

Do parental employment and hours of work matter for children's educational achievements?

(Preliminary draft, not for citation)

Abstract

This paper addresses the issue of parental employment and parental hours of work and its impact on children educational outcome at the age of sixteen. I contribute to existing research applying more accurate measure of parental time spend outside household- using direct measure of hours of work spend at work and commuting. Secondly this analysis focuses on both mothers and father hours of work, which permits to examine independent effect of mother's and fathers' work involvement, as well as their joint effect. Additionally I use longitudinal datasets (British Household Panel Survey and Longitudinal Survey of Young People in England) which allows to examine the impact of the parental hours of work in the preceding year on the exam's result in the following year.

My results show that there is statistically significant and positive association between parental engagement at the labour market and number of final secondary school exams taken by a child. On the other hand I found that children, whose parents work very long hours, exceeding 85 hours per week, perform worse at the GCSE exam. This result holds even if unobservable family characteristics are taken into account, and instrumental approach applied to control for potential endogeneity of parent's hours of work. Moreover the effect of long parental working hours is more harmful for girls than for boys. In addition it was showed that mother's working hours are more important in determining child's educational outcome, than father one.

JEL Classification: J22, J13, I21

Keywords: household labour supply, parental working hours, child educational development, sibling estimator

1 Introduction

Parental labour supply has an ambiguous effect on children's educational achievements. On the one hand it contributes to household income, which is generally positively associated with children's performances at school (Becker and Tomes, 1986; Duncan et al., 1994; Haveman and Wolfe, 1995). On the other hand, according to Becker's theory of time allocation (Becker, 1965), generating income requires time which cannot then be spent with the family. It has been shown that *'parental time is one of the resources which has a positive impact on children's outcomes later in their life'* (Leibowitz, 1974). Parents' time at work, and away from the home environment, may reduce their involvement in their children's learning activities, or in parental control.

The majority of previous studies of the impact of parental employment on children's educational outcomes focus on how the labour supply of mothers affects the cognitive development of children, ignoring any effect of fathers' employment (Han et al., 2000; Gregg et al. 2005; Ruhm, 2008; Verropoulou and Joshi, 2009). However, recent changes in social patterns, in particular the increasing involvement of both parents in childcare and increasing female labour market participation, necessitates a less traditional approach. This paper focuses on the effects of parental hours of work on children's educational achievement at the age of 16 using data from the British Household Panel Survey and Longitudinal Study of Young People in England (BHPS, LSYPE). As well as exploiting two different datasets, we also account for unobserved family characteristics using family-fixed effects and sibling difference estimators. We address the potential endogeneity of parents' hours of work, which would arise from the adjustment of parental working time to a child's ability, using several methods. First, we condition our analysis on the labour market status of parents before a child was 5 years old. Second, we use an instrumental variables approach, using the attitudes toward the labour market participation of women as an instrument. In light of the growing importance of overtime work (Kalwij and Gregory, 2000; Bell et al., 2000; Francesconi, 2001; Kuhn and Lozano, 2005) we apply a comprehensive measure of hours of work which includes normal hours of work plus overtime and the time spent commuting to and from work. This provides a more complete picture of the time spent away from the household than the typical full-time/part-time distinction. In the absence of time diary data, this approach will yield a more accurate assessment of the effect of parental absence from home due to work and its impact on the educational achievements of the child. We focus on mothers' and father' hours of work, which allows us to separately indentify the independent effect of mothers' and fathers' employment, as well as their joint effect. Longitudinal data allow us to examine the impact of parental working hours in the preceding year on a child's exam results in the following year.

The paper is organised as follows: Section 2 describes previous studies of parental labour market participation and children's outcomes and gives a brief outline of the educational system in England and Wales; Section 3 describes the labour market situation in the UK. Section 4 describes the datasets used in the analysis; Section 5 presents descriptive statistics, and Section 6 outlines the methodological approach used. Results from empirical analysis are presented in Section 7 and discussed in Section 8.

2 Literature review

The growth in the labour market participation of women, including mothers of young children, has led to an increasing awareness among economists, sociologists, psychologists and policy makers of childcare related issues and their potential impact. As a result there have been a substantial number of studies which examine the role of a mother's employment on her child's/children's development (Leibowitz, 1977; Stafford, 1987; Han et al., 2000; Ermisch and Francesconi, 2000; Gregg et al., 2005; Ruhm, 2008; Verropoulou and Joshi, 2009). At the same time, the impact of the father's involvement in childcare has been largely ignored, despite empirical studies which find that fathers' involvement could have beneficial effects on their children's well-being (Harris et al. 1998). In this section we review the most recent empirical studies, with a particular emphasis on studies which model the impact of both parents' labour market participation on children's educational outcomes.

It is difficult to identify a direct causal relationship between parental employment and child development. One of the constraints is the potential endogeneity of parental working hours, which arises from simultaneity. According to their preferences, parents could adjust their working time to meet their children's needs. For example, if a child has problems at school, parents could limit their working time, so they spend more time with their children. The same could occur if a child possesses very high ability which parents want to reinforce. In these cases, estimates of the impact of parents' working time on children's educational achievements are biased (Hörisch, 2008; Del Boca et al. 2010). There are two channels through which parental employment might affect the outcomes of children. While labour market participation generates income, time spent at work reduces the amount of time parents can spend with children. These two channels work in opposite directions. A greater income allows parents to purchase more educational goods and services (such as books, private tutorial classes, better childcare, etc.), which could boost the educational development of a child. However, as assumed in the theory of family behaviour (Becker and Tomes, 1986), parental investment in children is also subject to parental preferences and the utility which arises from a child's development. Hence, there is not necessarily a direct link between family income and spending on educational goods. On the other hand, more limited time with parents might have negative influences on children. Some studies demonstrate that the relative effects of those two factors vary depending on the child's age, suggesting that the parent's presence in early childhood is crucial for later outcomes and is more beneficial than their presence in adolescence (Price, 2008). Another complicating factor is that children differ in their capacity for learning (endowment), and so their achievements are not only an indirect effect of their parent's contribution but also result from their own choices and personality traits.

2.1 Parental time allocation and children's outcomes

In our analysis we assume that parental working time limits child-parent contact which is, according to theory (Becker, 1965), a valuable input in child development. However, we first review the findings from empirical studies. The education and socio-economic status of parents are among most important determinants of the parental time spent

with a child. Guryan et al. (2008) use the American Time Use Survey to show that children of mothers with college or higher education spend on average 4.5 hours per week more in childcare than children of other mothers, and this relationship is observed among children of working and non-working mothers. Apart from education, another important factor in shaping intra-family time allocation is parental attitude toward child development. As reported by Stafford and Yeung (2005), parents with highly positive parental attitudes towards the value of child development spend on average 52 minutes more time with their children during the week than those who place less value on their child's development. This evidence indicates that the relationship between the working time of parents and its impact on child outcomes is not straightforward, as socio-economic characteristics and parental attitudes seems to play an equally important role. There are also differences between parent-child time-use depending on the parent's gender. Rasmussen (2005) reports that, among intact Danish families, mothers' childcare time on weekdays and fathers' childcare time at weekends are positively correlated with the educational attainment of children.

Some other studies look at the time use of children, trying to assess the impact of parents on children's time-use patterns. Mullan (2009), using recent Time Use Survey data from the UK, reports that children of mothers in full-time employment spend more time watching TV and less time on education related activities than those whose mothers are not working. However, the effect is much smaller for children aged 14 - 18 than those aged 8 - 13. Children are also found to replicate the time-use patterns of their parents (Cardoso et al. 2008). In families in which parents spend more time on intellectual activities, such as reading newspapers and participating in courses and training, children also spend more time on similar activities (reading, studying, etc) than children from other families. Cardoso et al. (2008) concluded that, through the intergenerational transmission of preferences and a network effect, children in families in which parents devoted more time to the acquisition of human capital are more likely to spend time in similar activities.

2.2 Income and the educational achievements of children

The employment of parents limits their time availability but also generates income. We next review existing empirical studies which analyse the role of household income in children's educational achievements.

Household income is often found to be an important factor in determining children's educational achievements (Becker and Tomes, 1986; Duncan et. al., 1994; Haveman and Wolfe, 1995; Blau, 1999; Plug and Vijverberg, 2005). This effect emerges in different ways. Exposure to poverty in childhood, particularly persistent poverty, has a large negative impact on a child's educational outcomes (Duncan et. al., 1994). However, Duncan et al (1994) argue that an increase in family income *ceteris paribus* will not automatically lead to an improvement in children's outcomes, as a child's developmental outcomes depend also on the learning environment of the household, as well as parental and neighbourhood characteristics. The role of family background is a much more powerful determinant of child development than temporary financial situation measured by household income (Blau, 1999). Moreover, as argued by Plug and Vijverberg (2005), the effects of income on children's educational outcomes might be biased due to unobserved parental abilities which both allow

parents to obtain higher earnings, and are transferred genetically to their children. However, while controlling for family background (education of parents, IQ of parents, etc.), among families with adopted children they still found that household income has a positive influence on the educational attainment of children. This could indicate that although family income captures other unobservable family characteristics (like parental ability, etc.), sometimes its impact on children's educational achievement is overestimated. Therefore, it remains an important facilitator of educational achievement.

2.3 Parental employment and the educational achievements of children

Finally, we look at studies which examine the impact of parental employment on children's educational outcomes. They mainly focus on employment during the first years of a child's life, and again reveal the complexity of this issue and provide contradictory evidence.

Ermisch and Francesconi (2000) report that a mother's full-time employment when a child is less than six years of age reduces the chances that the child will stay in post-compulsory secondary education. Part-time employment of mothers also has a negative impact on a child's educational attainment defined as an A-level qualification¹ or higher, and both results persist if the whole period of childhood is analyzed (up to the age of 15). Another study of UK families that is based on the 1958 National Child Development Study by Verropoulou and Joshi (2009) suggests a much smaller impact of maternal employment on the behavioural and mental development of a child. Of the four analyzed outcomes - children's maths scores, reading scores, exhibiting aggressive behaviour, and exhibiting anxious behaviour - only reading skills were negatively affected by mothers' employment when a child was less than 4 years old. This negative effect was more pronounced among women with a low level of education, which could also suggest intergenerational transmission of skills and abilities rather than the actual impact of labour market participation. Gregg et al. (2005) found a negative impact of mothers' employment on development of 4-7 year olds only for children who were in informal childcare. Those children who were placed in formal childcare performed no worse in literacy and cognitive development assessments, suggesting that formal care is a good substitute for maternal care.

On the other hand, there are also numerous studies which show that children's education and development can benefit from parental employment. The positive impact of parental employment on children's results at school in the UK is reported by O'Brien and Jones (1999). They found that children from Eastern communities in London with employed mothers performed better in GCSEs than children of non working mothers, although the positive effects declined if both parents worked full-time. Von Ochsén (2008) also found a positive impact of the combined employment of parents on educational attainment for children in Germany. This study showed that a father's full-time and a mother's part-time employment had statistically significant and positive effects on children's educational

¹ This is a qualification required to be admitted to University or other tertiary level of education in the UK.

² Disadvantaged and advantaged children are defined by the socioeconomic status of household, ethnicities, mothers' education and family structure.

³ More information is available at:

attainment. Horisch (2008), using the same dataset, has drawn similar conclusions, although her results are statistically insignificant. Some important distinctions between the effects of parental employment for children with parents with different socioeconomic statuses were drawn by Ruhm (2008). He found that a limited amount of time worked by mothers of 'disadvantaged children' could help them to achieve better scores in standardised tests, while more 'advantaged children' were more likely to perform worse if their mother was employed.² Therefore, the impact of maternal employment on children's education is sensitive to their socio-economic background.

From this literature we may conclude that parental employment has different impacts on the educational development of children depending on the timing of employment (early childhood or adolescence), its amount (full-time, or part-time), and socio-economic background. It is also possible that the inconsistent outcomes from empirical studies arise from differences in the measurement of educational outputs and the variables of interest. Ermisch et al. (2004) add an additional perspective; they claim that the joblessness of parents during childhood could have harmful effects on children's education, as well as on other outcomes in life such as inactivity, early pregnancy and smoking. According to their results, living in a household with non-working parents when the child is between the ages of six and ten reduces the chances of having an A-level qualification by five to six percentage points. However, they emphasize that the joblessness of parents is closely related to poorer economic conditions, and household income is not controlled for in their analysis. This is in line with evidence from Canada provided by Coelli (2010). The job loss of the main income provider in a household when a child is 16-18 years old decreases the probability of enrolment in tertiary education. The author claims that this effect is mostly driven by the shock of the job loss.

