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# Family Size and Educational Consequences in the UK

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The family is the nucleus of civilisation.

*Will Durant*

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# Abstract

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This thesis investigates in what ways the family matters for educational outcomes. Six research questions are answered. First, is family size associated with familial resources? Second, is having a large family associated with lower levels of objective and subjective educational outcomes and has this changed over the 20th century? Third, is there evidence of an association between family size and emotional health and life perspectives of young people? Fourth, is there any evidence of an association between family size and the degree of confidence and sociability? Fifth, do parenting strategies vary by family size? Sixth, is there evidence if a casual relationship between family size and educational outcomes?

The British Household Panel Survey, the Longitudinal Survey of Young People in England and the ONS Longitudinal Study are used to answer these questions.

The key findings from the observational studies are as follows. First, as family size increases there is a reduction in familial resources. Second, as a result of resource dilution there is a reduction in the highest qualification attained; this finding is robust to alternative measures of educational outcomes. Third, there is a positive relationship between family size and reporting poor emotional health and external locus of control. Fourth, there is some evidence that the manner in which the young person socialises varies by family size. Fifth, parenting strategies vary by family size; these strategies are positively associated with GCSE achievement and ameliorate the negative family size association. Sixth, testing the resource dilution model using twins as an exogenous increase in family size found that there is weak evidence of a causal relationship between family size and educational outcomes.

This thesis addresses the influence of the family on inequalities in education. The findings have important implications for future research on this topic.

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# Chapter 1: Introduction

In what ways does the family matter for a child's educational outcomes? This thesis focuses on that question, investigating the importance of the family environment on educational consequences. It examines the impact and nature of familial resources which may differ by socioeconomic status and family size, Blake argues that as the number of siblings increase there is a reduction in educational opportunities (Blake, 1981a; 1981b; 1986; 1989). The educational opportunities examined in this thesis include the highest qualification achieved, grade attainment in compulsory schooling and subjective measures of educational progress. Furthermore there is an examination of whether individual characteristics relevant for education, such as sociability, aspiration and motivation, vary by the number of siblings a young person has.

In the section that follows there is an outline of the research questions and a discussion about the changing trends of family and education in the UK. Thereafter the analytical framework is discussed, including a brief introduction to the theories which are tested in this thesis. A more detailed analysis of the theoretical literature will feature in the relevant substantive chapters. Chapter summaries, which offer a brief outline of the aims and main findings, precede a discussion about the datasets and limitations, before some concluding remarks.

## Study Rationale

Family background is the most influential factor on student achievement (Lee and Orfield, 2005; Gamoran, 2001). Children from less advantaged class backgrounds achieve lower levels of educational attainment than children from more advantaged backgrounds

(Erikson et al., 2005) and this relationship is relatively stable despite educational expansion and inclusion policies (Breen & Goldthorpe, 1997; Shavit & Blossfeld, 1993).

The strong and persistent relationship between family background and educational attainment in observation studies has prompted a number of competing explanations. These explanations have focussed on resources (Blake, 1981a; 1981b; 1986; 1989); parenting styles (Baumrind, 1978; Kohn, 1977; Lareau, 1989; 2003); social capital (Coleman, 1988); education support (Gamoran, 2001); and cultural knowledge (Sullivan, 2008). Others have argued that what best explains these inequalities are preferences which are shaped by the environment in which they live (Boudon, 1974; Erikson et al., 2005; Jackson et al., 2007).

The focus of this thesis is to identify the consequences of family factors on educational outcomes variables. This thesis includes a study of family resource allocation and therefore focuses on what Boudon would call primary effects (Boudon, 1974). Primary effects refer to the influence of social origin on the level of educational performance; they may be social, cultural or genetic in nature. In contrast secondary effects operate through the educational choices the child and the family make within the limits of their own ability and performance. Empirical tests of Boudon's theory have found that primary and secondary effects are self reinforcing, and that the secondary effects account for between one quarter and one half of all class differentials for educational transitions at age 16 in England and Wales (Jackson et al., 2007). As well as presenting this finding Jackson et al. makes a cautionary remark:

*'[It is] a serious error to ignore Boudon's distinction between primary and secondary effects and to discuss class differentials in educational attainment as if only primary effects were involved.'*

(Jackson et al. 2007; 224)

However I would argue that there is value in investigating primary effects as they are deeply complex and difficult to disentangle. This is particularly true in the family where a vast number of parental decisions and family interactions can influence the educational performance of children. By studying the family in this way, particular characteristics which present a challenge for a child's educational attainment can be identified. Furthermore Jackson et al. (2007) identify that primary effects account for 76% of the total social background effect in the UK in 2001, which is no small number. Although secondary effects are, in many respects, seen as more important (Boudon, 1974; Erikson et al. 2005; Jackson et al. 2007) they stem from the primary effects, so there is much to be gained from understanding the issues at the source.

## Aim and Research Questions

The aim of this thesis is to identify in what ways the family matters for the educational outcomes for children in the UK. In order to address this aim, this thesis attempts to answer six research questions.

1. Is family size associated with familial resources?
2. Is having a large family associated with lower levels of objective and subjective educational outcomes and has this changed over the 20$^{th}$ century?
3. Is there any evidence that family size is associated with the emotional health and life perspectives of young people?
4. Is there any evidence that family size is associated with the degree of confidence and sociability outside of the home?
5. Do parenting strategies vary by family size?

6. Is there evidence of a causal relationship between family size and educational outcomes?

This thesis uses cohort comparisons and a longitudinal design to identify the effects of family factors on a mixture of dependent outcomes including a study of quantitative and qualitative educational advantage, social outcomes and measures of wellbeing. First, I replicate the findings from observation studies which show an association between family size and educational outcomes. The underlying assumptions of the resource dilution model are tested (Blake, 1981; 1981b; 1986;1989). Blake uses the term 'family size' and 'sibship size' interchangeably to refer to the number of siblings a young person has, I follow this precedent throughout. After this, using twins as an instrument, I show that there are reasons to doubt that the relationship between family size and educational outcomes is causal, which has consequences for future research. The British population[1] is studied in chapter two; the English population is studied in chapter three and four; and England and Wales are studied in chapter five.

