhood (negative effect). Next, the parameter estimates[12] describing the relationship between subsequent risk factors indicate a continuous and strong influence over time, which is slightly stronger between ages 5 and 10 than between ages 10 and 16. For example, educational achievements at an early age are strongly associated with schooling outcomes in middle childhood (0.93 SD), and these, in turn, also have a great (though slightly smaller) influence on educational attainments at age 16 (0.80 SD).

Similarly, the paths describing the cross-lagged associations between educational attainment and behavioural attitudes indicate greater time-lagged effects at an earlier age. The parameters, though small, are significant only between ages 5 and 10 such that higher educational achievements at age 5 decreases the chances that behavioural problems will be encountered at age 10 (-0.10 SD), and that experience of behavioural disorders at age 5 somewhat reduce the probability of obtaining higher schooling qualifications at age 10 (-0.13 SD). In contrast, the effect of the cross-lagged associations between ages 10 and 16 are of smaller size and non significant. On the other hand, the paths representing the concurrent relationships between educational achievement and behavioural outcomes suggest that the mutual influence between these factors is greatest at early childhood (with SD values of -0.31, -0.07 and -0.09 at ages 5, 10 and 16, respectively). Hence, these findings suggest that what happens early is of utmost importance.

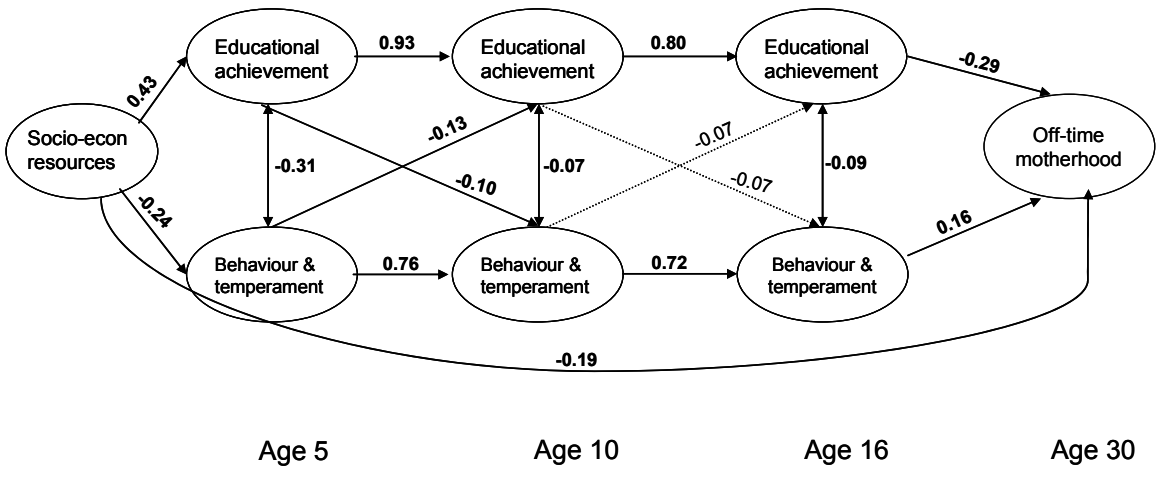
Results from Model 3 indicate that social class at birth has a significant impact on experiences at age 5, with a greater effect on educational achievement (0.43 SD) than on behavioural attitudes (-0.24 SD). Furthermore, Table 4 shows that the total effect of parental social class on off-time motherhood is of moderate size (-0.31 SD). If we disaggregate this result, we observe that the direct effect (-0.19

11 In Figure 2, doted lines represent the pathways that are not statistically significant.
12 The standardised parameter estimates for the structural component 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 (Bollen 1989).

SD) is somewhat larger than the indirect one (-0.12 SD), providing evidence of the persistent influence of this variable over time. In addition, we identify that the main path through which social class affects young motherhood is through the continuity of educational achievement over time (-0.09 SD). It also has a significant, but much smaller, effect through the continuity of behavioural attitudes (-0.02 SD). Altogether, these results corroborate the crucial role of socio-economic characteristics over time.

The model also shows that high levels of academic performance decrease moderately, but significantly, the likelihood of having a child. The total effect of this latent construct is significant at all ages and of similar size (-0.24, -0.25, -0.29 SD for ages 5, 10 and 16, correspondingly), suggesting a pervasive influence of this dimension (see Table 4). Although the size of the effect increases slightly with age, it is unlikely that these differences are statistically significant (consistent with results presented in the previous section). In addition, we observe that the main pathway through which educational attainment at ages 5 and 10 affect early motherhood is through its continuity on later academic achievements. Hence, these findings confirm that academic performance has a continuous and significant role on predicting young motherhood.