2.4 The role of other factors in the educational achievements of children

There are factors in addition to parental time, income and employment which are believed to have a causal relationship with children's educational achievements. For example, the parental level of education is one of the most important determinants of a child's education (Leibowitz, 1974; Duncan et al., 1994; Haveman and Wolfe, 1995; Verropoulou and Joshi, 2009), accounting for up to thirty percent of the variation in the educational attainment of a child (Haveman and Wolfe, 1995). Additionally, as claimed by O'Brien and Jones (1999), parents' aspirations and maternal praise have a positive and significant impact on GCSE exam results in the UK. Similar conclusions are drawn by McIntosh (2007) for Canadian families.

Family structure (Ermisch et al., 2004; Francesconi et al., 2005) family size (Hanushek, 1992), and birth order (Booth and Kee, 2009) are among other determinants of children's educational outcomes, as are neighbourhood characteristics (Geaner and Raudenbush, 1991).

² Disadvantaged and advantaged children are defined by the socioeconomic status of household, ethnicities, mothers' education and family structure.

3 Patterns of hours of work in the UK

The involvement of both parents in the labour market is nowadays a common phenomenon in the UK. Between 1970 and 2008 the labour market participation of women increased from 55% to 70% (ONS). However, one of the distinguishing patterns of women's employment in the UK in comparison to other European countries is its part-time nature (McOrmond, 2004). In 2006, 54% of working mothers had part-time jobs, compared to 32% of childless women (Biggart and O'Brien, 2009). Biggart and O'Brien (2009) also found that parenthood results in a reduction in working hours among mothers and an increase in working hours among fathers. While, in France, Denmark and Sweden, the usual hours of work are similar for men and women (around 40 hours per week), in the UK the majority of men work more than 38 hours while the majority of women work less than 30 hours per week (Bishop, 2004). The disparities between fathers' and mothers' working patterns are even greater than the average differences between men's and women's working patterns (Biggart and O'Brien, 2009).

At the same time the UK, in comparison to other European countries, has a much higher number of individuals working long hours. In 2002, 27% of men in the UK reported working more than 50 hours per week, compared to 10% in Sweden and 13% in France. The mean number of hours worked by childless men in full-time employment was lower than that for fathers, especially those with children aged under six (Biggart and O'Brien, 2009).

There are also considerable numbers of children living in families with no earners in the UK (O'Brien and Jones, 1999). Although, since 1996, the percentage of children living in workless families has slightly fallen, in 2007-2008 about 6.3% of children had no employed parents. Moreover, transitions into employment or self-employment from non-work are rare. About three quarters of families who were without jobs in 2006 had no jobs three years later (Brewer et al., 2009). The majority of children living in workless families live in poverty. As reported by Brewer et al. (2009), around 60% of children with workless parents lived in a household with an income below 60% of the median between 1996 and 2006.

Therefore, we observe two distinctive patterns of parental employment in the UK. Parental involvement in the labour market for some groups is growing, and the most commonly observed pattern is to have a father working long hours and a mother in a part-time job. However, almost one fifth of children live in workless families with a low standard of living, which makes them more likely to experience poverty or hardship.

4 Data and model specification

I identify the impact of parental working time on children's educational outcomes using two datasets whose complementary characteristics allow for more detailed and comprehensive analysis. The British Household Panel Survey (BHPS) is a general household panel survey which collects detailed information about all family members, while the Longitudinal Study of Young People in England (LSYPE) is a longitudinal survey of one cohort of pupils which provides detailed information on pupils' performance at school and school characteristics.

4.1 The British Household Panel Survey (BHPS)

The BHPS is an annual panel survey begun in 1991 which collects information from individuals aged 16 or above from 5,000 nationally representative households (Taylor et al., 2002)³. A special questionnaire for children aged 11-15 years old was introduced in wave 4 (1994) and maintained until the most recently available wave which relates to 2008. The youth questionnaire collects information on the child's family, friend relationships, aspirations, behaviour, psychological well-being and health.

Our analysis mostly draws on data from the Youth Questionnaire that was applied (wave 4 - wave 18) covering the period 1994-2008. Additionally, I exploit data from wave 2 on the date of birth of any children born to adult respondents to construct the birth order of children. This wave also contains information about respondents' employment history since leaving full-time education.

I use three samples, each constrained to England and Wales. First I use a sample of all children aged 16 for whom I could also match information on the working hours from the previous year of at least one of the parents, and who reported the number of subjects passed at GCSE. As some respondents did not report the number of subjects taken at GCSE but did report the highest level of education achieved, I also construct a second sample including those from the first sample plus individuals who report the highest level of education at the age of 17, and for whom information about parental working time at the age of 15 is available. For this sample, the dependent variable of interest identifies those who obtained at least one GCSE. The third sample includes those in the second sample for whom I could also match at least one sibling who also provided information about their highest level of education or GCSE performance. In this sample, one child families were excluded, as well as children who only had siblings younger than 15 years old.

4.2 The Longitudinal Study of Young People in England (LSYPE)

The majority of control variables used in this paper from the LSYPE dataset are created using data collected in both parent and youth questionnaires from wave 2 (2005), while some supplementary information about parental attitudes are obtained from wave 1 (2004). Administrative data which contains exam results was merged with survey data and made available for users of LSYPE in wave 5 (2008). They were used for the construction of our dependent variable, which is the number of GCSEs passes with a grades A*- C.

Each of the datasets has relative advantages and disadvantages, and we exploit their complementary sources of information. The BHPS, due to its household related structure, provides detailed information about all household members which allows us to conduct some comparisons of children from the same family. Additionally, because it consists of individuals from different cohorts, our results are not biased by any unobserved cohort specific characteristics. The main disadvantage of BHPS is its relatively small sample size, especially when restricted to adolescents. The LSYPE, on the other hand, is a large scale

³ More information is available at:

http://www.iser.essex.ac.uk/survey/bhps/documentation/pdf_versions/volumes/bhpsvola.pdf

cohort study with a starting sample of around fifteen thousand children. As issues connected to education are the main focus of this survey it provides us with additional information about parental participation and attitudes towards their children's education. One of the limitations of the LSYPE is the less detailed information about other members of the family and missing information about the second parent (fathers, in the majority of cases). Using both datasets allows us to estimate complementary models and overcome the limits of each dataset, and allows for a more comprehensive analysis.

5 Model specifications

Our main outcome of interest – educational achievement at the age of 16 - is defined as the number of GCSEs obtained at grades A*- C.⁴

The main explanatory variables of interest consist of parental labour market participation and hours of work. In both surveys parents were asked to report the usual number of working hours per week, as well as weekly overtime hours. In the BHPS, respondents were additionally asked about the time they spent commuting to and from work. Commuting time contributes to the total time parents spend away from their household, so adding it to working hours should better capture any relationships between parental working time and their children's performance at school. Measures of working hours in analysis based on the BHPS dataset include commuting to and from work, while measures of working hours in LSYPE data does not.

5.1 Descriptive statistics

Summary statistics are presented in Table 1 (summary statistics for all variables used in analysis is reported in the Appendix, Table 11). In the BHPS we pool data over the years 1994-2008 for people aged 15, and we use an individual cross sectional weight for youth respondent provided in the BHPS⁵. In the LSYPE we use data from 2005, which again was weighted using the non-response weights combined with design weights.

Table 1 shows that, in the LSYPE, 95% of children achieved at least one GCSE compared to 90% in the BHPS. Similarly, the number of GCSEs passed with grade A*- C is slightly higher in the LSYPE than in the BHPS (5.8 compared with 5.7). These differences are consistent with the general increase in GCSE attainment illustrated in the previous section in Figure 3.1. The average number of parental hours of work differs only slightly between datasets. Fathers work on average 47 hours per week according to the BHPS, and 45 hours per week in the LSYPE data; average weekly hours of work by mothers are the same in both datasets, at 30 hours. The distribution of hours of work does, however, differ between the datasets. In the BHPS, 18% of parents work very long hours (more than 85 hours per week),

⁴The characteristics of individuals who do not report the number of GCSEs are not significantly different from the characteristics of those who do, especially in regards to the highest level of education. This implies that the missing information could be assigned at random in our sample, and we do not need to be concerned about selection problems which could bias our estimates.

⁵ The overall weights used for the calculation are the product of the following weights: (1) Weights to adjust for unequal selection probabilities of delivery points (design weights); (2) Weights to adjust for non-response at the household level; (3) Weights to adjust for non-response of individuals within responding households; (4) Re-scaling of final weights to the raw sample size.

compared to only 10% in the LSYPE, and a larger proportion of both fathers and mothers work long hours in BHPS than in the LSYPE. For example, 23% of fathers in the BHPS declare working more than 56 hours per week compared to 13% in the LSYPE.

Table 1: Descriptive statistics

	BHPS		LSYPE	
	Mean	Std. Dev.	Mean	Std. Dev.
GCSE results				
GCSE or higher level of education	0.90	0.30	0.95	0.22
No of GCSEs (A*- C)	5.74	4.04	5.79	4.30
Girls (proportion)	0.51	0.50	0.51	0.50
Parental work characteristics				
Working father	0.88	0.33	0.86	0.35
Working mother	0.76	0.43	0.71	0.46
Parental hours of work (total)	57.18	25.94	53.41	25.04
0-30 hours	0.14	0.35	0.20	0.40
31-60 hours	0.36	0.48	0.41	0.49
61-85 hours	0.32	0.47	0.28	0.45
More than 85 hours	0.18	0.38	0.10	0.31
Hours of work of father (total)	46.82	12.49	44.99	10.93
0-30 hours	0.04	0.19	0.05	0.23
31-39 hours	0.10	0.29	0.20	0.40
40-45 hours	0.31	0.46	0.33	0.47
46-50 hours	0.18	0.38	0.22	0.41
51-55 hours	0.14	0.35	0.07	0.26
More than 56 hours	0.23	0.42	0.13	0.33
Hours of work of mother (total)	30.16	14.15	30.19	12.55
0-20 hours	0.22	0.42	0.26	0.44
21-35 hours	0.34	0.48	0.37	0.48
36-42 hours	0.23	0.42	0.24	0.43
More than 43 hours	0.20	0.40	0.13	0.34

Apart from variable GCSE results, all other variables are measured at time t-1, one year before the child took a GCSE exam.

Next, we examine correlations between parental hours of work and children's GCSE performance. As reported in Table 2, parental hours of work and children's GCSE performance are significantly correlated. Although the correlations are not particularly strong, they are positive which indicates that parents working more hours have children who perform better at GCSE level.

Table 2: Correlation matrix: parental hours of work and child's GCSE performance

	BHPS Number of GCSEs grade A*- C	LSYPE Number of GCSEs grade A*- C
Father's hours of work at age 15	0.149	0.161
Mother's hours of work at age 15	0.120	0.136
Parental hours of work at age 15	0.176	0.193

All significant at 0.001 level.

We also compare parental hours of work for children obtaining different numbers of GCSEs with A*-C grades. As shown in Table 3, children who get fewer than 3 GCSEs have parents who, on average work 10 hours less per week than parents of children who get at least 6 GCSEs, and this gap is observed in both datasets.

Table 3: Average number of parental hours of work when child is 15 by number of child's GCSE results

	At age 15, parental hours of work		At age 15, father's hours of work		At age 15, mother's hours of work	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
BHPS						
Less than 3 GCSEs	39.81	33.25	35.14	23.91	19.94	19.15
3 to 6 GCSEs	43.88	30.27	38.84	21.35	21.55	17.91
6 to 9 GCSEs	51.19	30.18	42.79	19.29	25.03	17.62
9 to 12 GCSEs	54.18	28.99	42.69	16.55	24.72	17.35
More than 12 GCSEs*	53.24	28.68	44.82	12.48	23.27	16.23
LSYPE						
Less than 3 GCSEs	29.03	30.48	29.41	22.88	14.62	17.17
3 to 6 GCSEs	37.35	32.02	33.65	21.33	18.82	17.82
6 to 9 GCSEs	40.03	31.07	34.58	20.24	20.24	17.91
9 to 12 GCSEs	45.04	30.76	37.80	19.04	21.67	17.42
More than 12 GCSEs **	43.45	31.44	36.77	18.67	20.59	17.70

Differences significant at 0.001 level.

* Only 1 % of students obtain more than 12 GCSEs. ** Only 3% obtain more than 12 GCSEs.

The results from this descriptive analysis contradict our expectations based on theory and other empirical evidence. However, hours of work capture other parental characteristics which are important factors in determining a child's educational outcomes, such as parental level of education and household income. It might be the case that those parental and family characteristics have a relatively large impact on educational achievements, and hence these descriptive statistics overestimate the impact of the working hours of parents. Therefore,

these descriptive statistics do not allow us to conclude that parental hours of work have a positive impact on children's educational output; more detailed multivariate analysis is needed to investigate this, and reveal a causal relationship.

