PRELIMINARY DRAFT

The Effect of Parents' Employment on Children's Educational Attainment

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1. Introduction

In the last two decades there has been an extensive body of empirical work concerned with the links between parental investment in children and children's outcomes, particularly educational attainment. Most of this work is embedded in the household production model introduced by Becker (1965) and developed by Michael (1973), Leibowitz (1974), Becker (1981), Becker and Tomes (1976, 1979, 1986), and Behrman et al. (1982). Although this model emphasizes the distinction between production technology and preferences, there are only a few studies that attempt to disentangle the household's tastes from its technology in "producing" young people's human capital.[1]

In the literature on educational outcomes, Hanushek (1992) formulates a value-added model to estimate achievement growth using data on schools, families, and students observed over a four-year period.[2] Most of the other studies in this literature have estimated education equations that contain one or more education inputs as well as prices and income variables on the right hand side.[3] Since these hybrid equations do not generally embody any restriction derived from economic theory, they cannot provide relevant information on the household's preferences or education technology and their specifications are likely to be arbitrary. Moreover, many of these studies have ignored the possible endogeneity of education inputs by assuming that young people do not differ in terms of their "endowments" relevant to educational attainment. Therefore, it is not surprising that both the wide variety of specifications

[1] Examples of such studies in the child health literature are Rosenzweig and Schultz (1983), and Grossman and Joyce (1990), which employ instrumental variables techniques, and Rosenzweig (1986), Rosenzweig and Wolpin (1988, 1995), Strauss (1990), and Currie and Cole (1993), which employ data on siblings, half-siblings and cousins to examine how maternal choices and characteristics affect child health outcomes.

[2] Blau et al. (1996) also apply a value-added model to analyse the relationship between infants' health and the labour supply of their mothers.

and the near total neglect of potential endogeneity problems make "generalizations regarding the absolute and relative effects of potential determinants on attainment virtually impossible" (Haveman and Wolfe 1995, p. 1873).

Several studies have attempted to determine whether parents' (particularly mothers') employment affects children's educational attainment. In reviewing some of the most influential studies that have examined the effects of early maternal employment on children's early development, Harvey (1999) underlines that "the results of these studies have been surprisingly mixed considering they used the same data set" (p. 445), that is, the National Longitudinal Survey of Youth. But all of them, including Harvey's own study, estimate hybrid equations and thus confound the technological properties of the education production function and the characteristics of the household's preferences. A similar point can be raised for most of the currently available analyses that use British data, which are concerned either with early learning or with later educational achievements (see Kiernan 1997; Gregg and Machin 1999; Joshi and Verropoulou 2000).

In this paper, we estimate the relationship between parental employment patterns during childhood and children's educational attainment during young adulthood using a "sibling difference" estimator. Although the use of kinship data has become increasingly common in economics (Rosenzweig and Wolpin 1995), there is no study attempting to estimate the effect of parental behaviour during childhood on children's later education using a sibling estimator within a framework embedded in economic theory. Other studies have employed kinship data to estimate the relationship between maternal employment and children's education (e.g., Duncan et al. 1997; Duncan et al. 1998). But these studies do not estimate the relationship of

[3] Rosenzweig and Schultz (1983) define such equations as "hybrid" equations.

interest within an economic-theory approach. Rather, by including both measures of mothers' labour supply and parental income, they estimate hybrid equations, which fail to have a meaningful economic interpretation. Yet, a meaningful interpretation is relevant for policies concerned with family leave and work-family balance, and for policies intended to reduce dependency on state benefits and improve family finances by encouraging mothers to take up paid work (Department for Education and Employment 2000).

In Section 2 we develop a conceptual framework that allows us to assess the effect of parental behaviour on children's education in the presence of heterogeneity in "endowments". The data are described in Section 3, while Section 4 illustrates the econometric model employed to account for such heterogeneity. Section 5 discussed the estimates and Section 6 concludes.

2. Framework

Under what circumstances can we give a causal interpretation to the association between a mother's employment and future outcomes for her children arising from human capital investment in them, such as education and earnings?

2.1 A Static Model of Parents' Human Capital Investment in their Children

It is clear that, in general, the time a mother spends in employment is chosen jointly with human capital investment in her children and parents' own consumption. It would, therefore, be hard to interpret, for example, the coefficient of mother's employment time in an equation for her child's eventual educational attainment. Furthermore, there would be no valid instruments for mother's employment, because all exogenous variables, such as her wage and other family income, are also determinants of the child's educational attainment.

There is, however, intuitive appeal in assuming that parents have preferences characterized by a utility function which has earning capacities of children separable from parents' consumption; that is, in the case of a two-child family, parental utility is given by $U=U(x,W(e_a,e_b))$, where x is parental consumption; e_i (i=a,b) are the future earning capacities of their children, and W(.) is the sub-utility function representing parental welfare from children's earnings. We assume that only mothers provide time inputs to human capital investment in children, and so fathers' earnings and non-earned income are exogenous to the family. Relaxing this assumption does not alter the main message from the model. The constraints include two human capital production functions, $e_a=f(t_a,\varepsilon_a)$ and $e_b=f(t_b,\varepsilon_b)$, where t_i is the mother's time input into human capital production for the i-th child and ε_i is the "earnings endowment" of the i-th child. The resource constraint is $y + wT = x + w(t_a+t_b) = x + R$, where total mother's time available is T, w is the wage of the mother, y is father's earnings and other income and $R=w(t_a+t_b)$ is resources devoted to human capital investment in children.

Separable utility implies that e_a and e_b can be expressed as functions of R, ε_a and ε_b, with w and y entering these "conditional demand functions" for e_a and e_b only through their effect on R (see Pollak, 1971). Thus, investment in the human capital of each child can be expressed as a function of total hours that the mother does not spend in paid employment (t_a+t_b) weighted by her wage.[4] Unfortunately for econometric purposes, R is not generally independent of ε_a and ε_b. It could, however, be instrumented using estimates of w and y.