Figure 4. Pathways to off-time motherhood using Model 3.



In contrast, the effect of behaviour and temperament increases slightly, but significantly, the risk of early childbearing. Table 4 shows that the total effect of this variable is significant at all developmental stages, but its size increases considerably with age (from 0.07 SD at age 5 to 0.16 SD at age 16). This result is

in line with the findings of the previous section, which highlighted that behavioural measures have a stronger influence on the outcome variable at age 16. Similarly to educational achievement, the main pathway through which behaviour at ages 5 and 10 affect off-time motherhood is through its influence on later behavioural outcomes.

5. Discussion

Consistent with previous studies the main predictors of early motherhood identified in this paper include socioeconomic resources, educational achievements, some behavioural characteristics, and mother's age at first birth. Our findings also provided some evidence that the timing at which these childhood antecedents occur (or are measured) is important. We observed that covariates associated with academic performance and socio-economic resources have a continuous influence on our outcome variable. However, measures of behaviour and temperament have a greater impact on young motherhood at older ages, particularly during adolescence.

This study finds evidence of a pervasive and lasting effect of socio-economic characteristics on young motherhood, a result in agreement with previous studies that have shown a continuous effect of socio-economic adversity on future outcomes (Hobcraft 1998; Schoon 2002; Schoon et al. 2003; Sigle-Rushton 2004). Estimates from a logistic regression suggested that the covariates under this dimension have a somewhat stronger influence on the outcome variable during early childhood. However, differences by age are not statistically significant, suggesting that the incidence and not the timing of socio-economic deprivation is linked to young motherhood.

Unfortunately, the SEM models did not allow us to examine explicitly the timing of socio-economic resources because the covariates used for measuring this latent construct seem to be highly correlated over time. Nevertheless, this approach provided some useful information regarding the trajectories through which social class affects young motherhood. It is important to note that measuring socio-economic circumstances with a unidimensional construct has its limitations. Social class at birth cannot assess fully the living standards of an individual because numerous factors are associated with disadvantage (e.g. poor educational

achievements, poor housing, health problems, unemployment, lone parenthood, among others). Thus, one has to bear in mind that this part of our analysis does not provide a comprehensive view of socio-economic resources.

Despite this limitation, findings using the SEM approach provide evidence that social class at birth initiates pathways to disadvantage. We observed that this background variable has a moderate impact on early motherhood. The data supported the hypothesis that this influence takes place through both direct and indirect pathways. Furthermore, the main pathway through which it affects the outcome of interest is via the mediating effect of educational achievement i.e. low social class is associated with poor academic performance alter on. It also influences early childbearing through the mediating effect of behavioural attitudes, but this path is of much smaller size. The strong continuities of educational achievement and behavioural attitudes suggest that the developmental outcomes of children born into a family with limited capabilities, as assessed by social class, are more likely to be compromised.

This paper confirms that educational achievements play a crucial role on predicting early childbearing, as observed previously by Kiernan (1997), Hobcraft (1998) and Sigle-Rushton (2004). All our models showed that academic outcomes have a continuous and significant influence on becoming a young mother, and that its impact is of similar magnitude across time. The SEM models suggested that academic performance at one point in time has a strong link with the level of achievement at a later point. Additionally, we observed that the time-lagged effects of educational attainments on subsequent behavioural outcomes are significant between ages 5 and 10 only, and that the concurrent association between these variables is greatest at age 5. It might be that the previous paths are not significant at later ages because the percentage of children reported as being highly aggressive or restless was quite low (see table A.1 in Appendix). Mother's may find their children more aggressive or more restless when they are younger. Another possibility is that with increasing age educational capacities have consolidated, hence they are independent of the behavioural attributes analysed. It is also possible that this pattern is due to the amount of missing data on test scores at age 16.

The findings from this study have also shown that behaviour and temperament are associated with early childbearing. Nevertheless, this effect is of much smaller size than that of educational achievements, and it is somewhat stronger with increasing age. Our results resonate with those of Kiernan (1999) and Collishaw *et al* (2004), who also observed that adolescents with conduct problems are more likely to have a child at an early age. This is of particular relevance when devising strategies for tackling early parenthood because recent evidence has shown a substantial increase in adolescent conduct problems (Collishaw et al. 2004).