5.2 Methodological approach

A foundation for theoretical studies of working hours in the context of time allocation and income within the family was provided by Becker (1965), Becker and Tomes (1976, 1986), and Leibowitz (1974). Dynamic models measure the changes in educational outcomes resulting from changes in income and changes in parental time allocation. Static models are more common and they consider an outcome from one period. A static approach is relevant here, as the outcome of interest – GCSE performance - is measured only once, at the age of 16.

We develop a simple theoretical framework of parental utility to study the impact of parental working hours on children's human capital. We assume that the utility of parents depends on the consumption of goods and services (Y), leisure (L), and the human capital of the child (H):

$$U = U(Y, H, L) \quad (1)$$

Let us assume that total time available of parents T_M, T_F (where M-refers to mother, F-refers to father) can be divided into time spent at work (t_w), on household production (t_p), on the child's human capital (t_H), and on leisure (t_L). We also assume that t_L represents time off work, and time off from household production.

$$T_M = t_{WM} + t_{PM} + t_{HM} + t_{LM} \quad (2)$$

$$T_F = t_{WF} + t_{PF} + t_{HF} + t_{LF} \quad (3)$$

The productivity of the investment in the child's human capital depends on the time spent on the child's human capital (t_H), goods that influence the child's human capital (Y_c), the child's human capital endowment (G) and the efficiency of parental time inputs (P):

$$H = H(t_{HM}, t_{HF}, Y_c, G, P) \quad (4)$$

Part of household production is dedicated to the development of the child's human capital. However, this choice is limited by family budgetary constraints. We define the budget constraint as follows:

$$Y_c + Y = t_{WM}w_M + t_{FW}w_F + V \quad (5)$$

Where: w is the hourly wage rate and V is unearned income, for example, transfers from other households. We omit savings from previous income, as parents could save part of their revenue for financing the future education of their children. Inclusion of this would require a dynamic model which took into account income flows across analysed periods. Moreover, this simple framework ignores the overlapping of mother's and father's time spent together with a child, and assumes that there is no premium associated with overtime work. Hence, the parents' utility-maximising allocation of time depends on the marginal utility of leisure, the price of goods used to increase the human capital of child, and the marginal effect of the parental time input, assuming that G , P , and V are fixed:

$$MaxU = U(t_{WM}w_M + t_{FW}w_F - Y_c, H(t_{HM}, t_{HF}, Y_c), T_M - (t_{WM} + t_{HM} + t_{PM}), T_F - (t_{WF} + t_{HF} + t_{PF})) \quad (6)$$

Here we estimate the marginal effect of parental time input on the child's human capital, which enter the above equation as $H(t_{HM}, t_{HF}, Y_c)$.

6 Empirical analysis

The empirical question addressed in this paper relates to the impact of parental time inputs on a child's educational development. However, due to the lack of information about the actual time parents spend with the child, we instead examine the association between parental time spent away from the household (time spent at work and on commuting) and the child's educational achievements. As parental time spent on work-related activities limits the daily time available to invest in child human capital, these two factors are highly negatively correlated (Bittman, 2004; Inchino et al., 2005).

To estimate the model we need to make further assumptions. To estimate the model using OLS we need to assume that the observed characteristics of the child (X_i), family (Z_i) and working time of both parents ($t_{WP} = t_{WM} + t_{WF}$), are uncorrelated with the error term (e_{it}). There might be some problems in meeting those conditions, for instance if the error term captures the child abilities (intelligence, etc.) which could be related to parental characteristics (for example, parental level of education) or their working time. If those assumptions are violated our estimates will be biased. We estimate the following model for child i at time t :

$$H_{it} = \alpha + \beta t_{WPit-1} + \gamma X_{it-1} + \gamma Z_{it-1} + e_{it} \quad (7)$$

where:

- H_{it} - is the educational outcome (GCSE performance) of a child i , measured at t
- T_{WPit-1} - is a measure of combined time spent by both parents at work, at $t-1$
- X_{it-1} - is a set of child characteristics at $t-1$
- Z_{it-1} - is a vector of control variables for family characteristics

We measure independent variables in $t-1$ to allow them to influence our outcome which is measured in the subsequent year. We also estimate another model, which includes hours of work of the mother and the father separately, as their work commitments might have different impacts on the child's educational achievement, again using OLS:

$$H_{it} = \alpha + \beta_M t_{WMit-1} + \beta_F t_{WFit-1} + \gamma X_{it-1} + \gamma Z_{it-1} + e_{it} \quad (8)$$

This estimation is complicated by the presence of potentially unobserved characteristics of the family (for example, parents personality and family culture, such as: work ethic, leisure and time preferences, attitude towards educational activities, etc.). These unobserved characteristics could also be correlated with the child's educational outcomes, and so violate the OLS assumption that the observed characteristics are uncorrelated with the error term. We could rewrite equation (7) in the following way:

$$H_{it} = \alpha + \beta_M t_{WMit-1} + \beta_F t_{WFit-1} + \gamma X_{it-1} + \gamma Z_{it-1} + \varepsilon_{it} + \rho_j \quad (9)$$

Where:

- ε_{it} – is a random component of the error term
- ρ_j – captures time invariant unobservable characteristics of family j .

One possible way of dealing with these unobserved characteristics is to use a sibling difference estimator. If we assume that family characteristics are constant between siblings, then we can identify the model by exploiting differences between siblings' characteristics and their educational outcomes. The time invariant family specific unobserved characteristics are removed by estimating the following model:

$$\Delta H_{jt} = \beta_M \Delta t_{jW_{Mt-1}} + \beta_F \Delta t_{jW_{Ft-1}} + \gamma \Delta X_{jt-1} + \gamma \Delta Z_{jt-1} + \Delta \varepsilon_{jt} \quad (10)$$

Where:

- ΔH_{jt} is the difference in GCSE performance between siblings from family j ,
- $\Delta t_{jW_{Mt-1}}$ is the difference in working hours of the mother from family j between a period $t-1$, when an older sibling was aged 15, and period t , when a younger sibling was aged 15
- $\Delta t_{jW_{Ft-1}}$ is the difference in working hours of the father from family j between a period $t-1$, when an older sibling was aged 15, and period t , when a younger sibling was aged 15
- ΔX_{jt-1} is the difference in the characteristics of siblings from family j between a period $t-1$, when an older sibling was aged 15, and period t , when a younger sibling was aged 15
- ΔZ_{jt-1} is the difference in characteristics of family j between a period $t-1$, when an older sibling was aged 15, and period t , when a younger sibling was aged 15.

The main advantage of this approach is that it allows us to control for all permanent unobservable family characteristics, which might be incorrectly attributed to the effect of parental working time. However, it also has some limitations. First, it can only be applied to families for which information on at least two children is available. Secondly, it only accounts for unobserved family characteristics which do not vary with time, which is more realistic if there is only a small difference between the dates of birth of the children.

There are two possible ways to estimate equation (10). The first uses the sibling difference estimator⁶, while the second uses family fixed effects. They give the same result if there are only two siblings in the family, but they differ slightly if we consider siblings from larger families. In the first approach we compare pairs of siblings from the same family. If a family has three children we compare, for instance, the GCSE passes of the first sibling with the results of the second sibling, and the results of the second with the results of the third sibling. The family fixed effects estimator differs a little as we compare the results of each of the siblings with the mean value of results within the family. Both estimators are unbiased; however, they are efficient under different assumptions (Wooldridge, 2002). To estimate equation (10) with the sibling difference estimator, key assumptions need to be satisfied: $\Delta \varepsilon_{jt}$ should be uncorrelated with $\Delta t_{jW_{Mt-1}}$, $\Delta t_{jW_{Ft-1}}$, ΔX_{jt-1} and ΔZ_{jt-1} . The sibling difference estimator is the most efficient estimator under the assumption that the first difference of the errors ($\Delta \varepsilon_{jt}$,

⁶ This is an analogy to first difference estimator.

$t=2, \dots, T$) is serially uncorrelated, while the fixed effects estimator is more efficient under the assumption of homoscedasticity and no serial correlations of errors (ε_{jt} , $t=1, \dots, T$).

We will compare how much the estimates from those specifications differ, and will test for serial correlation of ($\Delta\varepsilon_{jt}$) in the sibling difference estimation by regression residuals $\hat{\varepsilon}_{it}$ (from equation 10, estimated by OLS) on residuals $\hat{\varepsilon}_{it-1}$ (from equation 10 but for the next pair of siblings (Wooldridge, 2002)).

The family fixed effects estimator and sibling difference estimator do not address potential endogeneity. This may arise if differences in sibling endowments motivate parents to allocate different amounts of time to work and childcare, either to reinforce the performance of the more gifted child, or help the more disadvantaged child. For example, if parents find that their child has a relatively low human capital endowment, they may conclude that investing their time in that child will have a limited effect, so they spend more time at work. To control for this potential endogeneity, Ermisch and Francesconi (2000) used information about parental employment when the child was 0-5 years old, arguing that an assessment of the child's human capital is unlikely to be made at this stage. I use two approaches to address this endogeneity problem. Firstly, I address the research question by measuring the working time of parents using their labour market supply in the first five years of their child's life. Secondly, I also use the 'value added' approach (Todd and Wolpin, 2003), which conditions estimation on the child's performance in tests taken at the age of 11 (Key stage 2). These models therefore identify the 'value added' to the educational attainment of the child by explanatory variable of interest.

Thirdly, I use an instrumental variable approach. The challenge faced with this approach is to identify an appropriate instrument. A good instrument needs to meet the following criteria: i) – it should be uncorrelated with the error term from main outcome regression (instrument exogeneity), which, in our case, is GCSE performance; and ii) it should determine parents' working hours (instrument relevance). Although valid instruments allow consistent estimates to be produced, they may still have some limitations. If the instrument is weak (i.e., weakly correlated with the endogenous variable), the IV estimates are less efficient than OLS and produce larger standard errors. As the majority of fathers are working, most variations between household hours of work comes from female labour market participation. Therefore, I use as an instrument: attitudes towards female employment, based on the responses to the question "Do you agree with the statement that full time jobs make women independent?" This was asked of both men and women and was coded on a Likert scale: strongly agree, agree, neither agree/neither disagree, disagree, strongly disagree. These attitudes should be correlated with mothers' working time, and could also moderate fathers' hours of work⁷, while they should not be related to child's GCSE performance. We check this correlation using our data and present it later in the results section.

⁷ For example, if a father supports a mother's labour market participation, he might also prefer a more equal division of working time between the couple, and work fewer hours than his counterpart, who is a single earner.

7 Results

7.1 Multivariate estimates⁸

We estimate different specifications to capture different measures of parental working hours. First we investigate the impact of the total working time of both parents measured as a continuous variable, assuming that each parent's working time has the same impact on their child's achievements. We then investigate whether the impact of the mother's working time and the father's working time differs.

All specifications include a set of explanatory variables which control for family background and characteristics (parental education, parental age, number of children and birth order, household income⁹, and home ownership), the child's gender and the month of birth. Finally, a set of variables capturing parental involvement in their children's education is included, such as participation at school meetings, voluntary involvement at school and aspirations about the future educational attainment of the child.

We initially present results from simple OLS regressions. Our dependent variable is the number of GCSE passes at grade A*- C reported by 16 year olds. It takes values from 0 to 20, which might cause some limitation in the use of OLS. However, it takes too many values to use methods for ordered categorical variables. We estimate a number of different specifications which define the main explanatory variable of interest – parental hours of work - in different ways:

- as a continuous variable measuring the total time parents spent at work and commuting to work (BHPS), as a continuous variable measuring only the total hours of work for both parents (LSYPE)
- as a continuous variable measuring the time the father spent at work (LSYPE), and at work and commuting to work (BHPS)
- as a continuous variable measuring the time mother spent at work (LSYPE), and at work and commuting to work (BHPS).

Table 4 presents OLS estimates from the two specifications. Model 1 and Model 3 use information about total parental working time, while Models 2 and 4 include mother's and father's working hours separately. Additional control variables include: gender, mother's age, father's age, mother's and father's highest level of education, birth order of the child, number of siblings, region, year of GCSE exam (BHPS only), and child's quarter of birth. Estimated coefficients on these variables are shown in Appendix Tables 13.

A consistent finding is that having an employed father has a positive and significant impact on the number of GCSEs attained by the child at the age of 16, increasing it by between 0.46 and 1.25, depending on the model specification and dataset. These results are in

⁸ I also checked if the relation between my variable of interest and dependent variable is non linear estimating regressions with polynomial form of parental hours of work, and including set of dummies for different level of working hours instead of continuous variable. The coefficients of parental working hours in polynomial form were found not to be statistically significant, so I decided not to include them into the regressions. When analysis of the impact of parental working time defined by set dummy were used I found that statistically significant impact occurs when parents together work more than 85hours, or if mother works more than 43 hours per week. However due to clarity of research I decided to restrain myself to the use of continuous measure of parental working hours.