[4] This is analogous to expressing demand functions within a period as a function of total expenditure in that period in the context of life cycle optimisation and a separable inter-temporal utility function (Blundell and Walker, 1986). Note that full family income wT+y does not appear in this demand

There is, however, a special case in which R and t_a+t_b are independent of ε_a and ε_b. Assume that the production functions take the form $e_i=\varepsilon_i t_i^{\alpha}$ ($\alpha\leq 1$), and following Behrman, Pollack and Taubman (1982), let $W(e_a,e_b) = [e_a^{c}+e_b^{c}]^{1/c}$, with $c\leq 1$ (i.e. a CES form). The parameter c indicates the degree of aversion to inequality between children's earnings, with lower c indicating more inequality aversion. It determines whether parents' human capital investments *reinforce* earnings endowments (c>0) or *compensate* for differences in children's endowments (c<0). If the parents utility function $U(x,W(e_a,e_b))$ is Cobb-Douglas with parameters β and $1-\beta$ respectively, then

(1) $ln(t_a+t_b)= ln[(1-\beta)\alpha]-ln[\beta+(1-\beta)\alpha] + ln[(wT+y)/w]$

(2) $ln(e_a)=\alpha\{ln(t_a+t_b)-ln[1+(\varepsilon_b/\varepsilon_a)^{c/(1-c\alpha)}]\}+ln(\varepsilon_a)$,

with a similar equation for $ln(e_b)$.

In this case, if β and α do not vary across families, we could treat t_a+t_b as exogenous in the equations for e_i. It would be a 'sufficient statistic' for the effects of w and y on e_i. Unfortunately the assumption of identical tastes and production technology (i.e. the same β and α) is not very credible, and so t_a+t_b would be correlated with the stochastic element of parents' preferences.

One way to control for heterogeneity in β and α is to take differences between siblings in families. This static model is not, however, very helpful in structuring such an analysis because t_a+t_b does not differ between siblings. The static model could be interpreted as one in which non-identical twins are born, or siblings are born close together. The potential for the use of sibling differences in estimating the effect

function. If the father also provides time inputs to human capital investment, then $R=w_m(T-h_m)+w_f(T-h_f)$, where w_f and h_f (w_m and h_m) are the father's (mother's) wage and hours employed.

of mother's employment on child outcomes comes from the differences in birthdays for two siblings, but this requires that we consider the dynamics explicitly.

2.2 A Dynamic Model of Parents' Human Capital Investment in their Children

In this model, each family is assumed to have two children, each of which lives for two consecutive periods in the parental home (until the end of childhood) and then moves out. Parents again choose time inputs to human capital investment in their children and their own consumption. We also assume that there is no borrowing or lending across the periods. The first child arrives in the first period, and the second in the second period. During the second period, both children are receiving human capital investments from parents, while in the first and third period only one child receives them. For simplicity, we again assume that only mothers provide time inputs to human capital investment in children.

Parents are again assumed to have preferences characterized by a utility function which has earning capacities of children separable from parents' consumption; that is, parental utility is given in each period j by $U=U(x_j,W(e_a,e_b))$, where x_j is parental consumption in period j (j=1,2,3). The constraints include two human capital production functions, $e_a=f(t_{1a},t_{2a},\varepsilon_a)$ and $e_b=f(t_{2b},t_{3b},\varepsilon_b)$, where child a is the first child, born in the first period, and child b is born in the second period, t_{ji} is the mother's time input into human capital production for the i-th child in period j and ε_i is the earnings endowment of the i-th child. There is also a parental resource constraint for each period j: $y_j+w_jT= x_j+ w_j(t_{ja}+t_{jb})= x_j+R_j$, where T denotes total mother's time available in period j, w_j is the wage of the mother in period j, y_j is father's earnings and other income in period j, R_j is resources devoted to human capital investment in children in period j, and $t_{1b}\equiv 0\equiv t_{3a}$ because of the timing of

children. The dynamic nature of the problem comes through human capital investment.

We shall show that, even in the special case used in the static model, $R_j=w_j(t_{ja}+t_{jb})$ is not independent of the children's earnings endowments ε_a and ε_b. In what follows, we assume Cobb-Douglas production functions, $e_a=\varepsilon_a t_{1a}^{\alpha 1} t_{2a}^{\alpha 2}$ and $e_b=\varepsilon_b t_{2b}^{\alpha 1} t_{3b}^{\alpha 2}$ $(\alpha_1+\alpha_2\leq 1)$, and $W(e_a,e_b) = [e_a^c+e_b^c]^{1/c}$, with $c\leq 1$. The production technology is characterised by identical elasticities, α_1 in the first childhood period and α_2 in the second childhood period, for the two siblings.

This time allocation problem is solved in a backward manner (i.e. starting with the third period). Solving the third period problem (when all human capital investment in the first child has finished), we find that

(3) $\partial R_3/\partial \varepsilon_b = [c\beta(1-\beta)\alpha_2 e_b^c e_a^c][\partial ln(e_b/e_a)/\partial ln(\varepsilon_b)](y_3+w_3T)/\varepsilon_b D^2$

where $D=[e_a^c+e_b^c]\beta+(1-\beta)\alpha_2 e_b$; $\partial R_3/\partial \varepsilon_a$ is similar, but of the opposite sign. As long as parents respond to their children's individual earnings endowments (i.e. $c\neq 0$), $R_3= w_3 t_{3b}$ depends on ε_a and ε_b, and so R_3 is not exogenous in equations for e_a and e_b.[5] If parents act to compensate for differences in endowments, a higher endowment for child b (child a) reduces (increases) R_3, because we expect that $\partial ln(e_b/e_a)/\partial ln(\varepsilon_b)]>0$. [6] The opposite is the case if parents reinforce endowment differences in their human capital investment decisions. Similar analysis indicates that neither R_1 nor R_2 are exogenous. The conclusion would be the same if children did not overlap in the time periods of human capital investment.

[5] In the case of a Cobb-Douglas specification for $W(\cdot)$, $c\rightarrow 0$.

[6] We expect $\partial ln(e_b/e_a)/\partial ln(\varepsilon_b)>0$, because $\alpha_1+\alpha_2\leq 1$ and $c\leq 1$. Note that in the static model above, $\partial ln(e_b/e_a)/\partial ln(\varepsilon_b/\varepsilon_a)=1/(1-\alpha c)>0$.

Sibling difference estimates of the "effect" of mother's employment time on child outcomes often compare the amount of the mother's time devoted to human capital investment when the first child is "young" relative to that when the second child is "young", $t_{1a}-(t_{2a}+t_{2b})$; similarly, the difference in amounts when each child is in the second part of his/her childhood is $(t_{2a}+t_{2b})-(t_{3b})$. We have shown that these differences are not likely to be exogenous when parents respond to children's endowments.