### *Contribution and relevance of the research questions*

The research presented in this thesis will advance social theory by systematically explaining the processes within the family which contribute to children's educational attainment. The processes of interest include family resource allocation, family size, birth order, age spacing, parenting strategies and sibling effects. Furthermore this thesis makes a methodological contribution by including a test to establish whether endogenous factors may be driving the differences of educational attainment between and within families.

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[1] The Britain includes: England, Wales, Northern Ireland and Scotland.

The research questions, outlined above, are important for two main reasons. The first is that answering these questions helps to identify differential outcomes by family background. More specifically, this thesis will identify whether differences in attainment by family background are associated with differences in parental preferences. Comprehensively and systematically examining the changing influence of the family over time can inform family and education policy. Secondly, these research questions are more salient because of the recent changes in family size and education trends which will be discussed in the next section.

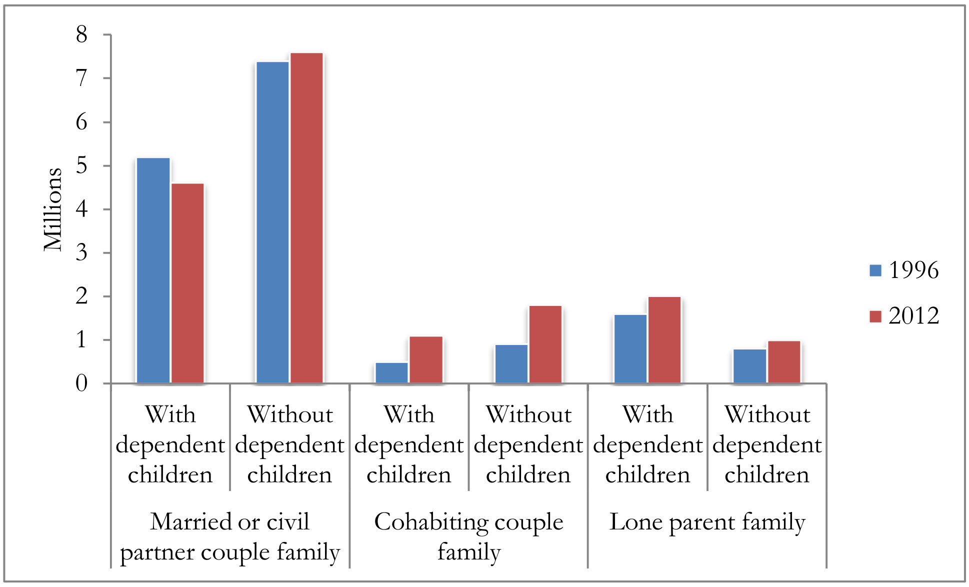
## Trends in the UK

### *Family Trends*

The family has changed much over the last century. There has been a long term decline in marriage in the UK since the 1895 (ONS, 2008a); divorce rates have increased since the 1970s and they have recently started to fall (ONS, 2008c); the incidence of cohabitation has increased in the UK; and the proportion of step families has grown, accounting for 10% of all families with dependent children in 2005. Legal changes such as the introduction of The Civil Partnership Act 2004, which came into force in December 2005, enables same-sex couples to have a legally recognised relationship status offering another way in which the shape of the families may change in the future. Furthermore fertility rates have declined, the total fertility rate (TFR[2]) for the UK fell sharply from the 'baby boom' peak of just under three children in 1964 to a trough of 1.69 in 1977. During the 1980s, it stabilised at around 1.8 children then fell to around 1.7 in the second half of the 1990s. The lowest

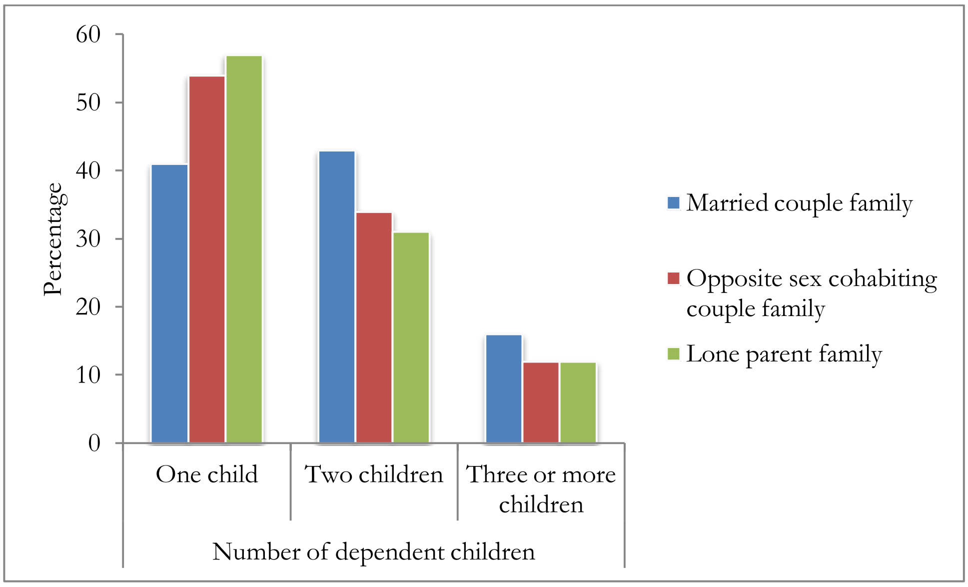
[2] TFR is the term used to describe the total number of children the average women in a population is likely to have based on the current age-specific fertility rates (ONS, 2012b).

**Figure 1.1: Families by family type in the UK, 1996 and 2012**




Source: Labour Force Survey 2012, reported in ONS 'Families and Households' (2012).

**Figure 1.2: Families with dependent children by family type and number of dependent children, UK, 2012.**




Source: Labour Force Survey 2012, reported in ONS 'Families and Households' (2012).