⁹ Monthly household income per person adjusted to year 2000.

line with previous evidence reported for Britain (O'Brien and Jones, 1999; Ermisch et al., 2004). Similarly, having an employed mother increases the number of GCSEs attained by the child by between 0.33 and 0.74. However, these coefficients are not statistically significant in Model 1 and significant only at the 5% level in Model 2.

Table 4: Determinants of the number of GCSE passed at grades A*-C

	BHPS Model 1	BHPS Model 2	LSYPE Model 3	LSYPE Model 4
Working father	1.247** (0.422)	0.777 (0.504)	0.460*** (0.116)	0.428*** (0.122)
Working mother	0.477 (0.282)	0.738* (0.320)	0.328*** (0.089)	0.372*** (0.102)
Hours of work of both parents	-0.012* (0.006)		-0.006*** (0.002)	
Hours of work of father		-0.003 (0.008)		-0.005** (0.002)
Hours of work of mother		-0.021** (0.007)		-0.008** (0.003)
Monthly household income	0.183* (0.072)	0.181* (0.072)	0.094*** (0.025)	0.095*** (0.025)
Family house ownership	1.605*** (0.209)	1.619*** (0.209)	1.317*** (0.086)	1.319*** (0.086)
No. of rooms	0.362*** (0.052)	0.357*** (0.052)		
Saving from current income	0.394* (0.194)	0.413* (0.195)		
<i>N</i>	2094	2094	12374	12374
adj. <i>R</i> ²	0.245	0.245	0.287	0.287

Estimates from OLS regressions. Dependent variable is the number of GCSE passes at grades A*-C. All independent variables are measured while the child is 15 years old. For families where nobody works working time of parents is coded as zero. All models also include controls for: child's gender, birth order, quarter of birth, number of siblings, mother's and father's age, mother's and father's level of education, family house ownership, region. Model 1 and Model 2 also control for the year when exams were taken, number of rooms in family home, and family savings from current income. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Full results in Appendix Table 13.

Looking now at parental hours of work, we observe that in all specifications the impact of parental hours of work on the number of GCSEs is, as anticipated, negative when controlling for child- and family-specific characteristics. Estimates from Model 1 and Model 3 indicate that an increase of 10 hours in the combined parental weekly work hours reduces the number of GCSE exams achieved by their child by 0.12 (Model 1) and by 0.06 (Model 3), controlling for other characteristics. Model 2 and Model 4 also indicate a negative relationship between

the working time of a mother and of a father and child's educational achievement. Although father's working time has a negative impact, the estimates are significant only in the LSYPE dataset and are small. The impact of the mother's hours of work is slightly larger than the impact of the father's working hours: an increase in mother's hours of work by 50 hours per week reduces her child's GCSEs by one in Model 2 and by 0.4 in Model 4, holding income constant, while an increase in father's hours of work by 50 hours leads to a GCSE loss of 0.25.

A comparison of the coefficients on employment and working hours indicates that the positive effects of mothers holding a job exceed the negative effect of their hours of work, provided she works less than 35 hours per week (Model 2) or 46 hours per week (Model 4). We can then conclude that the employment of mothers has a positive impact on their children's performance at school up to a point: children of mothers who work less than full-time obtain more GCSEs than those with non-working mothers, all else being equal. However, those with mothers working more than 46 hours per week obtain fewer GCSEs. The estimated coefficient on the hours of work, and employment of fathers are statistically insignificant in the model on BHPS data (Model 2), while in Model 4 they indicate that the positive impact of the father holding a job on GCSE performance disappears if a father works more than 85 hours per week. However, this is a very high threshold very rarely exceeded in a working week (a father would have to work more than 12 hours per day, 7 days per week) and almost all fathers in our sample work less than that, which suggests that the positive impact of holding a job surpasses the negative impact of working long hours. To sum up, we find that parental employment has a positive impact on a child's GCSE performance, it disappears if mother's working hours exceed 46 hours per week, or father's, 85 hours per week.

These findings are similar to those from previous studies in the UK. For example, O'Brien and Jones (1999) found that the performance of children at school is reinforced by parental participation in the labour market, but having both parents working full-time reduces the number of GCSEs obtained.

Our estimates also indicate that household income (average monthly household income per person in thousands of pounds deflated to year 2000 prices) has a positive, although relatively small, impact on GCSE performance. An additional £1000 per month increases the number of GCSEs obtained by the child by about 0.18 (Model 1 and Model 2), and 0.09 (Model 3 and Model 4). Hence, very large increases in income are required to improve GCSE performance, all else being equal. However, income may be subject to measurement errors, and only captures the current resources of the household. Consequently, we also capture a wider concept of household wealth using home ownership, the number of rooms in the home (BHPS only), and saving behaviour¹⁰ (BHPS only). The estimated coefficients on home ownership indicate a very strong and positive influence on the number of GCSEs attained by the child. Switching from being a tenant to a home owner is associated with an increase in the number of GCSEs by between 1.3 (Model 3 and Model 4) and 1.6 (Model 1 and Model 2). The size of the home also has a positive impact on child

¹⁰ Binary variables, constructed on the basis of the question asked of a mother and a father about their child: Do you save any amount of your income?, equal one if at least one of the parents saves money from a current income, zero if none of them do .

performance, as does living in a household which saves from a current income. Of course, the relationship between income and educational achievements is not so immediate. As argued by Blau (1999) and Plug and Vijverberg (2005), an instant increase in family income will not result in an instant increase in educational attainment. Furthermore, there are some specific unobserved family characteristics associated with income or family wealth which also help children perform better at school (for example, parental aspirations, or better organisational skills, culture of learning, exposure to knowledge enhancing experiences). We discuss these unobserved family characteristics later, when describing results from the family fixed effects and the sibling difference estimator.

There are also connections between working hours of parents and household income as, in general, longer working hours generate more income (unless it is unpaid overtime). We therefore estimate a model which does not control for household income, in which an increase in parental hours of work will also reflect the increase in household income. The theory tells us that both parental time as well as spending on educational services and goods lead to higher human capital. Time at work lowers the parent availability for the child, and as expected has a negative impact on child educational achievements. However, additional income generated via additional hours of work could be spent on educational good, which will then increase educational achievements or mediate the negative impact of hours of work.

Table 5 presents results from the OLS estimation, in which we do not control for household income. The impact of father's employment is almost unchanged in comparison to results presented in Table 4. As expected, the impact of parental working time on GCSE passes is now lower than in the above regressions. Joint working hours of parents are statistically significant only in the case of the LSYPE dataset, and they indicate that working time of parent should increase by 100, so the child experiences 0.4 less GCSE passes at grade A*-C. Fathers' hours of work become statistically insignificant, while an increase in mothers' hours of work (by 20 per week) leads to 0.34 less GCSE passes (Model 2) and to 0.12 less GCSE passes (Model 4). As previously stated, the employment of parents is a very significant determinant of child's positive educational outcomes however, it is not always statistically significant in models based on BHPS datasets.

This approach has, however, some limitations. Since it does not control for household income, the income is partially captured by an error term, and as income influences the actual number of hours worked (somebody with already high income, will probably have a higher utility for one hour of leisure versus one hour of work) as well as GCSE results. Household income is statistically significant in all specifications in Table 4) the OLS assumptions are not met, and the estimates presented in Table 5 are biased.

Table 5 Determinants of the number of GCSEs passed with grades A*-C without controlling for income

	BHPS Model 1	BHPS Model 2	LSYPE Model 3	LSYPE Model 4
Working father	1.246** (0.423)	0.805 (0.505)	0.470*** (0.116)	0.443*** (0.122)
Working mother	0.552* (0.281)	0.799* (0.321)	0.323*** (0.089)	0.360*** (0.102)
Hours of work of both parents	-0.009 (0.005)		-0.004** (0.001)	
Hours of work of father		0.000 (0.008)		-0.003 (0.002)
Hours of work of mother		-0.017* (0.007)		-0.006* (0.003)
<i>N</i>	2094	2094	12374	12374
adj. <i>R</i> ²	0.242	0.242	0.286	0.286

Estimates from OLS regressions. Dependent variable is the number of GCSE passes at grade A*-C. All independent variables are measured while the child is 15 years old. All models also include controls for: child's gender, birth order, quarter of birth, number of siblings, mother's and father's ages, mother's and father's level of education, family home ownership, region. Model 1 and Model 2 also control for the year when exam was taken, and number of rooms in family home. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

7.2 Multivariate analysis by gender

Time diary data from the US indicates that mothers tend to spend more time with daughters and fathers more time with sons (Bryant and Zick, 1996). While the gender pattern was mainly found in regards to household tasks and leisure activities, fathers of sons also shoulder more responsibility in disciplining and helping them in school work than fathers of daughters (Morgan et al., 1988). These findings suggest that the impact of the mothers' and fathers' employment may differ between boys and girls. We estimate regressions using a continuous measure of mothers' and fathers' hours of work separately (Model 1 and Model 2), as well as parental hours of work in total (Model 3 and 4) using the LSYPE dataset. We decided to focus on a larger dataset - LSYPE - as BHPS while divided by gender contains a small number of observations, which could have an impact on the precision of our estimates. In all models we also added variables capturing parental involvement at school. It was revealed in previous empirical studies that parents with highly positive attitudes towards the value of child development spend, on average, more time with their children during the week, regardless of their employment status (Stafford and Yeung, 2005). Parental participation in school life (for example, helping in class, helping at sports activities, on excursions, or in the library), as well as their regular contact with teachers, was reflected by participation in parental evenings and might be used as a proxy for parental attitudes toward the child's educational development.

Results from these estimations are presented in Table 6. As we expected, there are substantive gender differences in the impact of parental working time. Having a working father has a positive, statistically significant impact on the number of GCSE passes for boys, and no impact for girls. While employment of mothers is only statistically significant at a 5% level, it became significant also for girls if mother's and father's working time was analysed separately. Therefore, we find that employment of father is an important determinant of educational performance for boys, while no such impact can be detected for girls. Again, the mother's labour market participation has a positive, although less significant impact on children's success at school for both boys and girls.

Table 6: GCSE performance by gender (LSYPE)

	Model 1	Model 2	Model 3	Model 4
	Girls	Boys	Girls	Boys
Working father	0.296 (0.164)	0.482** (0.165)	0.203 (0.172)	0.496** (0.174)
Working mother	0.241 (0.126)	0.307* (0.126)	0.367* (0.144)	0.287* (0.145)
Hours of work of:				
Both parents	-0.009*** (0.002)	-0.004 (0.002)		
Father			-0.006* (0.003)	-0.004 (0.003)
Mother			-0.014*** (0.004)	-0.003 (0.004)
Active parenting	0.498*** (0.129)	0.503*** (0.129)	0.501*** (0.129)	0.504*** (0.129)
Participation in parental evenings	0.983*** (0.117)	0.884*** (0.121)	0.984*** (0.117)	0.884*** (0.121)
Constant	2.032*** (0.466)	1.166* (0.467)	2.060*** (0.466)	1.164* (0.467)
<i>N</i>	6078	6180	6078	6180
adj. <i>R</i> ²	0.282	0.302	0.282	0.301

Estimates from OLS regressions. Dependent variable is the number of GCSE passes at grade A*-C. All independent variables are measured while the child is 15 years old. All models also include controls for: household income, family home ownership, mother's and father's ages, mother's and father's level of education, birth order, number of siblings, special needs education, one parent family, quarter of birth, and region. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Full results in Appendix Table 14.

However, the negative impact of an additional hour of work on GCSE performance for mother and father, respectively, and for both parents, reported in the earlier regression for a pooled sample, now only emerges among girls. Moreover, for girls, the effect of mother's working hours is much higher and more significant than the effect of father's working hours. For boys the estimated coefficients on hours worked by parents are not statistically

significant in any specifications. This is a very important extension of previous results. It suggests that the interactions of parent-adolescent child are gender specific, and that girls' educational accomplishments are much more negatively influenced by parental absence from the home, especially by mother's long hours of work, while for boys a positive example of father's employment transfers into their own higher achievements at school. As the majority of previous studies focus on the effect of parental employment on small children, the distinction between the different impact of parental employment on child by child's gender was not analysed. However, our findings are in line with previous psychological studies which report that teenage girls who spend time after school without supervision are more susceptible to peer pressure than those who are supervised (Steinberg, 1986), and are more likely to have behavioural problems (Galambos and Maggs, 1991), which could lead to their lower educational achievements.

As expected, two additional variables which reflect parental engagement with child's school life show a positive relationship with child's school performance. Having a parent who participates actively in school life increases the child's GCSE exam passes by 0.5 and is consistent in all specifications for both girls and boys. An even larger effect arises from parents' participation in parent evenings. These findings suggest that there are several ways in which parents could compensate for their absence at home due to work related reasons. As other research showed (Steinberg et al., 1992), the supportive attitude of parents can have a substantive impact on their child's educational performance.