One possible justification for their exogeneity is that parents do not know these endowments, which is probably more likely when the child is very young, e.g. pre-school age (see Rosenzweig and Wolpin, 1995, for an analogous process of information revelation). So let us suppose that ε_a and ε_b are not known until the second part of the child's childhood, periods 2 and 3 respectively for child a and b. Then the first period time allocation t_{1a} is independent of ε_a and ε_b. But

(4) $\partial R_2/\partial \varepsilon_a = \beta c(1-\beta)e_b^c e_a^c[\alpha_1-\alpha_2][\partial ln(e_b/e_a)/\partial ln(\varepsilon_a)](y_2+w_2T)/\varepsilon_a D^2$

Thus, the effect of the first child's endowment (ε_a) on the second period time allocation of the mother ($t_{2a}+t_{2b}$) depends not only on whether parents compensate or reinforce endowments, but also on the difference between the human capital production elasticities in the two periods of childhood, $\alpha_1-\alpha_2$. If, for example, $\alpha_1>\alpha_2$, a higher endowment for the first child would decrease (increase) the mother's total time allocation to human capital investment in period 2 ($t_{2a}+t_{2b}$) if parents reinforce (compensate for) endowment differences, because we expect that $\partial ln(e_b/e_a)/\partial ln(\varepsilon_a)<0$. Because information on ε_b is not yet revealed, $\partial R_2/\partial \varepsilon_b=0$.

It then follows that

(5) $\partial[t_{1a}-(t_{2a}+t_{2b})]/\partial \varepsilon_a = -[\partial R_2/\partial \varepsilon_a]/w_2$

If parents respond to endowments when they are revealed (i.e. $c \neq 0$), then expression (5) will only be zero if $\alpha_1=\alpha_2$. Thus, equal production elasticities in the two stages of a child's life are required to justify $t_{1a}-(t_{2a}+t_{2b})$ as exogenous (i.e. independent of ε_a and ε_b), even when information about a child's endowments is not revealed until he/she is older. The reason is that parents can make compensating or reinforcing investments when endowments are revealed. If, for example, $\alpha_1>\alpha_2$, then a higher endowment for the first child would increase (decrease) $t_{1a}-(t_{2a}+t_{2b})$ if parents reinforce (compensate for) endowment differences.

Under these information revelation assumptions, differences in amounts of the mother's time devoted to human capital investment when each child is in the second part of his/her childhood, $(t_{2a}+t_{2b}-t_{3b})$, are again not independent of endowments as long as parents respond to endowments when they are revealed:[7]

(6) $\partial[(t_{2a}+t_{2b})-t_{3b}]/\partial\varepsilon_a = [\partial R_2/\partial\varepsilon_a]/w_2 - [\partial R_3/\partial\varepsilon_a]/w_3$

(7) $\partial[(t_{2a}+t_{2b})-t_{3b}]/\partial\varepsilon_b = -[\partial R_3/\partial\varepsilon_b]/w_3$.

3. Data

The preceding framework implies that to examine the influence of parental working patterns during childhood on the educational attainments of young adults requires data that provide longitudinal information on parents' fertility, marriage, and work. The data must also allow us to identify siblings and half-siblings whose information is needed in the estimation of the conditional demand functions in the presence of heterogeneity in parental preferences and technology. The data used in this analysis

[7] When ε_b is not revealed until the last period, $\partial R_3/\partial\varepsilon_b = [c\beta(1-\beta)\alpha_2 e_b^c e_a^c](y_3+w_3T)/\varepsilon_b D^2$.

come from the first seven waves (1991-1997) of the British Household Panel Survey (BHPS).[8]

We match young adults to (at least one of) their parents in at least one of the panel years. Once parents are identified, the data provide a complete work history (collected in the 1993 wave), that makes it possible to construct the patterns of parental employment during the entire childhood of each young adult in the survey. For each young adult, we measure the length of time that his/her parents spent in paid work during three developmental stages, ages 0-5, 6-10 and 11-15, and for mothers we distinguish between time spent in part-time work and the time spent in full-time work. The data also provide a complete fertility and marital history (collected in the 1992 wave) so that it is possible to identify siblings and half-siblings and determine the patterns of childhood family structure. The measure of family structure used in this paper is a dummy variable taking the value of one if the young adult spent time in a single-parent family during his/her childhood. This measure is broken down by the timing of the start of a spell in a single-parent family, distinguishing between the three different child development stages. Notice that the parent-child matching allows us to measure other family background characteristics that would be unavailable otherwise (such as age of parents' at the young person's birth, parental education, and number of brothers and sisters) and permits the construction of childhood variables (such as family structure and parental employment) that do not suffer from the "window problem" discussed by Wolfe et al. (1996).

The analysis is performed on four samples, two of which only allow for cross-sectional estimates. These estimates offer a useful benchmark for comparison with the

[8] Detailed information on the BHPS can be obtained at http://www.iser.ac.uk/bhps/doc/index.html. A further description of the data used here can be found in Ermisch and Francesconi (2000).

existing literature. Our Main Sample (MS) consists of 1,026 individuals who: (i) are aged 18 or more and were born between 1970 and 1981; (ii) do not have serious disabilities;[9] (iii) lived with their biological, adoptive or step parent(s) for at least one year during the first seven waves of the panel study; and (iv) have complete information on mother's employment patterns during childhood and other variables relating to her. We impose this last condition so that, by construction, we have full information on the key variables for our analysis. Condition (i) is imposed because it is rare to obtain A levels before age 18, and also because it restricts the sample to a group of individuals with a comparable educational system. Condition (iii) is needed to match data on family background from the parents' records to their child. It creates, however, the potential for sample selection bias if unobservable attributes affecting educational attainment also affect the chances of residence with parents. This is the reason why we present evidence also on a Restricted Sample (RS), in which individuals from MS must be aged 16-17 when they live with their parent(s).[10] Because 95 percent of the panel members live with their parents when aged 16-17, RS is likely to be a random sample. This sample consists of 647 individuals.

Correspondingly, the two samples used for estimates of the effect of parents' employment patterns on children's achievements based on sibling differences are obtained from the siblings present in the main sample (SMS) and in the restricted sample (SRS). In SMS there are 274 households with 2 or more siblings (or half-siblings) for a total of 599 individuals and a maximum of 381 sibling comparisons. In

[9] Serious disabilities are defined as being registered as a disabled person (either with Social Security or with a green card) and having any of the following health problems: sight problems, hearing problems, asthma, diabetes, epilepsy, and emotional disturbances. See Blau and Grossberg (1992) for a similar sample selection. As a result of such a selection we lose 10 individuals in our sample. We have performed the entire analysis also including those 10 disabled individuals and found remarkably similar results to those reported here.

SRS we have 155 households with 2 or more siblings, totaling 326 individuals and 187 sibling comparisons.

Table 1 shows the means of all variables used in the analysis by estimating sample. Educational attainment of the child is defined as achieving an A-level qualification or higher qualification.[11] For each young person, we take the highest education level as that in the latest year in which we observe him/her in the panel. Table 1 indicates that the percentage of individuals who have achieved a highest qualification of at least A level is almost 62 percent in the main sample and 64 percent in SMS (63 and 67 percent in the younger RS and SRS).[12] In the SMS and SRS, we sort siblings by educational attainment in descending order and take.