There are a number of channels through which our latent constructs might influence early motherhood that our model does not account for. It is probable that academic success is associated with a set of skills, expectations, and/or psychological attributes that increase the likelihood of having a child at an early age. For instance, higher qualifications may be related with increased self esteem and locus of control. These behavioural attributes are likely to be associated with better quality relationships, which in turn may reduce the chances of an off-time pregnancy. On the other hand, behavioural problems may be linked with increased risk taking behaviours in adolescence (e.g. sexual activity), which in turn influence the risk of an early pregnancy, as observed by Woodward and Fergusson (1999).

Although our findings shed light on the trajectories to off-time motherhood, there are other risk factors that are likely to be associated with our outcome variable (e.g. genetic factors, sexual behaviour, peer relations, family functioning, parental interest, neighbourhood effects, among others). Future research should aim to disentangle in more detail the complex interplay of these factors. Although this task is faced with some data and methodological constraints, these pathways merit further analysis (e.g. influence of socio-economic resources and parental interest).

In sum, our results suggest that experiences during early childhood play a crucial role in predicting off-time motherhood because what happens at age 5 is strongly associated with subsequent events. This highlights the importance of interventions in early childhood aimed at promoting child development. Early

investments with a special focus on disadvantaged children (e.g. those who are reared by a young mother) may yield favourable impacts in childhood and adolescence (e.g. higher levels of schooling and positive social behaviour), which in turn could reduce the risk of early motherhood. Nevertheless, this model also shows that experiences at pre-adolescence and adolescence continue to play an important role in determining early motherhood. What's more, behavioural attributes during adolescence are more strongly associated with young motherhood than the same measures at younger ages. Hence, interventions at these developmental stages should also be part of the activities aimed at tackling early motherhood.

This paper contributes with the evidence on the timing and the pathways associated with off-time motherhood. This is of particular importance because young parenthood is associated with subsequent disadvantage and is one of the channels through which social exclusion is transmitted to the next generation. Moreover, although the UK government has set goals and implemented policies to tackle this problem, the continuing high rates of early pregnancies indicate there is still much to be done to reduce off-time motherhood in Britain.

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Table 1.
Logistic Regression for Early Motherhood (<23 years old)
BCS 1970

	Fwd (p<.05) & Bckwd (p<.01) Ages 5, 10, and 16			
	Odds Ratio	**Std. Err.**	**z**	**P>|z|**
Demographic characteristics				
Mother's age at 1st birth (<20 years)	1.77	0.14	7.1	***
Missing mother's age at 1st birth				
Both natural (all waves)				
Both natural w/partial information				
Dissolved				
Missing information				
Ever in care				
Missing in care				
Socio-economic resources				
Mother's education				
Mother left school at age 15	1.50	0.13	4.6	***
Missing information				
Free school meals (at age 10)	1.42	0.14	3.5	***
Missing free school meals	p=0.48			
Financial difficulties (at age 16)	1.53	0.17	3.8	***
Missing financial difficulties	p=0.58	p=0.21		
Father's social class at birth				
Semiskilled or manual occupation	1.34	0.12	3.3	**
Missing social class	1.56	0.20	3.5	***
Housing tenure				
Local Authority, age 5	1.70	0.18	4.9	***
Missing housing info, age 5	p=0.25 2.36	0.44	4.6	***
Local Authority, age 10	1.35	0.14	2.9	**
Missing housing info, age 10				
Local Authority, age 16				
Missing housing info, age 16	1.20	0.10	2.2	*
Academic performance				
Educational scores				
Test score 1st quartile, age 5	1.26	0.44	4.6	***
Missing test score, age 5	p=0.61 0.67	0.11	-2.4	*
Test score 1st quartile, age 10	1.39	0.13	3.6	***
Missing test score, age 10	p=0.58	p=0.91		
Test score 1st quartile, age 16	1.43	0.18	2.8	**
Missing test score, age 16	1.41	0.19	2.5	*
Behavioural attitudes				
Aggression high, age 5				
Missing aggression, age 5				
Aggression high, age 10				
Missing aggression, age 10				
Aggression high, age 16	1.65	0.27	3.0	**
Missing aggression, age 16				
Anxiety high, age 5				
Missing anxiety, age 5				
Anxiety high, age 10				
Missing anxiety, age 10				
Anxiety high, age 16				
Missing anxiety, age 16				
Restlessness high, age 5				
Missing restlessness, age 5				
Restlessness high, age 10	1.33	0.14	2.8	**
Missing restlessness, age 10				
Restlessness high, age 16				
Missing restlessness, age 16				
Cohort member's self esteem				
Self esteem 1st quartile, age 10				
Missing self esteem, age 10				
Self esteem 1st quartile, age 16				
Missing self esteem, age 16				
Cohort member's locus of control				
Locus of control 1st quartile, age 10	1.44	0.12	4.4	***
Missing locus of control, age 10	p=0.01			
Locus of control 1st quartile, age 16	2.17	0.29	5.8	***
Missing locus of control, age 16	1.35	0.19	2.2	*
Mother's malaise score				
Malaise score >7, age 5				
Missing malaise, age 5				
Malaise score >7, age 10				
Missing malaise, age 10	1.43	0.18	2.8	**
Malaise score >7, age 16				
Missing malaise, age 16				
Sample size	*5727*			
Pseudo_R2	*0.127*			
Likelihood ratio	*-2534.43*			
% Mothers before age 23	*20.46*			