TFR figure ever recorded in the UK was 1.63, in 2001. Since then, fertility rates have risen each year, except 2009, and by 2010 the TFR had reached 1.98. (ONS, 2012b). There is evidence that women are delaying parenthood; in 1981 1.4% of mothers experienced their first birth aged 35-44; in 2004 the proportion was 2.9% (ONS, 2006). Increased access to medical interventions such as in virto fertilisation (IVF) may have enabled this choice.

Figure 1.1 shows that despite an increase in cohabiting couple families and lone parent families over the last decade, the married couple family is still the most common family type in the UK in 2012. 7.6 million households were recorded as having married or civil partners without dependent children, which is a increase of over 200,000 since 1996 (ONS, 2012a). This suggests some stability of the traditional family. 38% of married couple families and 39% of opposite sex cohabiting couple families had dependent children in the household. Single parent households with dependent children represent 26% of all families with dependent children in 2012. This is an increase of four percentage points since 1996, indicating that although there is an increase, the magnitude of this change is relatively small. The majority of these single parent households have women as the head of the family (91%) and this has remained stable since 1996.

Figure 1.2 is a cross-sectional report on family size and shows that 57 % of lone parents with dependent children have only one child; higher than both other family types. Further, only 12 per cent of lone parents have three or more children. Married couples with dependent children tend to have larger family sizes than any other family types. Family size is found to be correlated with a number of other characteristics such as age profile and mother's education. The changing age profile of those who marry, as a result of delay, increases the likelihood that fewer families will have children at all (Stevenson and Wolfers, 2007). In addition to this Ratcliffe and Smith (2006) found that there is an increasing polarisation of childlessness by education and that there is a systematic relationship between the mother's educational level and fertility: with higher levels of education predicting lower fertility.

Since the end of the nineteenth century scholars have commented on this family size decline. Dumont (1890; as discussed in Srivastava, 2004) explained this 'demographic revolution' by the desire to be upwardly mobile, which would be more difficult if the family size was large. Given that the resources are required in order to gain status, he argued that the presence of siblings dilutes the pool of resources available to each child. He predicted that the family size would fall as social opportunities through mobility increased:

*"Just as a column of liquid must be thin in order to rise under the force of capillarity so must a family be small to rise in the social scale."*

Dumont, quoted in Srivastava (2004: p44)

Notestein (1945) argued that these changes would contribute to a universal phenomenon called the demographic transition which all countries will pass though at some stage as a consequence of modernisation. This demographic transition is characterised by a decline in fertility and mortality. This was followed by the Second Demographic Transition (SDT) theory (Van de Kaa, 1987), which is a consequence of fertility declining below replacement level; decline in the total first marriage rate and an increase in mean age at first marriage; increase in divorce; increase in cohabitation; increase of extra-marital births and the adoption of modern contraceptive methods (Van de Kaa, 2002). Coleman (2004) argues that grouping these trends as a transition is not warranted and may be better explained as a set of preferences or lifestyle choices, as the empirical evidence does not support this one theory. However Lesthaeghe (2010) predicts that SDT will spread beyond Western societies. Macro-social differences in fertility are not directly concern the questions addressed in this thesis, but the SDT theory reemphasise the importance of individual choices such as family size decisions in influencing and explaining social differences on the population level. More recently the Third Demographic Transition (TDT) was proposed (Coleman, 2006). TDT predicts the transformation of ethnic and racial composition of European countries based on migration and fertility practices and theorises how populations will change according to differential fertility by different social groups.

The speed, diversity and perceived consequences of changes to the family have prompted some sociologists to remark on the 'inevitable' social decline and degeneration. Ogburn and Nimkoff (1955) and Goode (1963) argued that modernisation, in particular the separation between work and family, began the process of individualisation which serves to weaken the bond between family members. Popenoe (1993) argues that families have been compromised because they no longer adhere to a traditional family structure. Central to Popenoe's argument is that as a result of people becoming more concerned with self fulfilment and less willing to invest time and energy into family life, the nuclear family has weakened. And as a consequence there is a reduction in social and psychological wellbeing for the next generation.

Popenoe (1993) has many critics who observe that there may be some ideological bias operating in his analysis (Glenn, 1993; Stacey, 1993; Cowan, 1993 ), but they do not dismiss all of his claims. Instead they suggest that the main argument against Popenoe's hypothesis is that he doesn't provide sufficient empirical evidence. However Bumpass (1990) argues that Popenoe avoids the important question, which is not whether the family is in decline but instead what the nature of the family will be in the future.

The key family trends, as discussed in this section, point to continuity *and* change of the family in British society over the past fifty years. While there is some evidence of more complex family structures, marriage and the traditional nuclear family remain the norm for most people. At the same time, family size is changing, which reflects the changing preferences and constraints of couples.

### *Education Trends*

Research indicates that socioeconomically privileged children have advantages over children with a less privileged background and this relationship has remained stable (Hannum and Buchmann, 2003; Shavit and Blossfeld, 1993; Breen and Jonsson, 2000; Erikson et al., 2005). These advantages come in the form of the quality of the grades in school and institution type (qualitative advantage) and the educational levels reached (quantitative advantage).

This strong relationship between social background and educational outcomes makes understanding the mechanisms which influence these outcomes highly relevant to the policy agenda. Investigating this relationship also aids our assessment of levels of social justice, social mobility and social inequalities. Education is of particular interest to this study, as the UK has one of the strongest associations between social class and educational performance in the OECD (Hirsch, 2007). Furthermore there is evidence that socioeconomic status persists across generations (Bowles et al., 2005).

In addition to this, early work on school effects by Coleman in a large scale study in the United States found no relationship between school resources and the achievement of students, instead he explained the differences between students as being related to family and personal characteristics (Coleman, 1966). Jencks et al. (1979) took this further by saying that if all schools were as efficient as each other, attainment difference would only be reduced by less than one percent. The educational gap cannot be explained by school effects alone. However both Coleman's and Jencks' work have been criticised for only looking at macro level variables such as school facilities and resources and therefore may not have got to the heart of the school climate, staff norms and ethos which may yield different results. Nevertheless there is strong evidence to suggest that social background and the family environment play an important role in the educational outcomes of children.