By construction, we have complete information about their mothers' childhood employment and the other background variables related to her for all young adults in our samples. But one in six people do not have a "father-figure" present during the panel period. When present, the father-figure is the natural father for the cases in which the family has remained intact, but he would be the stepfather in other cases. For short, we shall refer to the father-figures as "fathers". An additional one in six

[10] The age restriction on this sample means that individuals were born between 1974 and 1981. The age range is then 16-24, while the age range in MS is 16-27.

[11] We have also performed a similar analysis on another measure of educational success, that is, achieving more than an A-level qualification (higher vocational qualifications, teaching and nursing qualifications, first and higher degrees). Both measures of educational qualification are strongly related to future occupational success and expected earnings. The results for the second education measure are similar and not discussed further.

people do not have any information about their father's working patterns during childhood. This is either because the father was not present in the third wave of the BHPS, when the retrospective job history information was collected, or because we could not construct a complete work history over the young adult's childhood.[13] As expected, fathers spent a substantial fraction of time in the labour market. The average figures reported in square brackets of Table 1 are computed for children with fathers present and job history information available. These indicate that fathers worked on average 90 percent of the time during their children's childhood, or approximately 175 months over 192. This means about 1 month of non-employment in each of the 16 years of dependency of their child.

Mothers were, on average, in paid employment almost 96 months during childhood, that is, 50 percent of the first sixteen years of life of their children. Maternal employment and child's age are clearly positively related. Between the child's birth and the sixth birthday, mothers worked on average about 18 months in MS and RS and 16 months in SMS and SRS. During primary school years, their time in paid employment increased to about 30 months; and, finally, during their child's adolescence, they worked for 45 months. This picture does not significantly change if

[12] At first consideration, this percentage may appear high, but it includes those with "higher vocational" qualifications, such as teaching and nursing qualifications, City and Guilds certificate, Higher Certificate/Diploma and University Diploma, many of whom probably did not obtain an A-level. Indeed, 19 percent of the young adults in MS (16 percent of those in RS) have these qualifications (that is, 30 percent of those who have achieved a highest qualification of at least A level). In 40 percent of the sibling pairs, one has a qualification of at least A-level and the other does not. Notice, also, that a regression relating monthly earnings to educational qualifications as well as age and sex indicates that those with these higher vocational qualifications earn 6.6 percent more than those whose highest qualifications are at A-level (20 percent more than those with O-levels), thereby providing evidence that these are indeed qualifications higher than A-level; they earn 30 percent less than those with degrees. The regression uses observations on all those aged more than 22 and less than 65 in the BHPS over 1991-97 (N=26,739 person-years), and it allows for a person-specific unobservable influence on earnings, which is fixed over time.

[13] Rather than dropping individuals with missing father or missing father's work history information from the analysis, we chose to maximise our sample size by retaining all individuals and indicating missing father or missing father's work information with two dummy variables. All variables with missing values have been replaced with zeros.

we confine our attention to mothers who were employed sometime at each development stage (the figures are reported in square brackets of Table 1). More than 60 percent of their time in paid employment was in part-time work, but the employment gradient with child's age is as steep in part-time work as it is in full-time work.

Nearly 48 percent of young adults in each sample are women. The average age of the young adults in MS and SMS is just above 21 (the age range is 16-27), and slightly less than 20 in RS and SRS (the age range is 16-24). The average year of birth is 1975 for people in the main sample and 1977 for those in the restricted sample.[14] About one-fourth of the people in MS and RS experienced life in a single-parent family; that is, either their mother's partnership dissolved before they reached age 16, or they were born outside of a live-in partnership. Of the children who spent some time in a single parent family, 45 percent did so below the age of 6. In SMS and SRS the proportion of young adults who experienced life in a single parent family is lower, and approximately 20 percent. But again, of those who spent time in a single parent family, almost 45 percent did so by age 6.

The mother's and father's educational levels may reflect their academic ability and attitudes about education as well as the cultural environment of the family in which the young adults have grown up. More than one-quarter of the mothers and one-third of the fathers of these young adults had no academic qualification, while 9-10 percent of mothers and fathers held a university degree. Family size may be an important determinant of young people's achievements because parents' time and

[14] Ermisch and Francesconi (2000) document that the absolute age differences between siblings in SMS and SRS are on average of 3.08 and 2.72 years, respectively. Approximately 75 percent and 82 percent of the age differences are less than 4 years in SMS and SRS respectively, while only 15 percent and 7 percent of the age differences are above 5 years. Interestingly, we observe 7 and 5 twin births in SMS

material resources are spread more thinly as the number of children in the family increases. In view of this potential impact, our analysis of the main and restricted samples includes the number of brothers and sisters of each young adult. It also includes a variable indicating whether the respondent is the only child or not,[15] and also a variable indicating whether he/she is firstborn or not. The mother's and father's age at the child's birth have also been included as additional explanatory variables. On average, mothers gave birth at age 26, when fathers were approximately 2 years older: 11 percent (5 percent) of the young adults in all samples were born when their mother (father) was aged 21 or less, and around 2-4 percent (5-6 percent) of them had mothers who were aged 35 (fathers aged 37) or more at their birth. Approximately 7 percent of the young people were an only child, while 40 percent were firstborn. They had an average of 1-2 brothers and sisters.

4. Econometric model

Consider the model presented in Section 2.2 when information about the child's endowment is not immediately revealed to the parents (i.e., it becomes known only during the second part of the child's childhood). If $\alpha_1=\alpha_2$, the following equation is an approximation to the difference between the conditional demand functions for each sibling's earning capacity (e.g., the difference in educational attainment):

$$(8) \qquad e_a - e_b = \delta_0 + \delta_1[(t_{2a}+t_{2b})-t_{1a}] + \delta_2(\mathbf{X}_a-\mathbf{X}_b) + \varepsilon_a-\varepsilon_b,$$

where dynamic responses in the third period have been "substituted out". Parental time input into human capital production in each period has been replaced by parental employment time. The vector **X** denotes a set of individual characteristics, which, in

and SRS respectively, corresponding to a twinning probability of 0.0088 and 0.0098, which compares favourably with the statistics presented in Angrist and Evans (1998) and Ashenfelter and Rouse (1999).

our estimation, are: the young adult's gender, age, experience of life in a single-parent family at each developmental stage, age of the mother and father at the child's birth, whether or not he/she is the firstborn, whether or not there is a missing father figure, and whether there is no information on the father's employment patterns. Thus, t_{1a} and $t_{2a}+t_{2b}$ in specification (8) serve as sufficient statistics for the effects of w_1, w_2, y_1 and y_2. Ordinary least squares estimates of δ_1 would provide a consistent estimate of the impact of $(t_{2a}+t_{2b})-t_{1a}$ on e_a-e_b, because the difference between the amounts of the mother's time devoted to human capital investment when each child is "young" can be taken as exogenous in equation (8) when $\alpha_1=\alpha_2$. But the condition that $\alpha_1=\alpha_2$ may be difficult to defend. If this condition is not satisfied, the regression coefficient δ_1 would be a biased estimate of the impact of mother's time investment, and the direction of the bias depends on the signs of $\alpha_1-\alpha_2$ and c. Suppose $\alpha_1>\alpha_2$. Then δ_1 would overstate the impact if parents reinforce endowment differences and understate it if they compensate for differences in endowments.