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

Table 2.
Measurement model
Pathways to Off-time Motherhood using Structural Equation Models

	Model 1				Model 2				Model 3			
	StdYX	**Est./S.E.**	**p-value**	**R-square**	**StdYX**	**Est./S.E.**	**p-value**	**R-square**	**StdYX**	**Est./S.E.**	**p-value**	**R-square**
Socio-economic resources at BIRTH BY												
Father's social class	1.00	0.0	-	-	1.00	0.0	-	-	1.00	0.0	-	-
Socio-economic resources AGE 5 BY				*0.61*								
Parental housing	0.89	0.0	-	0.79	-	-	-	-	-	-		-
Father's social class	0.84	91.5	***	0.76	-	-	-	-	-	-		-
Behaviour AGE 5 BY				*0.19*				*0.09*				*0.06*
Aggression	0.67	0.0	-	0.45	0.67	0.0	-	0.44	0.66	0.0	-	0.44
Restlessness	0.66	21.7	***	0.43	0.67	23.2	***	0.45	0.67	23.4	***	0.46
Education AGE 5 BY				*0.35*				*0.26*				*0.19*
Vocabulary test	0.59	0.0	-	0.35	0.57	0.0	-	0.33	0.56	0.0	-	0.31
Copy design test	0.58	23.8	***	0.34	0.60	24.1	***	0.36	0.59	23.8	***	0.35
Socio-economic resources AGE 10 BY												
Parental housing	0.98	0.0		0.00	-	-	-	-	-	-	-	-
Father's social class	0.86	109.9	***	0.74	-	-	-	-	-	-	-	-
Free meals	-0.53	-27.9	***	0.29	-	-	-	-	-	-	-	-
Behaviour AGE 10 BY				*0.69*				*0.66*				*0.66*
Aggression	0.77	0.0	-	0.59	0.76	0.0	-	0.58	0.76	0.0	-	0.58
Restlessness	0.73	26.9	***	0.53	0.73	28.9	***	0.54	0.74	29.4	***	0.54
Education AGE 10 BY				*0.73*				*0.75*				*0.78*
Reading test	0.86	0.0	-	0.74	0.87	0.0	-	0.75	0.87	0.0	-	0.75
Maths test	0.81	42.6	***	0.66	0.81	45.2	***	0.66	0.81	45.3	***	0.65
Socio-economic resources AGE 16 BY				*0.00*				*0.78*				
Parental housing	0.80	0.0	-	0.63	0.75	0.0	-	0.56	-	-	-	-
Father's social class	0.74	65.6	***	0.54	0.71	25.1	***	0.50	-	-	-	-
Financial difficulties	-0.41	-18.0	***	0.17	-0.53	-15.6	***	0.28	-	-	-	-
Behaviour AGE 16 BY				*0.56*				*0.56*				*0.57*
Aggression	0.83	0.0	-	0.69	0.82	0.0	-	0.68	0.82	0.0	-	0.68
Restlessness	0.78	18.8	***	0.68	0.79	19.9	***	0.62	0.80	20.1	***	0.63
Education AGE 16 BY				*0.69*				*0.67*				*0.68*
Vocabulary5 /Reading10/ Vocabulary16	0.79	0.0	-	0.36	0.79	0.0	-	0.63	0.79	0.0	-	0.63
Copy designs5 /Maths10/ Spelling16	0.75	27.5	***	0.56	0.75	29.0	***	0.56	0.75	29.4	***	0.57
Sample size	*5727*				*5727*				*5727*			