Hirsch found a more generous estimation of the school effect with 14% of the variation in individual's performance being accounted for by school (Hirsch, 2007). In the UK studies have found some evidence of school differences on student outcomes, although it is difficult to separate the school influence from a selection effect as schools do not have a neutral intake of students (Reynolds et al., 1976; Rutter et al., 1979).

Halsey et al. (1980) examine the impact of class differences on access to different educational institutions in England and Wales between 1932 and 1972. The expansion of secondary education was hoped to widen the opportunities of young people, but their findings show that class and cultural capital were powerful predictors for entrance into the selective schooling[3] and this remained stable over 40 years (Halsey et al., 1980). Children from a service class background were three times more likely to attend a selective school than children from a working class background and they explained this by the differential availability of cultural and material resources in the family (Halsey et al., 1980). Boliver and Swift (2011) conducted analysis using the 1958 birth cohort from the National Childhood Development Study (NCDS). They found that comprehensive schools[4] were as good for mobility as the selective schools they replaced; once the child's ability is taken into account,

[3] Selective schools admit students based on academic criteria, in the UK this usually takes the form of the 11-plus exam, intended to be a general test of intelligence administered at age 11.
[4] Comprehensive schools accept all students, regardless of aptitude.

attending grammar schools, as opposed to comprehensive schools, does nothing to increase low-origin children's chances of being upwardly mobile[5].

The expansion of higher education opportunities in the USA and UK are well documented (Shavit et al, 2007). Prior to 1963, there were 31 universities, 10 colleges of advanced technology and 100 teacher training colleges in the UK. Degree teaching expanded in the 1980s in order to provide the skilled labour which could cope with the demands of the economy (the shift from primary to tertiary industrial sectors and the aftermath of a recession). Incorporation of polytechnics into [new] universities followed in 1992, resulting in over 169 higher education institutions in 1997 in the UK. Despite the changes within the sector, the extent to which class inequalities have been addressed is limited. Working classes remain underrepresented in higher education, parental education continue to be a strong predictor for success in higher education and class origin determines the eligibility for completion of a degree course (Shavit et al, 2007).

Raferty and Hout (1993) propose another theory for this persistence of inequality, based on their work in Ireland. Maximally Maintained Inequality (MMI) describes a situation where because the higher class backgrounds are better placed to take up these new places created by educational expansion, the absolute participation rates increase for all classes alike, but relative differences in participation rates persist. Once the participation rate for the most advantaged class reaches saturation point, relative inequalities will necessarily decline with further expansion. The outcome, according to this theory, is that if the demands of the upper classes are not saturated, the lower classes will not have the opportunity to enter into higher levels of education, thus creating and sustaining vertical inequality. The expansion of higher education, particularly in the UK, saw not only greater numbers of institutions,

[5] Attending grammar school was found to protect those from a service-class origin against downward mobility (Boliver and Swift, 2011).

but also greater differentiation between institutions. Raferty and Hout therefore neglect the horizontal educational advantage of the higher classes and subsequent discrimination of the lower classes, which Lucas (2001) addresses in his work.

Lucas (2001) proposed a theory of Effectively Maintained Inequality (EMI). He suggests that unlike MMI, which promises no competition when education is universal, EMI will still find competitive factors even when education is universal. For Lucas, the competition is derived from the high differentiation between type of university and subject studied. In principle EMI suggests that educational expansion does increase the educational opportunities of the lower classes, but it does not make the system any more equal. Although there is some equalisation quantitatively - more students from all backgrounds proceed to higher education - the socioeconomically advantaged seek out a qualitative advantage (for example through applications to 'old' or Russell Group universities or a more prestigious subject choice[6]). Thus inequality will persist within the education market by comparison of perceived value. By this definition, inequality will always persist in education as competitive advantage will always be sought and achieved more readily through differentiation of institution by the service classes. Therefore the increase of university places actively encourages a market which seeks qualitative advantage.

These works have identified that despite widespread educational expansion we have not seen a reduction in inequality. Education does not mitigate the effect of socioeconomic status on life chances and there is an incredibly strong link between education and class origin, which suggests that there is little evidence of equal opportunities (Marshall et al.

[6] Russell Group universities are research-intensive universities; 'old' universities include higher education institutions which were established prior to 1992; 'new' universities are those which were established or incorporated post-1992 (Boliver, 2005). Prestigious subjects are orientated towards professional occupations for example medicine (Boliver, 2005).

1997). Dardanoni, Fields, Roemer, Schnacez-Puerta (in Morgan et al. 2006) explain that things are equal in a society if:

*'...the chances that individuals have to succeed depend only on their own efforts and not on extraneous circumstances that may inhibit or expand those changes, what is contentious, however, is what constitutes "effort" and "circumstances.'*

(Morgan et al., 2006, 59).

They identify a number of channels through which transfer of status occurs: through social connections by influencing preferences and aspirations; by helping the child to form beliefs and skills through family culture and investment; and a genetic element through ability. They conclude that equality of opportunity could only exist if there was equality of family influence on preferences. To achieve this would require powerful family interventions, and even with such interventions, the outcomes may not be effective if the choices made by the parents were artificially equalised.

Educational attainment remains a useful measure for human capital, cultural understanding, preferences and ability because its variation captures both the young person's origin and destination. Furthermore educational attainment is a popular measurement in social surveys and therefore makes it an attractive and accessible variable to use for comparison particularly as it says so much about an individuals' social status and potential in the labour market.

## Analytical Framework

The desire to explain the relationship between family background and educational outcomes has produced a number of theories which have emerged from a range of disciplines (e.g. sociology, economics, biology and evolutionary psychology). In order to explore in what ways the family matters for the educational outcomes for children, the problem must be broken down into the elements which make it easier to solve. The analytical approach adopted is informed by social mechanisms detailed by Hedström and Swedberg (1998). This approach takes the view that we should try to make sense of individual behaviour in order to contribute to an explanation for some social phenomena.