We now provide an interpretation of the coefficients in (8). Suppose that the estimate of δ_1 is negative and statistically significant. While equation (8) approximates a complex reduced form expression, if $\alpha_1=\alpha_2$, we can interpret the negative δ_1 as reflecting the effect of less of the mother's time allocated to her children's human capital investment when they were of pre-school age on their subsequent educational attainments. In other words, this is analogous to the special case of the static model in equation (2) above, in which the coefficient of $ln(t_a+t_b)$ is α. As (8) is an approximation to a conditional demand function, the negative δ_1 means that higher full family income in the first period (w_1T+y_1) relative to that in the second

[15] Of course, this dummy variable is only included in the analysis of MS and RS.

period (w_2T+y_2) increase the educational attainments of the first child relative to those of the second child. Given full family income in each period, a higher mother's wage in the first period relative to the second reduces the educational attainments of the first child relative to those of the second.

These results also imply that the children from families with higher full income (lower mother's wages) throughout their childhood will have more invested in their human capital and have higher educational attainments and lifetime earnings. As we have not estimated the parameters that allow us to gauge the impacts of the mother's wage and full family income on the mother's time allocation, we are not able to assess the quantitative impact of them on children's educational attainments.

In a more complex model, in which the allocation of more of the mother's time to paid employment when the child is a pre-schooler increases her wage in the future and in which goods inputs also are important in human capital investment, the full effects of the mother's time allocation when the child is a pre-schooler are ambiguous. In such a model, the direct effect on human capital investment of spending more time in paid employment when the child is a pre-schooler, which lowers educational attainments, may be offset by the effect of higher full family income later in childhood if goods inputs are sufficiently more productive in human capital investment than mother's time inputs when a child is older.

The static model of Section 2.1 makes it clear that cross-sectional estimates of the relationship between parental employment during childhood and children's later educational achievements are likely to be biased. This is because the resources devoted to human capital investment in children, R, are not generally independent of their endowments, ε_a and ε_b (and even if they are, there is likely to be heterogeneity in preferences and technology). Most of our knowledge of the association between

parents' employment and children's educational attainments is, however, based on evidence obtained from cross-sectional estimates. We shall, therefore, present evidence on such estimates as well.

In the empirical analysis, we estimate logit regressions on both the cross-sectional samples (MS and RS) and the sibling samples (SMS and SRS). In the sibling samples, we sort siblings so that the sibling with higher education is listed first. Correspondingly, the dependent variable takes the value of unity if one of the siblings has an A-level or above and the other does not, and zero otherwise.[16] All figures are marginal effects and can be interpreted as deviations from the corresponding baseline probabilities.

5. Estimates

Our dynamic model suggests that a causal interpretation of the relationship between parental employment during childhood and educational attainment of children as young adults rests on fairly strong assumptions, even if sibling difference estimates are used. Researchers must be willing to assume that the children's human capital production function is characterised by identical elasticities in the two stages of a child's childhood and that parents do not know their children's idiosyncratic endowments. Since the latter assumption is more likely to be true when the child is very young (e.g., in pre-school years), our preferred estimates will be those that only use parents' employment patterns (and family structure) in the first of the three developmental stages (i.e., when the child is aged 0-5) as regressors. Before

[16] Because of the non-random sorting of siblings, a constant term is included in the differenced education equation (see Ashenfelter and Rouse, 1998).

presenting such estimates, we discuss the results for the entire childhood period, as most of the relevant literature has recently done.

5.1 The effect of mother's employment

We find evidence of an adverse effect on achieving A level or more of mother's employment in pre-school years, when the child was aged 0-5 (Tables 2 and 3). On the basis of the sibling comparisons in the main sample (SMS), the effect is around 4 percent lower probability when considering both part-time and full-time employment together (Table 2). The effect ranges between a 3 percent lower probability of achieving at least A level from an additional year of part-time employment to almost 8 percent lower probability from an additional year of full-time employment (Table 3).

In order to understand how these estimated effects may have come about, it is helpful to examine the distributions of mothers' part-time and full-time employment in each development stage. At the apparently crucial pre-school period (child age 0-5), about 60 percent of the mothers had no part-time paid work and 80 percent had no full-time employment. Among those who were employed in a part-time or full-time job sometime, the distribution is fairly uniform across the years of that type of employment, with some bunching at 1 and 6 years of employment. Furthermore, the occupational distribution of mothers employed full-time when their child was aged 0-5 is not very different from that of mothers employed full-time when their child was older, with the possible exception of larger representation of unskilled workers and a smaller proportion of professionals when the child was aged 0-5. Mother's employment from the child's sixth birthday onward is bunched at no employment in that type of job and 5 years of employment. Over these years of childhood, mothers tend to divide into two groups: those who worked in that type of paid employment

most of the time and those who were never employed in that type of job. These two groups may differ with regard to parents' endowments and other family background factors, many of which are not measured. These differences would be eliminated in the sibling comparisons.[17] If we look, instead, at the distributions of sibling differences in part-time and full-time employment, we find that there is no difference between siblings for the vast majority of comparisons. But the differences that do exist cover the entire range, with differences of one and two years being most common. It is these differences in conjunction with the differences in siblings' educational attainments (A-level or higher or not) which generate the estimated effects in the sibling main sample.