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

Table 3.
Structural model
Pathways to Off-time Motherhood using Structural Equation Models

	Model 1			Model 2			Model 3		
	StdYX	**Est./S.E.**	**p-value**	**StdYX**	**Est./S.E.**	**p-value**	**StdYX**	**Est./S.E.**	**p-value**
Socio-economic resources AGE 5 ON									
Socio-economic resources at birth	0.78	70.5	***	-	-	-	-	-	-
Behaviour AGE 5 ON									
Socio-economic resources at birth	-0.33	-13.9	***	-0.30	-13.0	***	-0.24	-10.5	***
Education AGE 5 ON									
Socio-economic resources at birth	0.59	23.4	***	0.51	21.0	***	0.43	18.4	***
Socio-economic resources AGE 10 ON									
Socio-economic resources AGE 5	1.02	65.9	***	-	-	-	-	-	-
Behaviour AGE 10 ON									
Behaviour AGE 5	0.76	17.5	***	0.77	17.5	***	0.76	17.4	***
Education AGE 5	-0.15	-4.0	**	-0.10	-2.6	**	-0.10	-2.6	**
Education AGE 10 ON									
Education AGE 5	0.88	18.9	***	0.91	18.6	***	0.93	17.9	***
Behaviour AGE 5	0.08	2.2	*	0.12	3.0	***	-0.13	-3.3	**
Socio-economic resources AGE 16 ON									
Socio-economic resources AGE 10	1.11	75.6	***	-	-	-	-	-	-
Socio-economic resources at birth	-	-	-	0.89	29.4	***	-	-	-
Behaviour AGE 16 ON									
Behaviour AGE 10	0.72	19.0	***	0.73	19.2	***	0.72	19.3	***
Education AGE 10	-0.07	-2.0	*	-0.06	-1.7		-0.07	-1.7	
Education AGE 16 ON									
Education AGE 10	0.80	25.7	***	0.80	26.4	***	0.80	26.6	***
Behaviour AGE 10	-0.07	-2.0	*	-0.06	-1.8		-0.07	-1.9	
Early motherhood ON									
Socio-economic resources at birth	-	-	-	-	-	-	-0.19	-7.6	***
Socio-economic resources AGE 16	-0.27	-13.8	***	-0.26	-9.2	***	-	-	-
Behaviour AGE 16	0.13	3.9	***	0.14	4.0	***	0.16	4.8	***
Education AGE 16	-0.24	-7.8	***	-0.26	-8.2	***	-0.29	-9.1	***
Behaviour AGE 5 WITH									
Education AGE 5	-0.19	-6.4	***	-0.26	-8.7	***	-0.31	-10.0	***
Behaviour AGE 10 WITH									
Education AGE 10	-0.03	-1.0		-0.07	-2.7	**	-0.07	-2.4	**
Behaviour AGE 16 WITH									
Education AGE 16	-0.09	-2.3	*	-0.10	-2.6	**	-0.09	-2.5	**
Socio-economic resources AGE 16	-	-	***	-0.19	-5.9	***	-	-	-
Education AGE 16 WITH									
Socio-economic resources AGE 16	-	-	***	0.14	4.5	***	-	-	-
Sample size	*5727*			*5727*			*5727*		
Chi-squared/Degrees of freedom	23.53			7.99			4.70		
P-value for Chi-squared	0.00			0.00			0.00		
RMSEA	0.06			0.04			0.03		
CFI	0.95			0.96			0.99		
WRMR (Weighted Root Mean Square Residual)	3.51			1.88			0.92		

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

Table 4.
Direct, Indirect and Total Effects of Pathways to Off-time Motherhood
Estimates for Model 3

	StdYX	Est./S.E.	P-val
Socio-economic resources at BIRTH			
Specific indirect			
EDU5 - EDU10 - EDU16	-0.09	-8.4	***
BEH5 - BEH10 - BEH16	-0.02	-4.4	***
EDU5 - BEH10 - BEH16	-0.01	-2.3	*
EDU5 - EDU10 - BEH16	-0.01	-1.8	
BEH5 - BEH10 - EDU16	0.00	-1.8	
EDU5 - BEH10 - EDU16	0.00	-1.5	
BEH5 - EDU10 - BEH16	0.00	1.6	
BEH5 - EDU10 - EDU16	0.01	3.0	***
Total indirect	*-0.12*	*-12.4*	***
Total direct	*-0.19*	*-7.6*	***
Total effect	**-0.31**	**-14.1**	***