7.3 Controlling for unobservable family characteristics

As discussed previously there may be potential biases caused by unobserved characteristics (for example, parents personality and family culture, such as: work ethic, leisure and time preferences, attitude towards educational activities, etc.) that are correlated with both the child's GCSE performance, and parental hours of work. If so, the OLS estimates will be biased. The design of BHPS data, in which information about more than one sibling is available, allows us to estimate models which can take into account unobservable family characteristics, assuming that they are constant over time. We use two approaches: a family fixed effects model and a sibling difference estimator, using the sample of those individuals for whom we could match at least one sibling, who provided information about the number of GCSEs passed, and for whom we have information about parental working time while the person was 15 years old. This analysis is only feasible for BHPS data, as the LSYPE dataset does not collect detailed information about other household members.

Table 7: Fixed effects and sibling difference estimator results (BHPS)

	Model 1	Model 2	Model 3	Model 4
	Family fixed effects	Sibling difference estimator	Family fixed effects	Sibling difference estimator
Working father	2.511 ^{**} (0.800)	2.302 ^{**} (0.876)	1.595 (0.937)	1.435 (0.936)

Working mother	0.654 (0.549)	0.602 (0.627)	1.174 (0.614)	1.103 (0.679)
Hours of work of both parents	-0.025* (0.010)	-0.026* (0.010)		
Mother's hours of work			-0.044** (0.014)	-0.044** (0.014)
Father's hours of work			-0.007 (0.014)	-0.008 (0.013)
Monthly income	-0.105 (0.114)	-0.079 (0.125)	-0.105 (0.114)	-0.079 (0.123)
House ownership	-1.367 (0.783)	-1.561 (1.085)	-1.371 (0.782)	-1.580 (1.076)
<i>N</i>	1158	613	1158	613
<i>N of groups</i>	523		523	
Rho	0.607		0.612	
F test that all $u_i=0$	F(522, 624) = 2.49 Prob. > F = 0.000		F(522, 623) = 2.50 Prob. > F = 0.000	

Estimates from a family fixed effects model (Model 1) and sibling difference estimator (Model 2). In model 2, standard error is adjusted for family specific clusters. Model 1 and Model 3 also include controls for: gender, quarter of birth, and missing information. All independent variables are measured while the child is 15 years old. Models 2 and 4 also include differences in gender, in quarter of birth, and in missing information. All differences, used as independent variables, are calculated while siblings are 15 years old. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 8 presents estimates from a fixed family effects model and a sibling difference estimator. Our dependent variable in fixed effects model (Model 1, Model 3) is the number of GCSEs at grades A*-C for each of the siblings. In Models 2 and 4, dependent variable is a differences in number of GCSEs passed at grades A*-C between siblings (in the same way the independent variables are constructed in Models 2 and 4). In Model 2 and Model 4 we additionally excluded constant variable and adjusted standard errors to allow for correlation in families clusters. The first two models report estimates of joint hours of work of both parents, while the other two columns show estimates when mother's and father's hours of work are analysed separately.

First, we notice that both specifications provide very similar estimates of coefficients. In the first two models the impact of having a working father is relatively large and statistically significant. The sibling with a working father while he was 15 is likely to achieve 2.5 (fixed effects model) or 2.3 (sibling difference estimator) more GCSE passes at grade A*-C than his other sibling who, at 15, experienced joblessness of father. This impact is much higher than that reported in Table 4 for OLS estimates for a whole sample of young people in the BHPS (1.25) and could indicate that there are huge gains in children school performance if a father rejoins the labour market. It might suggest that if a child sees some positive outcome of his parents in the labour market he/she is more motivated to do well at school, while distress of a parent at losing a job might have a detrimental impact on educational achievements. Our estimates also indicate a negative and statistically significant impact from joint working time of parents. A weekly rise of 10 hours of parental work while a child is 15

reduces the number of GCSE passes by 0.25 (fixed effects model) and by 0.26 (sibling difference estimator), relative to GCSEs achieved by his/her sibling while parents were working less. Hence, even when allowing for family unobserved characteristics, children's performance at GCSE declines as parents work more hours. Although mothers' and fathers' working hours were analysed separately, we only found a statistically significant impact from the working time of mothers. If a mother increases her weekly working and commuting hours by 10 while her child is 15 years old, this child could expect to obtain 0.44 less GCSEs passes at grades A*-C than her/his sibling while the mother worked less. The size of the effect is the same in both specifications (Model 3 and Model 4), suggesting that our results are not sensitive to method used. An increase in maternal absence at home due to work and commuting in the last years of compulsory education does have a detrimental impact on child's exam performance. However maternal employment still has a positive, yet not statistically significant, impact on a child's educational achievements.

After running the OLS pooled regression on differences between siblings (sibling difference estimator) we check if there is any serial correlation in differences of the errors, regressing residuals $\hat{\epsilon}_{it}$ on residuals $\hat{\epsilon}_{it-1}$. Our estimated coefficient of $\hat{\epsilon}_{it-1}$ is equal to -0.37 (Model 2) and -0.38 (Model 4), which indicates the serial correlation. Therefore, the estimates of fixed family effects will be more efficient; however, they are very similar to those from the sibling difference estimator.

Therefore, even when controlling for unobserved family-specific characteristics, there is a positive and statistically significant impact of having a working father and a negative and statistically significant relationship of parental working time on child's GCSE performance. However, this relationship may still be susceptible to bias caused by the potential endogeneity of parental hours of work, which we try to address in the next section.

7.4 Controlling for the potential endogeneity of parental hours of work

The parent's working hours may be endogenous, which will also introduce a bias into our estimates. For example, parents may adjust their working hours according to their children's performance at school and their preferences. If parents have preferences for child equality they would spend more time with the child who is less able, and adjust their working hours accordingly. In this case our estimates are biased upwards. If, on the other hand, parents decide that investing their time in a less able child will have little impact due to the child's lack of abilities, they may decide to work more hours and invest less time in the child, in which case our estimates are biased downward. As parental preferences are unknown, we cannot foresee confidently the direction of the bias. We apply several approaches to overcome this problem. First, we control for parental employment in the past, then we condition our estimation on the results of tests taken at the age of 11, and finally we use an IV approach.

7.4.1 Controlling for past parental employment

One method to overcome the endogeneity problem is to introduce measures of parental labour supply before the child's abilities are revealed. By doing this we assume that the child's abilities are not revealed until a child starts school (at age 5), so parents do not have

incentives to adjust their working time - for example, to reinforce child educational development. As suggested by Ermish and Francesconi (2000), we add to our specifications controls for mother's and father's employment in the first five years of their child's life. This information is based on retrospective data from the BHPS, which does not contain the actual hours of work. Instead, information is only available on whether the parents are working full-time or part-time or in self-employment. Therefore, I construct variables that measure the number of years spent in each status while a child was aged 0-5.

In Table 8 we present the results of OLS estimations with additional controls for parental market participation in early childhood, together with controls for parental labour market supply one year and two years before the GCSE exam (Model 2). This indicates that none of the controls for parental labour market participation in early childhood is statistically significant, and their inclusion does not change the impact of parental hours of work in the year before GCSE exams. Moreover, this may suggest that we do not face a serious problem of endogeneity if we consider the parental working time adjustment to child abilities and human capital endowment. Increasing parental hours of work by ten per week reduces the number of GCSE passes at grades A*- C by 0.14 (Model 1) when controlling for parental early childhood labour market status, and by 0.12 if we don't control for it (based on results from Table 4).

Table 8: OLS estimates with controls for parental working hours at age 15, and parental employment in early childhood

	Coefficients	Standard errors
Working father at age 15	1.324**	(0.425)
Working mother at age 15	0.432	(0.284)
Hours of work of both parents at age 15	-0.014*	(0.006)
Father's employment while child was 0-5 years old (number of years) in:		
Full time employment	-0.077	(0.082)
Part-time employment	-0.365	(0.690)
Self-employment	0.180	(0.154)
Mother's employment while child was 0-5 years old (number of years) in:		
Full time employment	0.078	(0.140)
Part-time employment	-0.101	(0.098)
Self-employment	0.012	(0.251)
<i>N</i>	2094	

Estimates from OLS regressions. Dependent variable is the number of GCSE passes at grades A*- C. All models also include controls for: mother's and father's age, mother's and father's level of education, child's gender, birth order, number of siblings, lone parents, family home ownership at age 15, year of GCSE exam, quarter of child's birth, and region. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Full results in Appendix Table 15.

Conditioning on previous exam results

Another method of at least partially eliminating this parental working hours endogeneity problem is to condition on children's previous educational achievements under the assumption of parental preferences being constant in time. We estimate models that control for child performance at key stage 2 (KS2) which is a national exam taken at the end of primary school at age 11.¹¹ If KS2 results are included then the coefficient on parental working time measures the proportionate difference in the number of GCSE passes for children having the same scores at KS2, but with parents working different amount of hours while the children were 15. This analysis is conducted only using LSYPE data as they contain administrative information about all exam results, while no such information is available in the BHPS.

Table 9: The effect of parental working time on GCSE performance conditional on KS2 (LSYPE)

	Model 1	Model 2	Model 3	Model 4
Results at KS2		0.614*** (0.008)		0.614*** (0.008)
Working father at age 15	0.425*** (0.120)	0.133 (0.099)	0.393** (0.125)	0.099 (0.103)
Working mother at age 15	0.293** (0.091)	-0.060 (0.075)	0.336** (0.105)	-0.013 (0.087)
Working hours of both parents at age 15	-0.007*** (0.002)	-0.004*** (0.001)		
Working hours of mother at age 15			-0.008** (0.003)	-0.006** (0.002)
Working hours of father at age 15			-0.006** (0.002)	-0.003* (0.002)
<i>N</i>	11714	11714	11714	11714
adj. <i>R</i> ²	0.295	0.521	0.295	0.521

Estimates from OLS regressions. Dependent variable is the number of GCSE passes at grades A*- C. All models also include controls for: child's gender, quarter of birth, birth order, number of siblings, special needs education, mother's and father's age, mother's and father's level of education, lone parents, active parenting, participation in school evenings, household income, home ownership, and region. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Full results in Appendix Table 16.

Estimates from these specifications are reported in Table 9, which also presents estimations without these controls (Model 1, Model 3). The addition of the KS2 results has

¹¹ The National Curriculum in England and Wales is divided into 4 key stages. Key stage 2 comprises of children aged 7 to 11. At the age of 11, the majority of students finish primary school and enter secondary school. The KS2 exam is taken at the end of primary school. However, in general, secondary schools do not select pupils on its results.

little impact on the effect of parental working hours, which remain negative and statistically significant. The size of the estimated coefficient of parental working hours falls from -0.007 to -0.004. The pattern is similar if we compare Model 3 with Model 4, which focuses on mother's and father's working hours separately. When controlling for KS2 results (Model 4), mother's and father's hours of work have a statistically significant, negative and quite small impact on GCSE performance. Ten additional hours of mother's work (father's work) reduces the number of GCSEs by 0.06 (0.03). This suggests that part of the negative impact of parental working hours in Models 1 and 3, respectively, is partially attributable to differences in family specific unobservables (in the meaning of different parental approaches to each of their children), while it has been controlled for, the impact is small, however, it remains statistically significant and negative.

7.4.2 IV estimations

The final approach we adopt to deal with potential endogeneity is to use instrumental variables. Finding appropriate instruments is the main challenge of this approach. Good instruments are required to be uncorrelated with the error term from the main outcome regression (instrument exogeneity), which in our case relates to performance at GCSE level, while at the same time they need to determine parental working hours (instrument relevance). Valid instruments lead to consistent estimates but they still may have some limitations. If the instrument is weak (weakly correlated with the endogenous variable), the IV estimates are less efficient than OLS, and they are also imprecise with larger standard errors. Our instrument is parental attitudes towards female labour supply. This is captured by responses to the question: Do you agree with the statement that full-time jobs make women independent? Responses were coded on a Likert scale: strongly agree, agree, neither agree/neither disagree, disagree, strongly disagree. This is a good instrument as it should lead to certain behaviour in the labour market. We might expect that those women who disagree with this statement are less likely to work full-time than those who agree. We might also expect that there is a similar, although slightly weaker, relationship between men's attitudes towards this statement and their wives' full-time employment. Additionally we might expect that a man who agrees that full-time jobs make women independent would be more supportive of his wife's labour market participation than a husband with a more traditional approach. We verify whether those attitudes are associated with parental working time and women's working time in simple OLS. We find that husbands' opinions are not significantly related to joint parental hours of work, but are related to wives' hours of work, while women's attitudes are associated with both parental working time, and women's working time. On the other hand, we expect that these attitudes do not have a direct impact on children's school performance. We estimate IV models using GMM, as it is more efficient than the two-stage least square approach (Wooldridge, 2002).