The negative effect from full-time employment when the child was aged 0-5 is relatively robust across the different estimation methods and samples. Table 3 shows that the impact of a one-year increase of mothers' full-time employment when her child was a pre-schooler ranges from almost 1 percent (first column) to a 10 percent (last column) reduction in the probability of achieving A level or more. Both cross-sectional estimates are, however, not well determined. The negative effect of part-time employment during the same developmental stage is smaller, but it is still sizeable and statistically significant, ranging between 3 and 6 percent in the sibling difference estimates. No significant effect of part-time employment is detected by the cross-

[17] For example, the tendency for more years of mother's full-time employment during adolescence to be associated with higher educational attainments according to the cross-section estimates is not confirmed by the sibling difference estimates. This suggests that the positive cross-section relationship between child's education and mother's full-time employment when the child was aged 11-15 merely reflects a positive correlation between the child's educational attainment and endowments of the mother (such as ability or ambition), which are also positively correlated with mother's employment. That is, it is not a true causal effect.

section estimates, but this could be due to the failure to control adequately for family background in these estimates.[18]

The sibling difference estimates from the main sample (third column of Table 3) suggest that one year more full-time employment when the child was aged 6-10 *increases* the probability of achieving A-level or higher by 8 percent. This large and statistically significant effect is not, however, replicated in the cross-section estimates, nor in the sibling difference estimates from the restricted sample. It is, however, also positive in the latter estimates. Thus, there may be an offset to the negative impact of full-time employment when the child was a pre-schooler for women who continued to work full-time when the child was aged 6-10. There is, indeed, a large amount of persistence in full-time employment: the correlation coefficient between months in full-time employment when the child was aged 0-5 and when he/she was aged 6-10 is 0.62.[19] Thus, women who do not work full-time when her child is a pre-schooler are not likely to do so when he/she is aged 6-10, and those who do are likely to continue to do so.

It is possible that the impact of full-time employment when the child was aged 0-5 may differ between mothers in better-paid jobs and mothers in poorer jobs. This may arise because the better paid mothers buy better childcare or they may allocate their non-employment time differently. In order to test for such a difference we divided mothers between those with highest qualifications above A-level (about 30%

[18] In their study of the 1970 birth cohort, Joshi and Verropoulou (2000) find that children whose mother was employed sometime while they were aged under 5 achieve significantly lower qualifications by the age of 26 than those whose mothers were not employed in these pre-school years. When we adopt the same pre-school employment indicator variable with our data and use a cross-section estimator comparable to theirs, we obtain almost exactly the same result as theirs, although our coefficient is less precisely estimated (t-value=1.57, compared with 2.56 in their analysis).

[19] The correlation coefficients between months of full-time employment in the first and second and the third and fourth development stages are both 0.64.

of mothers) and those with qualifications of A-level or below. We then examined whether the impacts of each type of employment at each development stage differed between these two groups of mothers. Overall, they did not.[20] In the sibling difference estimates from the main sample, there was some evidence that the negative effect of months of full-time employment when the mother was aged 0-5 was smaller for the more educated group of mothers, but the difference was only on the margin of statistical significance (*t*-value=1.85). In this case, the effect for less educated women is even larger than that shown in Table 3, and the effect remains negative and large for the more educated group. Thus, while there is some weak support for smaller employment effects among better paid mothers, adverse effects of their full-time employment when the child was aged 0-5 remain.

In sum, the sibling difference estimates suggest that more full employment by the mother when a child was a pre-schooler tends to reduce her child's educational attainments because of the reduction in the time she spent with the child in these formative years. Continuing in full-time employment when the child was aged 6-10 may offset this impact, although her child would do better if she did not work full-time until he/she reached the age of 6. More part-time employment when the child was aged 0-5 also adversely affects his/her educational attainment, but this effect is much smaller. These effects are not evident in the cross-section analysis, probably because children of women with better endowments, who are more likely to be in employment, particularly full-time employment, also have better endowments themselves and are more likely to obtain higher qualifications.

[20] For the sibling difference estimates from the main sample, the F-value for the joint significance of the coefficients of terms interacting mother's education group with differences in months employed part-time and full-time at each development stage is 0.82 (8 and 273 degrees of freedom), corresponding to a p-value of 0.58. Similar results were obtained with the other estimators and sample.

5.2 The influences of father's employment

Before discussing the results concerning the effect of father's employment on children educational attainment, it is worth making two general points. First, for almost one in six of the young adults in our samples we do not have any information on their father (see Table 1). Moreover, for one-third of the young adults we cannot recover any information on the father's employment patterns during the childhood of the child (either because the father is missing or because the information cannot be reliably used). Second, the vast majority of the fathers in our samples are employed most of the time; on average, almost 15.5 years of employment over the first 16 years of life of their children. This small variation in father's employment across families and over time makes it likely that variations in outcomes are not associated with variation in father's employment.

Table 4 reports the estimated effects of father's employment. We find little consistent evidence of an effect of father's employment on the probability of achieving A level or more. The cross-section associations suggest a positive impact if the father works when his child was aged 0-5. But the sibling difference estimates, although not precisely measured, suggest that more months in employment when the child was aged under 6 reduces his/her educational attainment. After age 6 of the child, we cannot detect any impact. In addition, we investigated whether there was any additional impact of being unemployed sometime in each development stage (in addition to the impact of being not in employment), and we found no such effect. Appendix Table A1 contains the estimates of the parameters for all the other variables used in estimation.

5.3 Preferred estimates

Our preferred estimates are presented in Table 5. They refer only to the effect of parental employment when the child was in pre-school years (ages 0-5), that is, when the parents were likely to have reduced information on each child's idiosyncratic endowment relevant to the human capital investment. Because endowments are likely to be fully revealed at later ages, information on the subsequent developmental stages is dropped from estimation.

From the sibling difference estimates, we again find evidence of an adverse effect of mother's full-time employment on her children's probability of achieving A level or more. The effect is precisely measured and ranges between 7 and 9 percent lower probabilities depending on the estimating sample. This effect is also detected by the cross-sectional estimates but it is not statistically significant. There is also evidence of a negative effect on education of the mother's part-time employment during the child's first five years of life. But this effect is smaller in magnitude, ranging from 3 to 6 percent lower probabilities of achieving A level or more, and less precisely estimated. Interestingly, the effect of father's employment is also negative and around 4 percentage points in the case of the siblings from the main sample. The positive cross-sectional relationship between child's education and father's time in paid work is likely to pick up the positive correlation between children's educational attainment and father's endowment, which, in turn, is positively correlated with his employment patterns.

6. Conclusions

This paper has presented a theoretical framework that provides the conditions under which we can give a causal interpretation to the association between childhood parental employment and subsequent education of children as young adults. In an

environment in which parental preferences are separable in own consumption and children's well-being, estimation is complicated by endowment heterogeneity and by the fact that parents may compensate or reinforce children's endowments relevant to educational attainment. While sibling differences may be useful to eliminate endowment heterogeneity that is common across siblings, they are generally not enough to account for differences in parental behaviour. That is, they confound preference and technology parameters. A causal interpretation of the parameter of interest rests, therefore, on two stronger assumptions. First, the idiosyncratic endowments of children are not revealed to parents at birth (but it takes time before parents fully know their children's endowments). Second, the children's human capital production function is characterised by the same parents' time elasticity across ages of the child and across siblings.