	StdYX	Est./S.E.	P-val
Education AGE 5			
Specific indirect			
EDU10 - EDU16	-0.22	-8.3	***
BEH10 - BEH16	-0.01	-2.3	*
EDU10 - BEH16	-0.01	-1.9	
BEH10 - EDU16	0.00	-1.5	
Total indirect	*-0.24*	*-9.5*	***
Total direct	*-*		
Total effect	**-0.24**	**-9.5**	***
Education AGE 10			
Specific indirect			
EDU16	-0.23	-9.3	***
BEH16	-0.01	-1.9	
Total indirect	*-0.25*	*-10.2*	***
Total direct	*-*		
Total effect	**-0.25**	**-10.2**	***
Education AGE 16			
Total indirect	*-*		
Total direct	*-0.29*	*-9.1*	***
Total effect	**-0.29**	**-9.1**	***

	StdYX	Est./S.E.	P-val
Behaviour AGE 5			
Specific indirect			
BEH10 - BEH16	-0.03	-3.1	***
BEH10 - EDU16	0.00	-1.6	
EDU10 - BEH16	0.02	1.8	
EDU10 - EDU16	0.09	4.6	***
Total indirect	*0.07*	*3.4*	***
Total direct	*-*		
Total effect	**0.07**	**3.4**	***
Behaviour AGE 10			
Specific indirect			
BEH16	0.12	4.8	***
EDU16	0.02	1.8	
Total indirect	*0.14*	*5.9*	***
Total direct	*-*		
Total effect	**0.14**	*5.9*	***
Behaviour AGE 16			
Total indirect	*-*		
Total direct	*0.16*	*4.8*	***
Total effect	**0.16**	**4.8**	***

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001
EDU= educational achievement; BEH= behavioural attitudes

Appendix

Table A.1
Distribution of Explanatory Variables
Females BCS 1970 interviewed at age 30

	Age 5 (%)	Age 10 (%)	Age 16 (%)
Mother's age at first birth			
< 20 years	22.8	23.7	22.8
Family structure			
Both natural parents	91.2	83.7	81.2
In foster care	1.4	1.5	1.9
Mother's education			
Mother left school at age 15	35.3	35.2	37.0
Father's social class			
Semi and unskilled manual	17.0	15.1	11.3
Skilled manual	46.1	43.4	40.7
Non-manual	36.9	41.5	47.9
Housing tenure			
Local Authority	29.9	29.4	20.4
Other	10.9	6.0	4.1
Owner Occupier/Being Bought	59.2	64.5	75.5
Free school meals			
Yes	-	13.1	-
Financial difficulties			
Yes	-	-	13.8
Agression			
Low (Agg sum = 0 | 1)	49.5	72.5	72.4
Medium (Agg sum = 2 | 3)	35.9	17.8	21.5
High (Agg sum >=4)	14.5	9.6	6.1
Anxiety			
Low (Anx sum = 0)	40.7	52.9	57.9
Medium (Anx sum = 1 | 2)	46.4	26.6	30.6
High (Anx sum >= 3)	12.9	20.5	11.5
Restlessness			
Low (Res sum = 0 | 1)	49.0	67.1	90.3
Medium (Res sum = 2 | 3)	35.1	19.3	8.5
High (Res sum >=4)	15.9	13.7	1.2
Educational scores			
Vocabulary[5] /Reading[10] / Vocabulary[16]			
Low	27.4	20.1	23.8
Middle	51.0	53.0	50.2
High	21.6	26.9	26.0
Copy designs[5] /Maths[10] / Spelling[16]			
Low	29.3	25.6	20.9
Middle	47.5	53.7	52.0
High	23.2	20.7	27.1
Cohort member's			
Malaise score >= 7	-	-	22.5
Low self esteem (1st quartile)	-	29.2	24.3
Low locus of control (1st quartile)	-	29.2	27.4
Mother's malaise score			
Malaise score >= 7	22.7	17.8	12.0
Sample size[1]	*5727*	*5727*	*5727*

Note 1: Sample size exlcudes cases with first birth before 17.