Hedström and Swedberg's (1998) approach offers three types of mechanism for consideration: the situational, the action formation, and the transformational. Situational mechanisms are examined in this thesis by looking at how the exposure to a particular family context influences educational outcomes. Linked to this are the action formation mechanisms which relate to the beliefs, desires and opportunities of the actors. Although this is not directly examined in this thesis, some aspect of aspirations of the actors are tested in chapter three and chapter four. The transformational mechanisms relate to how individuals interact with others, in this case through parental involvement and sibling interaction. This thesis seeks to identify and describe whether there is any evidence of these mechanisms. However, a considerable limitation of this work is that it cannot offer certainty about the direction of causation for these mechanisms.

The study of social mechanisms requires detail about which particular component performs, or fail to perform, in relation to the dependent variable (Merton, 1967). In relation to this thesis the factors of interest include family resource allocation and parenting strategies. A brief summary of the theories used to explain the relationship between family background and education are outlined below. More detailed analysis of this literature is offered in the relevant substantive chapters.

### *The Resource Dilution Model and its Critics*

Hirsch (2007) argues that many working class children fall behind in education because of their home environment. The home environment is a source of social, emotional and material resources. Similarly, Blake notes that family resources, including parental skills, human capital and physical resources, are the mechanisms for educational inequality (1981a; 1981b; 1986; 1989). However, access to these familial resources is dependent on the number of children in the family. She finds that as the number of siblings increase, educational attainment decreases. This theory explains why children from larger families have lower educational outcomes than children from smaller families.

In his analysis of recent tests of the dilution model, Downey considers the reasons why there are different results in different national and cultural contexts. He notes that studies which report a weak relationship between family size and educational outcomes have social norms which support larger families (Downey, 2001). Extended families, beanpole families[7], or close communities may result in the child from larger families having interactions with alternative adults which can ameliorate the negative effects of resource dilution in contexts where larger families are prevalent. Shavit and Pierce (1991) and Downey and Neubaruer (1998) offer extended families as an explanation of different strengths of the resource dilution model between ethnic and religious groups. Despite these variations in the effects of the resource dilution in the family, Downey considers the theory to be the most promising explanation for why there is this negative relationship between family size and educational outcomes.

[7] Families which are long and thin with many older persons still living but with fewer children in the family (Bengston and Martin, 2001).

However Downey acknowledges that the relationship between educational outcomes and family size could be a spurious one. By this he means that it is difficult to separate the effects of parents choosing to have small families and these parents being the most likely to choose to invest heavily in their child's education (Downey, 2001). Unobserved effects may be operating through family size to create the association with child outcomes. Furthermore in *The Nurture Assumption,* Harris (1998) states that parental influence has been overestimated and instead, it is genetics and peer influences which are much more salient. However, Conley (2004) challenges Harris' thesis by arguing that her findings can be interpreted in a way that points to the fact that parents are important, as the children's environment is mostly chosen by the parents. For example to move to a particular country, to select a nanny, to send their children to a particular school, or to live in a particular neighbourhood provides the child with access to their peers. Parents make choices that select the institutional structure which generates the outcomes for their children, so in fact, parents do matter.

Zajonc argues the case for the confluence model which offers an alternative explanation to the resource dilution model; he suggests that the intellectual climate of the family is reduced by an increase of number of children in relation to adults (Zajonc, 1976; Zajonc and Markus, 1975; Zajonc, 1983). In addition to this they extend their work to consider birth order and argue that last born children and lone children are at a disadvantage because they are unable to teach their younger siblings. A lone child disadvantage that has been found by a number of researchers (Rodgers, 2001; Blake, 1989; Iacovou, 2008; Booth and Kee, 2009) which can be explained by the confluence model, but this is not a consistent finding. Furthermore it is difficult to identify the manner in which siblings spend their time together due to data constraints. In addition to this there are some concerns about the way that the intellectual climate of the household is captured (Rodgers 2001; Rodgers et al. 2000) making it a theory which is difficult to falsify.

There are some objections to the operationalisation of the resource dilution model. Some critics focus on the absence of birth order in the model (Booth and Kee, 2009: Iacovou, 2008), the absence of spacing between siblings (Powell and Steelman, 1993: Gailbraith, 1982: Kidwell, 1981) and the absence of gender composition (Heer, 1985). These criticisms highlight the limitations of large quantitative datasets, but do little to destabilise the theory itself.

There is additional concern with regard to the degree of influence the family can have, particularly when a young person reaches adolescence. However Alwin & Thornton (1984) challenge this, they found independent effects of family size on school achievement using an 18 year longitudinal study. In particular they found that early family size measures have a stronger role than socioeconomic factors in cognitive development and school achievement, while in later stages, they found that larger family size has a negative effect on preparations for college, including aspects of financial support. Therefore Alwin & Thornton (1984) suggest the type of resources required may vary by age of the young person and stage in their educational progression.

Resource is a prominent feature in the other explanations regarding family size. Gary Becker offers some insights into the reasons why we have seen a reduction in family size in the most developed nations, particularly the observation that as income increases the number of children in the family decreases (Becker, 1960; Becker and Tomes, 1976; Becker, 1981). He argues that there is a trade off between child quality and child quantity (Becker, 1960). This theory is based on the conception that the home activities have a production function and the aim of parents is to seek to maximise the utility of the family through decisions made about familial inputs and outputs. According to Becker's theory, children are considered a good like any other and so in order to produce a high quality child (measured through child achievement) parents must be willing and able to invest in the child despite budget and time constraints. As these resources are limited, parents must choose whether they will have many children, which will spread the resource thinly, or fewer children in order maximise their quality. This theory has been tested relating to the budget constraints of the parents (Becker and Tomes, 1976; Behrman and Taubman, 1986; Behrman et al., 1982) and through parental time investments (Hanushek, 1992).

Bowles et al. (2005) argue that economic transfers of property and economic resources explain less of this advantage than previously thought, although is still important to social outcomes. Mayer (1997) finds that additional income may provide the opportunity to pay for private schooling, extra tuition, extra-curricular activities and materials such as workbooks and texts. Furthermore additional income serves a secondary function, as it may increase the opportunity for parents to spend more time with their children as they can afford not to work in shifts.