We perform our empirical analysis using data from various samples of young people drawn from the British Household Panel Survey. There is a negative and significant effect on the child's educational attainment as a young adult of the mother's full-time employment when the child was aged 0-5. The effect of mother's part-time employment is again negative but smaller and less well determined. Similarly, the effect of father's employment is small, not always precisely estimated but again negative. The negative effects of mother's part-time work and, particularly, of mother's full-time work persist even if we include parents' employment patterns over the entire childhood period. In the context of our conditional demand function framework, these results suggest that a higher full family income increases the educational attainment of children, and given full family income, a higher mother's wage reduces her children's educational attainment.

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Table 1: Means of variables used in analysis

Variable	Estimating sample			
	MS	RS	SMS	SRS
Dependent variable				
A level or more	0.617	0.629	0.641	0.665
Parental work variables				
Mother's work:[a]				
child aged 0-5 (years)	1.607	1.569	1.405	1.255
	[2.617]	[2.531]	[2.528]	[2.261]
child aged 6-10 (years)	2.581	2.554	2.430	2.416
	[3.134]	[3.060]	[2.996]	[2.917]
child aged 11-15 (years)	3.548	3.593	3.569	3.798
	[3.788]	[3.799]	[3.732]	[3.857]
Mother's part-time work:[a]				
child aged 0-5 (years)	0.952	0.973	0.987	0.921
	[2.331]	[2.359]	[2.355]	[2.327]
child aged 6-10 (years)	1.625	1.598	1.678	1.706
	[3.009]	[2.930]	[2.933]	[2.867]
child aged 11-15 (years)	2.093	2.123	2.231	2.471
	[3.808]	[3.816]	[3.776]	[3.891]
Mother's full-time work:[a]				
child aged 0-5 (years)	0.655	0.596	0.419	0.334
	[2.584]	[2.280]	[2.365]	[2.115]
child aged 6-10 (years)	0.957	0.956	0.751	0.710
	[3.146]	[3.076]	[2.831]	[2.754]
child aged 11-15 (years)	1.455	1.470	1.339	1.327
	[3.563]	[3.602]	[3.349]	[3.547]
Father's work:[a]				
child aged 0-5 (years)	3.630	3.612	3.770	3.643
	[5.413]	[5.398]	[5.462]	[5.549]
child aged 6-10 (years)	3.064	3.052	3.162	3.034
	[4.569]	[4.561]	[4.594]	[4.617]
child aged 11-15 (years)	3.095	3.078	3.175	3.048
	[4.615]	[4.599]	[4.612]	[4.644]
Other variables				
Age	22.285	20.821	22.259	20.902
Female	0.470	0.477	0.467	0.472
Year of birth – 1900	74.729	76.454		
Ever in single-parent family:				
child aged 1-5	0.107	0.111	0.073	0.080
child aged 6-10	0.078	0.085	0.068	0.061
child aged 11-15	0.049	0.045	0.050	0.052
Age of mother at birth ≤21	0.102	0.094	0.097	0.098
Age of mother at birth ≥35	0.037	0.019	0.015	0.015
Age of mother at birth	26.341	26.400	26.070	26.220

Age of father at birth ≤21	0.048	0.051	0.045	0.049
Age of father at birth ≥37	0.056	0.051	0.042	0.034
Age of father at birth[b]	28.698	28.637	28.477	28.301
Number of brothers	0.859	0.869		
Number of sisters	0.718	0.708		
Firstborn	0.450	0.419	0.421	0.411
Only child	0.070	0.062		
Mother's education:				
No qualification (base)	0.	0.		
Less than O level	0.117	0.114		
O level	0.222	0.224		
A level	0.072	0.076		
Higher vocational quals.	0.203	0.221		
Higher qualification	0.081	0.088		
Father's education:				
No qualification (base)[c]	0.	0.		
Less than O level	0.069	0.059		
O level	0.160	0.159		
A level	0.095	0.107		
Higher vocational quals.	0.230	0.233		
Higher qualification	0.085	0.094		
Father is missing (1=yes)	0.166	0.162	0.150	0.156
Information on father's work is missing (1=yes)	0.329	0.331	0.311	0.344
N	1026	647	599	326

Note: Figures in SMS and SRS are computed on levels (rather than sibling pairs). N is the number of sample-specific observations.

[a] Computed on all cases. Values computed only on cases with working mother or nonmissing father are in square brackets.

[b] Computed only on cases with nonmissing father. The base category (age of father at birth is between 22 and 36) contains also cases with missing father information.

[c] Includes cases with missing father.

Table 2: Effects of childhood maternal time in employment on the probability of achieving A level or more by child developmental stage (Absolute ratios of coefficient to standard error are shown in parentheses)

Time of maternal employment by child developmental stage	Cross-sectional estimates		Sibling difference estimates	
	MS	RS	SMS	SRS
Baseline	0.617	0.629	0.641	0.662
Child aged 0-5	-0.003	-0.008	-0.044	-0.083
(+ 1 year)	(0.473)	(1.042)	(2.384)	(2.627)
Child aged 6-10	-0.004	0.002	0.015	-0.005
(+ 1 year)	(0.905)	(0.376)	(1.483)	(0.304)
Child aged 11-15	0.009	0.010	-0.006	-0.016
(+ 1 year)	(2.511)	(2.135)	(0.702)	(1.433)
N	1026	647	381	187

Note: MS = main sample; RS = restricted sample; SMS = siblings from main sample; SRS = siblings from restricted sample. Figures are marginal effects obtained from logit regressions. Estimated standard errors account for arbitrary forms of correlation within siblings or half-siblings. *N* is number of individuals in MS and RS, and number of siblings differences in SMS and SRS. Other variables included in the regressions performed with MS and RS are: gender, cohort, seven age dummies, dummies for firstborn and only child, ever lived in a single parent family by developmental stage, number of brothers and sisters, age of mother at child's birth (two dummy variables), age of father at birth (two dummy variables), mother's education (five dummy variables), father's education (five dummy variables), dummy variables for missing father and missing father's work history information, father's working time by developmental stage, and a constant. Other variables included in the regressions performed with SMS and SRS are the sibling differences in: age, gender, firstborn, ever lived in a single parent family by developmental stage, mother's age at birth was 21 or less, mother's age at birth was 35 or more, father's age at birth was 21 or less, father's age at birth was 37 or more, missing father and missing father's history. A constant term is also included because of non-random sorting of siblings.