Table 10 compares results from OLS regression with the IV estimates. The instrumented variable in Model 2 is parental hours of work, while the instruments are mother's and father's attitudes towards female full-time work. In Model 4 we use the same instruments but the instrumented variable is mother's working hours.

Table 10: Comparison of IV regression results and OLS estimations (BHPS)

	Model 1 OLS	Model 2 IV	Model 3 OLS	Model 4 IV
		Instruments for parents' hours of work		Instruments for mother's hours of work
Working mother at age 15	0.387 (0.284)	4.569* (2.078)	0.706* (0.324)	4.041** (1.559)
Working father at age 15	1.360** (0.428)	8.544* (3.451)	0.794 (0.511)	1.289* (0.585)
Working hours of both parents at age 15	-0.014* (0.005)	-0.157* (0.072)		
Mother's working hours at age 15			-0.024** (0.008)	-0.133* (0.052)
Father's working hours at age 15			-0.002 (0.008)	-0.001 (0.009)
F statistic		5.057		15.301
J statistic		0.002 (p = 0.969)		0.003 (p = 0.955)
N	2095	1025	2095	1025

Estimates from OLS regressions and IV estimations. Dependent variable is the number of GCSE passes at grades A*- C. All models also include controls for: mother's and father's age, mother's and father's level of education, birth order, number of siblings, household income, home ownership, the year of exam and region. Standard errors in parentheses, * p < 0.05, ** p < 0.01, *** p < 0.001. Full results in Appendix Table 17.

We first check the relevance of our instruments. In Model 4 we reject the null hypothesis of weak instruments (F statistic = 15.3) while Model 2 yields a much lower F statistic (F statistic = 5.1) which does not reject the null hypothesis. A common rule of thumb for models with one endogenous regressor is for an F-statistic larger than 10 against the null hypothesis that the excluded instruments are irrelevant in the first-stage regression (Greene, 2003). Given the weakness of the instrument in Model 2, the OLS estimates are preferred as the IV estimates from Model 2 are biased in the same direction as OLS estimates, but are inconsistent (Bound et al., 1995).

Having two instruments for mother's working hours also allows us to test over-identifying restrictions. We test this for the instruments in Model 4 using the J statistic (Hansen, 1982). The test assumes that one instrument is valid and then tests for the validity of all other instruments (meaning that they are uncorrelated with an error term from the main equation). The value of the J statistic, which has a χ^2 distribution, is 0.003 (p=0.95) and does not reject the null hypothesis that the instruments are valid. This confirms that, in Model 4 at least, we have identified good instruments.

The IV estimates on parental working hours in Model 2 are larger than those estimated using OLS (Model 1), and remain statistically significant. Similarly, in Model 4, the coefficient on mother's hours of work becomes more negative in IV estimation. The

coefficient on mother's labour supply also increases substantially. A comparison of the coefficients on employment and working hours indicates that the positive effects of mothers holding a job exceed the negative effect of their hours of work, provided she works less than 30 hours per week (Model 4). Fathers' working hours, in both OLS and IV specifications, have a negative, although statistically insignificant, impact on the number of GCSE passes by their child. The general conclusion remains that the hours of work of both parents reduce the number of GCSEs at grades A*-C passed by their child, and there is a large casual relationship between the mother's hours of work and the child's GCSE performance. In the OLS specification an additional 10 hours of mother's work per week decreases the number of GCSEs achieved by her child by 0.24. The IV estimates suggest a larger impact: 10 additional hours of mother's work per week reduces the number of A*-C graded GCSEs by about 1.3. However, as shown above, there is a positive impact of having a parent who has a job; therefore, this harmful effect of working hours is only present after crossing a threshold.

To sum up, it is difficult to indicate the best specification used in this paper, mainly because of the drawbacks of the two datasets, which do not allow us to combine different approaches presented here in just one model. It is also difficult to compare results from the two datasets, which, despite having a lot in common, focus on different samples: one representative of British households (BHPS), another representative of a cohort of young people in England born in 1989/1990. There are some discrepancies in our results depending on the specification and dataset used. However, we can identify findings which hold under all the approaches presented here, showing the same direction of the analysed effects. In the majority of our models we found a positive and statistically significant impact of father's employment on number of child's GCSE passes at A*-C grades. When family specific unobservable characteristics were controlled for in family fixed effects and sibling difference estimations, the effect of father's employment (corresponding coefficients: 2.5, and 2.3) was even larger than that predicted by OLS (1.2). Also, when endogeneity of parental employment was partially allowed for when controlling for parental employment while the child was 0-5 years old, in IV approach parental working was a positive predictor of the child's better achievement at the end of compulsory education. However, when we analysed separately the impact of father's employment on girls and boys, this effect was relatively large, and statistically significant only for boys.

Another finding which was relatively unaffected by the different models' assumptions and specifications was the negative impact of mother's hours of work on child's GCSE performance. It holds in all specifications, apart from the estimation done separately for boys and girls. When this distinction was made we found that mother's working hours have a statistically significant, detrimental impact only on girl's results at school. When joint parental working time was analysed it was also found to have a negative effect, which could indicate, in the light of above findings, that it is mainly drawn by mother's hours of work.

8 Summary and conclusions

Our results suggest that parental employment in the year before sitting the GCSE exams has a positive impact on child performance, while especially father's employment remains significant under different assumptions and specifications. This is consistent with

previous evidence for the UK (O'Brien and Jones, 1999; Ermisch et al., 2004). Bearing in mind that, in 2006, almost 7% of children in the UK lived in a non working family (Brewer et. al., 2009), this finding might be a matter of concern for policy makers, as lack of a job is not only associated with lower income and higher chances of living in poverty, but also affects the academic success of children. It was also shown, when controlling for family specific unobservable characteristics, that a 15 year old child having a non working father will have much lower GCSE achievements than his sibling who hasn't, at the age of 15, experienced the father's joblessness. Gender specific analysis also indicated that the father's labour market status is especially important for boys, reinforcing their school performance, and having a positive impact on their GCSE results.

We extended this research by focusing not only on the employment status of parents, but also by applying a more accurate measure of working time – the number of hours spent at work and commuting. We found that working and commuting hours do have harmful effects on children, for instance, an increase of ten working hours for both parents leads to a decrease of the number of GCSEs passed at grades A*- C by 0.12 (OLS), by 0.14 when we control for endogeneity of parental employment and by 0.25 when unobserved family effects are accounted for. However, this effect is much lower than the positive effect of parental labour market participation, and we should take it into account when providing a concluding summary. No previous UK study has studied the effect of such a direct measure. However, our results are consistent with those for the UK from Ermish and Francesconi (2000), who distinguish between full-time and part-time employment of parents. They contrast with results for Germany where no evidence was found that parental working time affects child's educational achievements (Horisch, 2008). Our results are robust to controls for family unobserved characteristics in both sibling difference and family fixed effects models. However, as our instrument for parental hours of work is weak, we could not draw similar conclusions for other forms of potential endogeneity of parental hours of work.

If we consider the working time of mothers and fathers separately, we find a negative although not always significant impact of the hours of work of the father, and a slightly larger negative and always robust effect of mother's hour of work on child's GCSE performance. This different impact of each parents working time might be explained by different patterns of child-parent interactions. Rasmussen (2005) concludes that children's educational outcomes are higher if the mother spends time with children during week days and the father spends time at the weekend. If we assume that the majority of parents work weekdays, then the effect of the mother's absence could be more harmful for a child. This evidence of negative impact of mother hours of work is important in the context of the growing labour market participation of women, especially mothers. Considering that their employment is beneficial for a child even when we are controlling for family income, mothers should be encouraged to be professionally active, on the other hand our evidence suggest that the positive effect of mothers employment disappears if they work more than 36 (BHPS) or 42 (LSYPE) hours per week. It indicates that as long as mothers spent a reasonable amount of time at work their labour market participation is positive for their children educational outcomes. Also if working parents are engaged in their children school life, monitoring their development by regular participation in evening's meetings with teachers they could compensate for their absence at home. Policy encouraging flexibly working conditions,

which allows women to combine professional life with family chores will be the best suited policy recommendation coming from our findings.

Further extensions of the research could use time diary data which provides more detailed information about child - parent interactions. In particular it might allow for a more comprehensive analysis of the effect of parental time with the child, conditional on hours of work of parents, which would allow for a more direct application of time allocation theory. Another enhancement of this research may be done by analysing the long-term effects of parental employment, here we only captured the effects of parental employment on the exam results in the subsequent year. In the light of the growing cost of higher education, it will be worth to examine the long term parental strategy for their children education, and their real effect.

9 Appendix

Table 11: Descriptive statistics (full sample)

Variable	BHPS		LSYPE	
	Mean	Std. Dev.	Mean	Std. Dev
GCSES results				
GCSE or higher level of education	0.90	0.30	0.95	0.22
No of GCSE (A*-C)	5.74	4.04	5.79	4.30
Girls (proportion)	0.51	0.50	0.51	0.50
Parental work characteristics				
Working father	0.88	0.33	0.86	0.35
Working mother	0.76	0.43	0.71	0.46
Parental hours of work (total)	57.18	25.94	53.41	25.04
0-30 hours	0.14	0.35	0.20	0.40
31-60 hours	0.36	0.48	0.41	0.49
61-85 hours	0.32	0.47	0.28	0.45
More than 85 hours	0.18	0.38	0.10	0.31
Hours of work of father (total)	46.82	12.49	44.99	10.93
0-30 hours	0.04	0.19	0.05	0.23
31-39 hours	0.10	0.29	0.20	0.40
40-45 hours	0.31	0.46	0.33	0.47
46-50 hours	0.18	0.38	0.22	0.41
51-55 hours	0.14	0.35	0.07	0.26
More than 56 hours	0.23	0.42	0.13	0.33
Hours of work of mother (total)	30.16	14.15	30.19	12.55
0-20 hours	0.22	0.42	0.26	0.44
21-35 hours	0.34	0.48	0.37	0.48
36-42 hours	0.23	0.42	0.24	0.43
More than 43 hours	0.20	0.40	0.13	0.34
Other parental characteristics				
Father's age	45.50	6.28	45.10	7.99
Mother's age	42.40	5.39	42.51	6.17
Fathers highest level of education				
Degree	0.15	0.36	0.15	0.36
Higher vocational	0.40	0.49	0.10	0.31
GCE A level	0.10	0.29	0.18	0.38
GCSE or O level	0.14	0.35	0.25	0.43
Basic education	0.06	0.23	0.09	0.29
No qualification	0.13	0.34	0.17	0.38
Mothers 's highest level of education				
Degree	0.13	0.34	0.12	0.33
Higher vocational	0.38	0.48	0.13	0.34
GCE A level	0.07	0.26	0.14	0.35
GCSE or O level	0.17	0.38	0.30	0.46
Basic	0.10	0.30	0.12	0.33
No qualification	0.14	0.35	0.18	0.39

Family characteristics

First born	0.48	0.50	0.33	0.47
Second born	0.35	0.48	0.34	0.48
Third born	0.13	0.34	0.14	0.35
Fourth born	0.06	0.23	0.08	0.27
No. of siblings	1.67	1.40	1.88	1.39
House ownership	0.75	0.43	0.72	0.45
Adjusted income**	1.94	1.31	1.95	1.76
Number of rooms	5.34	1.69	n/a	n/a
Saving from a current income	0.31	0.46	n/a	n/a
Index of deprived area	n/a	n/a	0.21	0.18
Family benefits receiver	n/a	n/a	0.39	0.49
Active parenting	n/a	n/a	0.16	0.37
School meeting participation	n/a	n/a	0.78	0.41
No full information about father	0.44	0.50	0.42	0.43
No full information about mother	0.25	0.43	0.14	0.19

Table 12: Descriptive statistics (siblings sample)

Variable	No of Observations	Mean	Std. Dev.
GCSE or higher level of education	1278	0.92	0.28
Girls (proportion)	1413	0.51	0.50
Quarter of birth			
1 quarter	1413	0.25	0.43
2 quarter	1413	0.23	0.42
3 quarter	1413	0.27	0.44
Parental work characteristics			
Working father	1413	0.76	0.43
Working mother	1413	0.71	0.46
Parental hours of work (total)	1413	58.81	33.49
Hours of work of father (total)	1413	36.51	23.74
Hours of work of mother (total)	1413	22.31	18.38
Adjusted income	1407	2.01	1.29
House ownership	1400	0.81	0.39
No full information about father	1413	0.12	0.33
No full information about mother	1413	0.08	0.27