Mayer takes an alternative view on the impact of income: he argues that poorer parents may be more stressed than those with a higher income level and this stress diminishes the quality of non-monetary transfers to children (Mayer, 1997). This may reduce the emotional development of the child and consequently the child's educational opportunities are restricted. The implication of these theories is that an increase in income would explain the educational gap. However Mayer finds that the relationship between parenting style and income is weak as doubling parental income provides no improvement on warmth, nurturing and discipline practices of parents; consequently income alone is not enough to improve children's social outcomes substantially (Mayer, 1997). Morgan and Kim (2006) offer a cautionary note for just using income as an explanatory measure. They argue that sociologists should avoid using wealth as a one-dimensional variable: they ask us to consider the meaning of such a resource. For them, wealth is an indicator for behaviours including success, ability to defer gratification, ambition, educational investment and ability to save.

### *Siblings as a Resource*

While the resource dilution theory concentrates on the disadvantages of having a large number of siblings, Downey (2001) argues that having siblings may be beneficial to children as they can serve as a resource. Siblings may provide a young person with insight, protection or emotional support. This support is distinct from parenting support, particularly as siblings closely share their experiences of life. In addition to this, being a sibling enables an individual to experience and address conflict and issues of fairness from a young age. Sorensen (2008) found that older sibling children benefit from the experience of teaching their younger brothers and sisters, and that in addition to improving cognitive development, having siblings should reinforce the child's own knowledge. Sorensen's work suggests that the differences go beyond objective educational attainment in the form of grades or highest education achieved and therefore it may be useful to examine issues relating to self concept, confidence, aspiration and belief in progress made.

### *Parenting Strategies*

In addition to the family resources identified, the attention, time and warmth that parents offer their children is another factor which can explain educational differences. These factors can be measured through parenting strategies. Baumrind (1978) created a typology of parental styles based on a psychological analysis and considered the effectiveness of each style related to social competence of children. She identifies the parental styles as: authoritarian, which follows a strict convention; authoritative, where parents wield authority in a democratic way; and a permissive style which allows children to set their own boundaries. Permissive parents can either act in a warm, careful and caring way, or may be cold and uncaring, which can be viewed as neglectful. Chan and Koo (2011) found that parenting style, using Baumrind's typology, is not associated with parental education or class after controlling for family structure. But they did find statistically significant associations between parenting style and a number of subjective measures, including wellbeing, health, high risk behaviours and self esteem, and a number of objective measures, including academic achievement and school enrolment.

The link between socioeconomic status and parenting strategies was also studied by Kohn (1977). Kohn described the relationship between work values and parenting values of the class. He found that middle class parents are more likely to value children's self direction, and working class parents are more likely to emphasise their conformity to external authority. This highlights what he sees as the main difference between the middle classes self-governing style and the tendency for the working classes to subsume their power to an external governor, preparing the child for their role in the labour market. Kohn and Schooler (1983) later identified the importance of social class on parenting and childrearing values based on stratification of personality traits, drawing on both sociological and psychological literature.

Lareau (2003) finds that the socioeconomic status makes a difference in the 'cultural logic of childrearing'. Her theory suggests that middle class parents adopt a strategy of concerted cultivation which involves linguistic culture, or language used in the home;

interventions in institutions in order that their children get the best opportunities available to them; organising their child's days so that in their free time they are cultivating a talent. Lareau suggests that working class parents, on the other hand, adopt a strategy of natural growth, so that children spent more unstructured time at play, and parents are less likely to intervene on their behalf in institutions. The parental focus of the working class is on feeding, housing and clothing their children. Lareau's research is qualitative however the theories have been tested quantitatively by Bodovski and Farkas (2008), who examined the effects of concerted cultivation strategies for children in elementary school in the USA. They found that parental socioeconomic status is positively and very strongly associated with concerted cultivation, also that concerted cultivation impacts on test scores as well as the teacher's judgement of student language and literacy skills. Although their finding of a direct effect of concerted cultivation on achievement is modest in size, their work does suggest that Lareau's theory has some explanatory power.

The key education trends, as discussed, point to expansion of educational opportunities but stability of inequality. This is due to the strong correlation between family background and educational attainment.

## Chapter Summaries

The structure of the thesis is outlined below. There are four substantive chapters; each includes a review of literature, data and methods section, findings and summary in which specific research questions will be addressed.

*Chapter two: Testing the Resource Dilution Model in Britain, 1948-1976*

Chapter two makes use of the British Household Panel Survey (BHPS) to measure the stability of the resource dilution model for those born in the UK between 1948-1976. This chapter tests whether family size varies by social class before running a series of tests of the resource dilution model. Interactions between family size and number of different resources including parental education, family structure, number of books in the home and socioeconomic status predict the highest qualification achieved. They key findings from this chapter are: resources do vary by family size; and there is evidence of the resource dilution model in the UK. There is little evidence that the strength of the resource dilution effect has weakened for cohorts born between 1948-1976. In terms of relative importance, family size is second only to socioeconomic status as a predictor of highest education achieved.

*Chapter three: Exploring the Educational Advantages and Disadvantages of having Siblings in England*

Chapter three takes advantage of the detailed family and education variables in the Longitudinal Study of Young People in England (LSYPE) to identify whether there are any advantages or disadvantages of having siblings. In addition to GCSE grade achievement, the resource dilution model is used to predict subjective measures of education including whether the young person likes school; their own perception of the progress they are making at school; and higher education aspirations. To understand the young person's educational environment further, the resource dilution model is used to predict the young person's emotional health, perspectives on life and social skills. The findings from this observation study suggest that there is evidence of the resource dilution model, as family size increases the probability of achieving five good GCSEs reduces; however there is no evidence that a change in resources in the two years prior to GCSE assessment, as a result of an increase or decrease in family size, influences the educational outcomes significantly. Furthermore subjective measures of educational success vary by family size, particularly for university aspiration and confidence. Children from larger families are more likely to report lack of control over their life and have poor emotional health and some evidence that those with five or more siblings are more likely to experience being bullied; however there is evidence that having siblings increases the socialising opportunities both inside and outside of the home.