Table 3: Effects of childhood maternal time in part-time and full-time employment on the probability of achieving A level or more by child developmental stage (Absolute ratios of coefficient to standard error are shown in parentheses)

Time of maternal employment by child developmental stage	Cross-sectional estimates		Sibling difference estimates	
	MS	RS	SMS	SRS
Part-time employment:				
Child aged 0-5	0.001	-0.005	-0.033	-0.064
(+ 1 year)	(0.097)	(0.342)	(2.128)	(1.828)
Child aged 6-10	-0.004	0.003	0.020	-0.007
(+ 1 year)	(0.547)	(0.352)	(0.844)	(0.173)
Child aged 11-15	0.012	0.012	-0.027	-0.041
(+ 1 year)	(1.865)	(1.519)	(0.708)	(0.627)
Full-time employment:				
Child aged 0-5	-0.008	-0.034	-0.075	-0.105
(+ 1 year)	(0.405)	(1.199)	(2.731)	(2.404)
Child aged 6-10	-0.018	0.009	0.081	0.045
(+ 1 year)	(1.114)	(0.438)	(2.596)	(0.802)
Child aged 11-15	0.029	0.024	0.002	-0.036
(+ 1 year)	(2.983)	(2.013)	(0.063)	(0.799)
N	1026	647	381	187

Note: See note of Table 2.

Table 4: Effects of childhood paternal time in employment on the probability of achieving A level or more by child developmental stage (Absolute ratios of coefficient to standard error are shown in parentheses)

Time of paternal employment by child developmental stage	Cross-sectional estimates		Sibling difference estimates	
	MS	RS	SMS	SRS
Child aged 0-5	0.029	0.034	-0.039	-0.031
(+ 1 year)	(1.905)	(2.352)	(1.887)	(1.188)
Child aged 6-10	0.016	-0.001	0.005	0.012
(+ 1 year)	(1.025)	(0.045)	(0.177)	(0.793)
Child aged 11-15	-0.009	0.018	-0.020	0.018
(+ 1 year)	(0.542)	(0.947)	(0.573)	(0.795)
N	1026	647	381	187

Note: Obtained with the estimates of Table 3. See note of Table 2.

Table 5: Effects on the probability of achieving A level or more of the time parents worked when the child was aged 0-5 (Absolute ratios of coefficient to standard error are shown in parentheses)

	Cross-sectional estimates		Sibling difference estimates	
Child aged 0-5	MS	RS	SMS	SRS
Mother's part-time employment	-0.003	-0.004	-0.031	-0.059
	(0.299)	(0.309)	(1.872)	(1.732)
Mother's full-time employment	-0.014	-0.024	-0.074	-0.086
	(0.893)	(1.060)	(2.888)	(2.409)
Father's employment	0.033	0.047	-0.042	-0.033
	(2.175)	(2.611)	(2.055)	(1.512)
Log likelihood	-608	-365	-235	-109
N	1026	647	381	187

Note: Estimates are obtained from regressions with the same specifications reported in the note of Table 2, except that ever lived in a single parent family (in MS and RS) and its sibling differences (in SMS and SRS) include only the first developmental stage (child aged 0-5).

Table A1: Effects of other variables on the probability of achieving A level or more (Absolute ratios of coefficient to standard error are shown in parentheses)

	Cross-sectional estimates		Sibling difference estimates	
Variable	MS	RS	SMS	SRS
Female	0.012	0.017	0.015	0.052
	(0.422)	(0.461)	(0.293)	(0.744)
Year of birth – 1900	0.029	0.038		
	(2.954)	(1.574)		
Age			0.009	-0.001
			(0.528)	(0.014)
Age 19	0.206	0.210		
	(3.536)	(3.414)		
Age 20	0.315	0.310		
	(5.087)	(4.179)		
Age 21	0.343	0.364		
	(5.401)	(4.142)		
Age 22	0.383	0.425		
	(5.400)	(3.921)		
Age 23 or more	0.421	0.453		
	(5.412)	(3.526)		
Ever in single-parent family:				
Child aged 0-5	-0.162	-0.142	-0.204	-0.244
	(3.116)	(2.219)	(2.072)	(4.372)
Child aged 6-10	-0.147	-0.162	-0.186	-0.228
	(2.534)	(2.223)	(3.619)	(5.372)
Child aged 11-15	0.021	-0.049	-0.051	-0.126
	(0.284)	(0.526)	(2.343)	(6.434)
Age of mother at birth ≤21	-0.086	-0.047	-0.063	-0.091
	(1.693)	(0.699)	(0.550)	(1.340)
Age of mother at birth ≥35	0.003	0.149	0.076	0.065
	(0.036)	(0.998)	(1.022)	(0.296)
Age of father at birth ≤21	0.131	0.224	-0.072	0.131
	(1.750)	(2.312)	(0.514)	(0.810)
Age of father at birth ≥37	0.146	0.032	0.069	0.079
	(2.014)	(0.379)	(0.707)	(0.354)
Number of brothers	-0.018	-0.008		
	(0.850)	(0.292)		
Number of sisters	-0.021	-0.020		
	(0.961)	(0.718)		
Firstborn	0.002	0.015	0.083	0.064
	(0.048)	(0.374)	(1.345)	(0.626)
Only child	0.066	0.070		
	(0.954)	(0.804)		
Mother's education:				
Less than O level	0.038	0.061		
	(0.818)	(1.048)		

O level	0.082	0.114		
	(2.084)	(2.314)		
A level	0.133	0.146		
	(2.170)	(1.959)		
Higher vocational quals.	0.172	0.226		
	(4.031)	(4.211)		
Higher qualification	0.193	0.241		
	(2.687)	(2.818)		
Father's education:				
Less than O level	0.068	0.064		
	(1.119)	(0.794)		
O level	0.050	0.066		
	(1.097)	(1.146)		
A level	0.107	0.131		
	(1.881)	(1.925)		
Higher vocational quals.	0.147	0.138		
	(3.318)	(2.520)		
Higher qualification	0.253	0.235		
	(3.280)	(2.572)		
Father is missing (1=yes)	0.089	0.141	-0.042	-0.065
	(1.397)	(1.768)	(0.197)	(0.259)
Information on father's work is missing (1=yes)	0.479	0.491	-0.498	-0.393
	(1.560)	(2.021)	(1.273)	(0.347)
Log likelihood	-599	-359	-231	-104
N	1026	647	381	187

Note: See Tables 3 and 4 for other estimates. See note of Table 2.