Table 13: Determinants of GCSE results

	Model 1	Model 2		Model 3	Model 4
	BHPS	BHPS		LSYPE	LSYPE
Working father	1.247** (0.422)	0.777 (0.504)	Working father	0.460*** (0.116)	0.428** (0.122)
Working mother	0.477 (0.282)	0.738* (0.320)	Working mother	0.328*** (0.089)	0.372*** (0.102)
Hours of work of both parents	-0.012* (0.005)		Hours of work of both	-0.006*** (0.002)	
Hours of work of father		-0.002 (0.008)	Hours of work of father		-0.005** (0.002)
Hours of work of mother		-0.021** (0.007)	Hours of work of mother		-0.008** (0.003)
Income	0.183* (0.072)	0.181* (0.072)	Income	0.094*** (0.025)	0.094*** (0.025)
Home ownership	1.605*** (0.209)	1.619*** (0.209)	Home ownership	1.317*** (0.086)	1.319*** (0.086)
Child's gender	-1.098* (0.515)	-1.088* (0.515)	Child's gender	-0.696*** (0.065)	-0.696*** (0.065)
Missing father info	1.225** (0.449)	1.250** (0.449)	Missing father info	-0.352 (0.193)	-0.353 (0.193)
Missing mother info	1.113* (0.439)	1.109* (0.439)	Missing mother info	-0.072 (0.222)	-0.067 (0.222)
Age of father	0.006 (0.011)	0.007 (0.011)	Age of father	0.020** (0.004)	0.020** (0.004)
Age of mother	0.0402** (0.014)	0.0396** (0.014)	Age of mother	0.047*** (0.005)	0.047*** (0.005)
Education of mother			Education of mother		
Degree level	2.083*** (0.364)	2.169*** (0.368)	Degree level	2.014*** (0.136)	2.026*** (0.136)
Higher vocational education	1.112*** (0.281)	1.126*** (0.281)	Higher vocational	1.309*** (0.124)	1.317*** (0.125)
A level	0.675 (0.377)	0.700 (0.377)	A level	1.103*** (0.121)	1.107*** (0.121)
O level	0.770* (0.307)	0.786* (0.307)	O level	0.537*** (0.100)	0.540*** (0.100)
Basic	0.818* (0.372)	0.827* (0.372)	Basic	-0.086 (0.120)	-0.085 (0.120)
Education of father			Education of father		
Degree level	1.792*** (0.372)	1.784*** (0.372)	Degree level	1.790*** (0.135)	1.777*** (0.136)
Higher vocational education	0.792** (0.292)	0.789** (0.292)	Higher vocational	1.039*** (0.143)	1.027*** (0.143)
A level	0.517 (0.389)	0.524 (0.389)	A level	0.622*** (0.122)	0.614*** (0.122)
O level	0.426 (0.353)	0.422 (0.353)	O level	0.428*** (0.110)	0.420*** (0.110)

Basic	-0.0502 (0.487)	-0.0565 (0.487)	Basic	-0.048 (0.147)	-0.055 (0.147)
Second child	-0.732*** (0.183)	-0.736*** (0.183)	Second child	-0.572*** (0.080)	-0.569*** (0.080)
Third child	-1.076*** (0.274)	-1.086*** (0.273)	Third child	-1.023*** (0.104)	-1.019*** (0.104)
Fourth child	-1.724*** (0.425)	-1.695*** (0.426)	Fourth child	-1.154*** (0.125)	-1.151*** (0.125)
Number of siblings	-0.027 (0.085)	-0.031 (0.085)	Number of siblings	0.219 (0.125)	0.215 (0.126)
Born in the 1 st quarter	-0.370 (0.229)	-0.372 (0.229)	Born in the 1 st quarter	-0.120 (0.092)	-0.120 (0.092)
Born in the 2 nd quarter	-0.803*** (0.234)	-0.799*** (0.234)	Born in the 2 nd quarter	-0.157 (0.091)	-0.156 (0.091)
Born in the 3 rd quarter	-0.657** (0.232)	-0.653** (0.232)	Born in the 3 rd quarter	-0.113 (0.091)	-0.113 (0.091)
Region variables			Regional variables		
South East	-0.002 (0.300)	0.013 (0.300)	South East	-0.095 (0.171)	-0.097 (0.171)
South West	0.152 (0.375)	0.162 (0.374)	South West	-0.332 (0.187)	-0.334 (0.187)
East Anglia	0.0207 (0.459)	0.0233 (0.459)	East Anglia	-0.255 (0.179)	-0.256 (0.179)
East Midlands	-0.520 (0.375)	-0.509 (0.374)	East Midlands	-0.227 (0.184)	-0.228 (0.184)
West Midlands conurbation	-1.223* (0.547)	-1.203* (0.547)	London	0.623*** (0.168)	0.625*** (0.168)
West Midlands	-0.373 (0.420)	-0.403 (0.420)	West Midlands	-0.344* (0.170)	-0.345* (0.170)
North West	0.316 (0.472)	0.357 (0.473)	North West	-0.673*** (0.178)	-0.675*** (0.178)
York and Humber	-1.159* (0.552)	-1.165* (0.552)	York and Humber	0.003 (0.000)	0.003 (0.000)
Manchester	-0.130 (0.536)	-0.121 (0.536)	Special educational	-3.031*** (0.084)	-3.032*** (0.084)
Merseyside	-0.276 (0.568)	-0.328 (0.569)	Constant	2.228*** (0.326)	2.236*** (0.326)
South York	0.001 (0.620)	0.0214 (0.619)	<hr/>		
Tyne	-0.584 (0.761)	-0.581 (0.761)	<i>N</i>	12374	12374
Year of GCSE exam			adj. <i>R</i> ²	0.287	0.287
1996	-0.207 (0.417)	-0.215 (0.417)			
1997	0.421 (0.427)	0.459 (0.427)			
1998	0.381 (0.482)	0.381 (0.482)			

1999	0.0934 (0.510)	0.0742 (0.510)
2000	0.610 (0.506)	0.620 (0.506)
2001	0.994* (0.485)	0.988* (0.485)
2002	0.240 (0.631)	0.246 (0.631)
2003	0.821 (0.550)	0.811 (0.550)
2004	0.456 (0.446)	0.468 (0.446)
2005	0.734 (0.471)	0.721 (0.471)
2006	0.719 (0.402)	0.732 (0.402)
2007	1.328*** (0.351)	1.335*** (0.351)
Making savings	0.394* (0.194)	0.413* (0.195)
Nr of rooms	0.362*** (0.052)	0.357*** (0.052)
Constant	-0.617 (1.691)	-0.596 (1.690)
<hr/>		
<i>N</i>	2094	2094
adj. <i>R</i> ²	0.244	0.245

All independent variables measured at age 15.

Standard errors in parentheses,

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 14: Determinants of GCSE performance by gender (LSYPE)

	Model 1 Girls	Model 2 Boys	Model 3 Girls	Model 4 Boys
Working father	0.296 (0.164)	0.482 ^{**} (0.165)	0.203 (0.172)	0.496 ^{**} (0.174)
Working mother	0.241 (0.126)	0.307 [*] (0.126)	0.367 [*] (0.144)	0.287 [*] (0.145)
<i>Hours of work of:</i>				
Both parents	-0.009 ^{***} (0.002)	-0.004 (0.002)		
Father			-0.006 [*] (0.003)	-0.004 (0.003)
Mother			-0.014 ^{***} (0.004)	-0.003 (0.004)
Income	0.074 [*] (0.034)	0.079 [*] (0.037)	0.076 [*] (0.034)	0.078 [*] (0.037)
Home ownership	1.426 ^{***} (0.122)	0.934 ^{***} (0.123)	1.430 ^{***} (0.122)	0.934 ^{***} (0.123)
Mother's age	0.044 ^{***} (0.007)	0.041 ^{***} (0.007)	0.044 ^{***} (0.007)	0.041 ^{***} (0.007)
Father's age	0.016 ^{**} (0.005)	0.019 ^{***} (0.005)	0.016 ^{**} (0.005)	0.019 ^{***} (0.005)
Mother's Education				
Degree level	1.518 ^{***} (0.192)	2.036 ^{***} (0.194)	1.551 ^{***} (0.193)	2.031 ^{***} (0.195)
Higher vocational education	0.939 ^{***} (0.174)	1.259 ^{***} (0.179)	0.959 ^{***} (0.175)	1.256 ^{***} (0.179)
A level	0.722 ^{***} (0.169)	1.136 ^{***} (0.174)	0.735 ^{***} (0.169)	1.134 ^{***} (0.174)
O level	0.344 [*] (0.138)	0.532 ^{***} (0.143)	0.352 [*] (0.138)	0.531 ^{***} (0.144)
Basic	-0.223 (0.168)	-0.018 (0.171)	-0.225 (0.168)	-0.019 (0.171)
Father's Education				
Degree level	1.455 ^{***} (0.191)	1.722 ^{***} (0.192)	1.414 ^{***} (0.192)	1.727 ^{***} (0.193)
Higher vocational education	1.082 ^{***} (0.200)	0.709 ^{***} (0.203)	1.049 ^{***} (0.201)	0.714 ^{***} (0.203)
A -level	0.632 ^{***} (0.172)	0.381 [*] (0.172)	0.611 ^{***} (0.172)	0.385 [*] (0.172)
O -level	0.290 (0.155)	0.383 [*] (0.155)	0.267 (0.156)	0.387 [*] (0.156)
Basic	0.146 (0.206)	-0.271 (0.208)	0.123 (0.207)	-0.269 (0.208)
Second child	-0.711 ^{***} (0.112)	-0.426 ^{***} (0.112)	-0.702 ^{***} (0.112)	-0.426 ^{***} (0.113)
Third child	-1.123 ^{***} (0.144)	-0.859 ^{***} (0.149)	-1.111 ^{***} (0.144)	-0.861 ^{***} (0.149)
Fourth child	-1.142 ^{***} (0.174)	-0.989 ^{***} (0.180)	-1.131 ^{***} (0.174)	-0.990 ^{***} (0.180)
Number of siblings	0.376 [*] (0.177)	0.166 (0.177)	0.360 [*] (0.177)	0.167 (0.178)
Lone parent	1.152 ^{***} (0.267)	1.014 ^{***} (0.247)	1.140 ^{***} (0.267)	1.015 ^{***} (0.247)

Recipient of benefits	-0.499 ^{***} (0.109)	-0.592 ^{***} (0.110)	-0.503 ^{***} (0.109)	-0.592 ^{***} (0.110)
Regional variables				
London	0.759 ^{**} (0.197)	0.811 ^{***} (0.201)	0.772 ^{***} (0.197)	0.809 ^{***} (0.201)
South East	-0.079 (0.202)	0.390 (0.202)	-0.083 (0.202)	0.390 (0.202)
South West	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
East Anglia	-0.180 (0.216)	0.166 (0.215)	-0.169 (0.216)	0.167 (0.215)
East Midlands	0.132 (0.228)	0.091 (0.221)	0.136 (0.228)	0.092 (0.221)
West Midlands	0.342 (0.210)	0.300 (0.206)	0.353 (0.210)	0.298 (0.206)
North West	-0.236 (0.204)	0.105 (0.199)	-0.234 (0.204)	0.105 (0.199)
Yorkshire Humber	-0.309 (0.217)	-0.394 (0.214)	-0.311 (0.217)	-0.394 (0.214)
North East	0.432 (0.258)	0.290 (0.268)	0.437 (0.258)	0.289 (0.268)
Special educational needs	-3.159 ^{***} (0.130)	-2.857 ^{***} (0.110)	-3.166 ^{***} (0.130)	-2.857 ^{***} (0.110)
Born in the 1 st quarter	-0.042 (0.128)	-0.210 (0.131)	-0.041 (0.128)	-0.210 (0.131)
Born in the 2 nd quarter	-0.154 (0.128)	-0.167 (0.130)	-0.151 (0.128)	-0.167 (0.130)
Born in the 3 rd quarter	-0.085 (0.128)	-0.155 (0.130)	-0.083 (0.128)	-0.155 (0.130)
Missing inf. about father	-0.534 (0.275)	-0.173 (0.274)	-0.535 (0.275)	-0.172 (0.274)
Missing inf. about mother	-0.576 (0.328)	0.158 (0.308)	-0.566 (0.328)	0.156 (0.308)
Active parenting	0.498 ^{***} (0.129)	0.503 ^{***} (0.129)	0.501 ^{***} (0.129)	0.504 ^{***} (0.129)
Participation in parental evenings	0.983 ^{***} (0.117)	0.884 ^{***} (0.121)	0.984 ^{***} (0.117)	0.884 ^{***} (0.121)
Constant	2.032 ^{***} (0.466)	1.166 [*] (0.467)	2.060 ^{***} (0.466)	1.164 [*] (0.467)
<i>N</i>	6078	6180	6078	6180
adj. <i>R</i> ²	0.282	0.302	0.282	0.301

All independent variables measured at age 15.