*Chapter four: Do Parenting Strategies Differ by Family Size?*

Chapter four is concerned with the parenting strategies literature, in particular the theory of Annette Lareau (2003). The LSYPE data is used to operationalise 'concerted cultivation' strategies, which involves: communicating with children; being involved in the child's education; and organising the child's time. First there is a test of whether concerted cultivation practices vary by family size. Second the efficacy of these parenting strategies is tested in relation to objective and subjective education measures. The findings show that parenting strategies do vary by family size net of background controls and the inclusion of these parenting strategies as a familial resource ameliorates the negative family size association. Furthermore concerted cultivations strategies positively predict GCSE achievement. In addition to this concerted cultivation strategies have differential effects on subjective measures of education, demonstrating the efficacy of these parenting strategies net of observed family resource.

*Chapter five: Testing Resource Dilution Using Twins as an Exogenous Increase in Family Size*

Chapter five makes use of the Office of National Statistics (ONS) Longitudinal Study which allows age spacing identification, enabling twin children to be identified. This chapter models an exogenous variation in family size due to the incidence of a twin birth to determine whether resource dilution effects exist for siblings of twins. The results indicate there is no evidence of resource dilution when families experience an exogenous increase in family size as a result of a twin birth. Implications of this finding are offered in this chapter.

*Chapter six: Conclusion*

The conclusion draws together the existing literature and a review of the empirical findings presented in this thesis to compose an argument about the manner in which the family is influential for a young person's educational outcomes. The concluding discussion focuses on the theoretical and methodological contribution including a discussion about limitations and avenues for future research.

## Data sets

This section includes a brief introduction to the datasets used in this analysis. More detailed information about the different measures collected in the study is given in individual chapters.

### *British Household Panel Survey*

The British Household Panel Survey (BHPS) is the dataset used in chapter two. It began in 1991 and is a multi-purpose study funded by the Economic and Social Research Council. As a panel survey it follows the same representative sample of individuals over a period of 18 years. In 1991 5,500 households were recruited from the Postcode Address File, using a stratified clustered design. All individuals within the household were interviewed. The same individuals were re-interviewed each successive year and new households were added if individuals from the original panel moved or split-off. Another source for new members joining the sample is when children in the household reached the age of 16. A booster sample of 1,500 households was added in 1999 for Scotland and Wales to enable cross-country analysis and in 2001 2,000 households were added from Northern Ireland. The BHPS has now been incorporated and replaced by a similar household panel survey known as Understanding Society.

### *Longitudinal Study of Young People in England*

The Longitudinal Study of Young People in England (LSYPE) is funded and managed by the Department for Education and Skills (DfES) (now the Department for Education (DfE)), and is a multi-site panel study of school children across England. It brings together data from a number of sources including interviews with young people, their parents and teachers[8]. The study started in 2004 when the young people were aged 13 and they were interviewed annually until 2010, resulting in seven waves of data.

[8] Parents and administrative sources were only interviewed in the first four waves of the LSYPE.

Sampling for the study was achieved via a stratified random sample with disproportionate sampling for deprived schools[9]. Schools were the primary sampling units, then children within schools. The sampling procedure was weighted to ensure that children from ethnic minority backgrounds had the same chance of being selected than their white counterparts, resulting in a substantial oversampling of non-white children.

In the first wave, around 15,500 young people were interviewed as part of the survey and the existing survey respondents were returned to every year for interviews. The response rates from Wave 1 – Wave 7 were 74%, 86%, 92%, 92%, 89%, 87% and 90% respectively. The final sample size at Wave 7 was around 8,700. To account attrition and other forms of non-response, two strategies were employed by the research team. The first was to create analytic weights which can be applied to the data for cross-sectional or longitudinal analysis (separate weights for each). These weights try to account for both attrition and study design (i.e. clustering). In descriptive tables, appropriate cross-sectional weights have been applied unless otherwise stated. The second strategy was to introduce a booster sample in wave four which consisted of 352 new participants. The LSYPE is used for the analysis in chapter three and chapter four.

### *The Office of National Statistics, Longitudinal Study*

The ONS Longitudinal Study[10] (LS) is a linked set of complete census records for individuals. A sample was drawn from the 1971 Census data comprising people born on

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[9] 35% or more pupils are entitled to free school meals.

[10] The permission of the Office for National Statistics to use the Longitudinal Study is gratefully acknowledged, as is the help provided by staff of the Centre for Longitudinal Study Information & User Support (CeLSIUS). CeLSIUS is supported by the ESRC Census of Population Programme (Award Ref: RES-348-25-0004). The author alone is responsible for the interpretation of the data. Census output is Crown copyright and is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.

one of the four selected dates[11]. The census files from 1981, 1991 and 2001 are linked to the 1971 data so that some life events could be recorded for LS members including family characteristics; fertility history; economic activity; ethnicity; educational qualifications; occupation and social class. This is not a household panel survey so information is not known about the educational outcomes of siblings, but there is information regarding sibship composition and age spacing. It makes up 1% of the total population of England and Wales and records over 30 years of life events. New sample members found in the 2011 Census will be added to the sample and will be made available in the summer of 2013.

New LS members enter the study through birth and immigration and existing members leave through death, emigration and incomplete census forms. Advantages of the LS are that it is a continuous sample of the population of England and Wales rather than cross-sectional and it includes records for over 950,000 individuals. Its size ensures a sample size large enough to provide statistically useful results, including results concerning ethnicity and people in multi-family households. Limitations of the LS come in the form of the range of variables available which are drawn from the Census questions. The Census questions must enable comparison over time so cannot change substantially; in addition the questions must meet the needs of a considerable number of stakeholders including the general public.

## Limitations

This thesis explores the choices that parents make regarding their fertility strategies, parenting strategies and allocation of resources given the constraints they face. The

[11] These dates are confidential.

analysis is based on actual reported behaviours of individuals and not the intended reported behaviour of individuals.

There are also limitations with regard to the manner in which 'resources' are measured. This is particularly important as some familial resources are flexible and likely to change over time, while others remain stable. Resource change is taken into account in the analysis where the data allows.