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 15: Determinants of GCSE with controls for previous years parental labour market participation

	Coefficients	Standard errors
Working father at age 15	1.324**	(0.425)
Working mother at age 15	0.432	(0.284)
Missing mother info at age 15	0.955*	(0.423)
Missing father info at age 15	1.163*	(0.457)
Hours of work of both parents at age 15	-0.014*	(0.006)
Monthly Income at age 15	0.186*	(0.073)
No of room at age 15	0.378***	(0.052)
Currently saving at age 15	0.418*	(0.195)
House ownership at age 15	1.674***	(0.212)
Child's gender	-1.239***	(0.158)
Father's age	0.004	(0.011)
Mother's age	0.038**	(0.014)
Mothers education		
Degree level	1.951***	(0.365)
Higher vocational education	0.984***	(0.280)
A level	0.573	(0.376)
O level	0.661*	(0.307)
Basic	0.718	(0.372)
Fathers education		
Degree level	1.813***	(0.374)
Higher vocational education	0.766**	(0.293)
A level	0.547	(0.389)
O level	0.412	(0.353)
Basic	-0.177	(0.488)
Second child	-0.730***	(0.179)
Third child	-0.923***	(0.272)
Fourth child	-1.181**	(0.430)
Number of siblings	-0.294***	(0.087)
Lonely parent	0.376	(0.224)
Year of GCSE exam		
1996	-0.240	(0.401)
1997	0.415	(0.418)
1998	0.353	(0.421)
1999	0.166	(0.399)
2000	0.587	(0.398)
2001	0.890*	(0.370)
2002	0.220	(0.375)
2003	0.995**	(0.374)
2004	0.630	(0.364)
2005	0.853*	(0.353)
2006	0.767*	(0.354)
2007	1.264***	(0.349)
Regional variables		
South East	-0.025	(0.299)
South West	0.089	(0.376)
East Anglia	-0.169	(0.461)
East Midlands	-0.572	(0.377)
West Midlands conurbation	-1.103*	(0.545)
Rest of West Midlands	-0.504	(0.419)
Greater Manchester	-0.268	(0.537)
Merseyside	-0.208	(0.563)
North West	0.248	(0.473)
South Yorkshire	-0.135	(0.623)

West Yorkshire	-0.157	(0.536)
Yorkshire Humberside	-1.075	(0.553)
Tyne and Wear	-0.624	(0.763)
North England	-0.161	(0.555)
Wales	0.753*	(0.320)
Fathers employment while child was 0-5 years old (number of years) in:		
Full time employment	-0.077	(0.082)
Part-time employment	-0.365	(0.690)
Self -employment	0.180	(0.154)
Mothers employment while child was 0-5 years old (number of years) in:		
Full time employment	0.078	(0.140)
Part-time employment	-0.101	(0.098)
Self-employment	0.012	(0.251)
Missing information about previous employment of father	-0.631*	(0.302)
Missing information about previous employment of mother	-0.162	(0.204)
Constant	-0.276	(0.845)
<hr/> <i>N</i>	2094	
<i>adj. R</i> ²	0.245	
<hr/> Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.		

Table 16: Determinants of GCSE performance conditional on K2 results (LSYPE)

	Model 1	Model 2	Model 3	Model 4
Result at K2		0.614*** (0.008)		0.614*** (0.008)
Working father	0.425*** (0.120)	0.133 (0.099)	0.393** (0.125)	0.099 (0.103)
Working mother	0.293** (0.091)	-0.060 (0.075)	0.336** (0.105)	-0.013 (0.087)
Hours of work of:				
Both parents	-0.007*** (0.002)	-0.004*** (0.001)		
Mother			-0.008** (0.003)	-0.006** (0.002)
Father			-0.006** (0.002)	-0.003* (0.002)
Income	0.078** (0.026)	0.025 (0.022)	0.079** (0.026)	0.025 (0.022)
Home ownership	1.154*** (0.089)	0.763*** (0.074)	1.156*** (0.089)	0.765*** (0.074)
Mother's age	0.043*** (0.005)	0.022*** (0.004)	0.042*** (0.005)	0.022*** (0.004)
Father's age	0.018*** (0.004)	0.007* (0.003)	0.018*** (0.004)	0.007* (0.003)
Mother's Education				
Degree level	1.789*** (0.141)	0.347** (0.118)	1.801*** (0.142)	0.360** (0.119)
Higher vocational education	1.081*** (0.128)	0.048 (0.107)	1.088*** (0.129)	0.056 (0.107)
A level	0.936*** (0.125)	-0.048 (0.103)	0.941*** (0.125)	-0.043 (0.104)
O level	0.437*** (0.102)	-0.271** (0.085)	0.441*** (0.102)	-0.267** (0.085)
Basic	-0.127 (0.123)	-0.437*** (0.102)	-0.126 (0.123)	-0.436*** (0.102)
Father's Education				
Degree level	1.636*** (0.140)	0.705*** (0.116)	1.622*** (0.141)	0.690*** (0.117)
Higher vocational education	0.937*** (0.146)	0.410*** (0.120)	0.926*** (0.147)	0.398** (0.121)
A -level	0.532*** (0.124)	0.068 (0.103)	0.524*** (0.125)	0.059 (0.103)
O -level	0.358** (0.112)	0.094 (0.093)	0.349** (0.113)	0.085 (0.093)
Basic	0.001 (0.150)	-0.030 (0.123)	-0.006 (0.150)	-0.037 (0.123)
Second child	-0.586*** (0.081)	-0.339*** (0.067)	-0.583*** (0.081)	-0.337*** (0.067)
Third child	-1.033*** (0.106)	-0.518*** (0.088)	-1.029*** (0.107)	-0.513*** (0.088)
Fourth child	-1.001*** (0.129)	-0.472*** (0.107)	-0.999*** (0.130)	-0.470*** (0.107)
Number of siblings	0.275* (0.130)	0.205 (0.107)	0.272* (0.130)	0.201 (0.107)

Lone parent	1.100 ^{***} (0.191)	0.272 (0.158)	1.096 ^{***} (0.191)	0.268 (0.158)
Recipient of benefits	-0.555 ^{***} (0.080)	-0.292 ^{***} (0.066)	-0.555 ^{***} (0.080)	-0.293 ^{***} (0.066)
Regional variables				
London	0.439 [*] (0.171)	0.355 [*] (0.141)	0.441 [*] (0.171)	0.358 [*] (0.141)
South East	-0.247 (0.174)	-0.393 ^{**} (0.143)	-0.250 (0.174)	-0.396 ^{**} (0.143)
South West	-0.447 [*] (0.189)	-0.422 ^{**} (0.156)	-0.449 [*] (0.189)	-0.424 ^{**} (0.156)
East Anglia	-0.398 [*] (0.182)	-0.344 [*] (0.150)	-0.399 [*] (0.182)	-0.345 [*] (0.150)
East Midlands	-0.269 (0.186)	-0.234 (0.154)	-0.271 (0.186)	-0.236 (0.154)
West Midlands	-0.109 (0.176)	-0.069 (0.145)	-0.107 (0.176)	-0.067 (0.145)
North West	-0.498 ^{**} (0.172)	-0.521 ^{***} (0.142)	-0.499 ^{**} (0.172)	-0.523 ^{***} (0.142)
Yorkshire Humber	-0.768 ^{***} (0.180)	-0.467 ^{**} (0.149)	-0.770 ^{***} (0.180)	-0.469 ^{**} (0.149)
North East	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Special educational needs	-3.080 ^{***} (0.086)	-0.699 ^{***} (0.077)	-3.081 ^{***} (0.086)	-0.700 ^{***} (0.077)
Born in the 1 st quarter	-0.117 (0.094)	0.066 (0.077)	-0.117 (0.094)	0.066 (0.077)
Born in the 2 nd quarter	-0.163 (0.094)	0.263 ^{**} (0.077)	-0.163 (0.094)	0.264 ^{**} (0.077)
Born in the 3 rd quarter	-0.098 (0.094)	0.218 [*] (0.077)	-0.097 (0.094)	0.219 ^{**} (0.077)
Missing inf. about father	-0.328 (0.202)	-0.378 [*] (0.167)	-0.328 (0.202)	-0.379 [*] (0.167)
Missing inf. about mother	-0.206 (0.237)	-0.465 [*] (0.196)	-0.202 (0.237)	-0.460 [*] (0.196)
Active parenting	0.508 ^{***} (0.094)	0.355 ^{**} (0.077)	0.508 ^{***} (0.094)	0.355 ^{**} (0.077)
Participation in parental evenings	0.930 ^{***} (0.086)	0.724 ^{**} (0.071)	0.930 ^{***} (0.086)	0.723 ^{**} (0.071)
Constant	1.978 ^{***} (0.349)	-12.437 ^{***} (0.347)	1.988 ^{***} (0.349)	-12.427 ^{***} (0.347)
<i>N</i>	11714	11714	11714	11714
adj. <i>R</i> ²	0.295	0.521	0.295	0.521

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 17: Determinants of GCSE performance, IV estimations (BHPS)

	Model 1 Instruments for parents' hours of work	Model 2 Instruments for mother's hours of work
Working mother at age 15	4.569* (2.078)	4.041** (1.559)
Working father at age 15	8.544* (3.451)	1.289* (0.585)
Hours of work of both parents at age 15	-0.157* (0.072)	
Hours of work of mother at age 15		-0.133* (0.052)
Hours of work of father at age 15		-0.001 (0.009)
Child's gender	-1.850 (1.100)	-1.790 (0.944)
Father's age	0.060 (0.031)	0.051 (0.027)
Mother's age	0.055 (0.036)	0.070* (0.030)
Mother's Education		
Degree level	3.406*** (0.919)	3.409*** (0.809)
Higher vocational education	2.110*** (0.498)	1.934*** (0.430)
A level	1.433* (0.624)	1.529** (0.584)
O level	1.517** (0.517)	1.511** (0.470)
Basic	1.671** (0.570)	1.780*** (0.513)
Father's Education		
Degree level	2.217*** (0.603)	2.152*** (0.531)
Higher vocational education	1.061* (0.486)	1.094** (0.420)
A - level	0.469 (0.622)	0.756 (0.509)
O - level	0.907 (0.565)	0.787 (0.473)
Basic	0.375 (0.681)	0.414 (0.605)
Second child	-0.706* (0.338)	-0.937*** (0.271)
Third child	-1.023* (0.483)	-1.400*** (0.376)
Fourth child	-1.300* (0.594)	-1.215* (0.545)
Number of siblings	0.061 (0.129)	0.006 (0.110)
Monthly Income at age 15	0.685* (0.273)	0.398** (0.144)
House ownership at age 15	0.775 (0.419)	0.888* (0.346)
Year of GCSE exam		
1996	-1.329*	-0.916

	(0.654)	(0.538)
1997	-0.112	0.662
	(0.710)	(0.600)
1998	0.316	0.390
	(0.746)	(0.656)
1999	0.048	0.079
	(0.869)	(0.804)
2000	0.307	0.723
	(0.898)	(0.754)
2001	1.241	1.454
	(0.850)	(0.771)
2002	-0.408	0.413
	(1.225)	(1.031)
2003	-0.127	0.276
	(1.018)	(0.876)
2004	-0.587	-0.004
	(0.816)	(0.678)
2005	-0.261	0.243
	(0.897)	(0.741)
2006	-0.137	0.166
	(0.753)	(0.649)
2007	0.316	0.802
	(0.695)	(0.581)
South East	-0.863	-0.112
	(0.673)	(0.467)
South West	-1.009	0.005
	(0.854)	(0.519)
East Anglia	-0.009	0.393
	(0.724)	(0.586)
East Midlands	-1.211	-0.628
	(0.738)	(0.566)
West Midlands conurbation	-2.026	-0.849
	(1.137)	(0.799)
Rest of West Midlands	-1.719	-1.194
	(0.889)	(0.670)
Greater Manchester	-0.481	0.253
	(1.039)	(0.804)
Merseyside	-1.840	-1.361
	(0.992)	(0.768)
North West	-0.026	0.772
	(0.793)	(0.619)
South Yorkshire	0.121	0.941
	(0.913)	(0.802)
West Yorkshire	-0.437	1.456
	(1.351)	(0.983)
Yorkshire Humberside	-2.335	-1.764
	(1.448)	(1.043)
Tyne and Wear	-0.834	-0.570
	(1.061)	(1.192)
North England	-0.737	-0.086
	(1.149)	(0.946)
Wales	0.725	1.192*
	(0.704)	(0.603)
Missing father info at age 15	1.423	1.553*
	(0.807)	(0.758)
Missing mother info at age 15	-1.755	-0.626
	(1.315)	(0.877)
Constant	-1.773	-2.789
	(3.630)	(3.069)
<hr/>		
F statistic	5.057	15.301

J statistic	0.002(p = 0.969)	0.003(p = 0.955)
<i>N</i>	1025	1025

10 References

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