This thesis does not explore the parent-child relationship as a two-way process, instead it is assumed that the parent-child relationship is stronger than the child-parent relationship and so for the purpose of this thesis parenting is assumed to be something that passively happens to the child. With respect to resource allocation this is a reasonable assumption to make, but it may be more complex when considering parenting strategies as in reality the relationships may be much more dynamic - the nature of one child may determine the choices that parents make relating to subsequent fertility decisions and the parenting strategies adopted with another child. Therefore it is a limitation of this current work that these detailed interactions cannot be unpacked but it remains an opportunity for future analysis.

This work does not compare the strength of the family size effect in the UK with another country or context. This makes it is difficult to identify what effect cultural norms have on family preferences and indirectly on educational outcomes. Furthermore there is no test which identifies the probable implications of moving from a society in which most people come from larger families to one in which most are from smaller families. However there is some effort to identify the strength of the resource dilution model over time.

In addition, this thesis does not take into account the secondary factors which influence educational progression and which are acknowledged to be greatly influential. Instead the thesis focuses on primary sources of influence, such as those family resources and interactions.

Lastly the current analysis does not take into account the increasing number of multi-family households in the UK. The ONS (2012a) observe that households with two or more families were the fastest growing household type, increasing by two thirds from 167,000 households in 1996 to 281,000 households in 2012. They still only account for 1% of all households in 2012, but this may present an opportunity for future research to examine the effects of resource dilution with non sibling children in the household and with multiple adult caregivers.

## Summary

This focus of this thesis is to identify the family factors which matter for educational outcomes. It is guided by an understanding that there are a number of different components of family life which may contribute to educational attainment and achievement. Specifically the research will focus on the division of resources within the family: resource allocation; family size; the influence of siblings; and parenting strategies. Within this context, this thesis sets out to examine parenting choices using observation data from cohort and longitudinal studies and a range of quantitative methods. Furthermore this thesis seeks to identify whether unobserved factors may be driving part of the differences in educational outcomes using advanced statistical techniques. This approach is intended to capture family differences whilst reflecting the broad nature of social inequalities. The next chapter begins by testing the resource dilution theory in order to identify whether the effect has strengthened or weakened over the twentieth century and the type of resources that matter.

# Chapter 2: Testing the Resource Dilution Model in Britain, 1948-1976

## Introduction

The aim of this chapter is to examine the relationship between family size and educational outcomes using data of subjects born in Britain between 1948-1976. The British Household Panel Survey (BHPS) is used to test whether there is evidence of resource dilution (Blake, 1981a; 1981b; 1986; 1989) as family size increases the resources available to each child decreases. Next there is a test to identify whether as a result of this resource dilution there is evidence of a family size effect on educational outcomes. Thereafter a cohort analysis will be undertaken and the magnitude of the family size effect will be established in relation to other important predictors of educational outcomes such as class and parental education. The concluding discussion focuses on whether support is found for hypotheses derived from the existing literature which is discussed below.

## Review of Literature

As discussed in the previous chapter, the family plays an important role in the educational attainment of children, through provision of economic resources (Blanden and Gregg, 2004; Reay et al, 2005; Smith and Noble, 1995), intellectual input (Bourdieu and Passeron, 1977; Ball et al. 1994: Sullivan, 2001) and emotional stability and support (Marsland, 1996; Murray, 1994). The family can be a source of security, material resource, knowledge and opportunities for learning. A number of studies have identified that intellectual ability and educational attainment is correlated with the number of siblings in the home: where achievement is better for those with a fewer number of siblings (Blau & Duncan, 1967;

Downey, 1995; Featherman and Hauser, 1978; Zanjonc & Markus, 1975; Marjoribanks, 1974). To explain how the benefits and disadvantages of family membership are conferred across generations, Blake proposed the resource dilution theory (Blake, 1981a; 1981b; 1986; 1989).

The resource dilution theory draws on a number of theoretical strands; cultural capital (Bourdieu, 1977), social capital (Coleman, 1988) and human capital (Becker, 1964) and is concerned with the division of parental resource. Blake considers the important resources to be the home environment, the number of books in the home and necessities for life (Blake, 1981a; 1981b; 1986; 1989). Also included in the description of resources are the opportunities for learning that parents provide their children through engaging with the outside world, as well as attention, intervention and making educational resources available for children.

Blake's own test of the model identified differences by family size on educational attainment, intellectual ability and educational aspirations and expectations (Blake, 1981a; 1981b; 1986; 1989). She found that individuals within a larger family have fewer years of graded schooling compared to those from a smaller family, she also notes a qualitative disadvantage of lower grades for individuals with three or more siblings (Blake, 1986). In addition, Blake finds that family size is as powerful as class as an explanatory variable for educational attainment (1989). Indeed Blake finds that advantaged parental socioeconomic status mitigates the negative effects of increasing family size (Blake, 1989).

*Empirical tests of the Resource Dilution Model*

The most persuasive empirical contributions identify a strong negative relationship between family size and academic advancement, including intellectual development, academic performance in school and educational attainment (Blake, 1981, 1989; Blau and Duncan, 1967; Downey, 1995, 2001; Heer 1985; Steelman 1985; Steelman and Powell, 1989; 1991; Steelman et al, 2002). In addition to the interest in the relationship between family size and intellectual development in this work, there remains a broad interest in how family composition, including birth order, shapes the way in which advantages and disadvantages are conferred on children (Conley, 2004; Iacovou, 2001; 2008; Booth and Kee, 2009).

*The Importance of Birth Order*

Blake (1989) sets out a number of important points while considering the relationship between birth order, family size and educational outcomes. Firstly she notes that later-born children are more likely to be born into larger families, and so she stresses the need to decompose family size from birth order. Secondly, because later-born children are more likely to be born in later years, she stresses the need to control for cohort effects. Thirdly, because later-born children are more likely to have older parents at birth, she stresses the need to control for parent age and cohort effects. Despite Blake's insights regarding the measurement of birth order, measurement strategies are considered by some to be ad hoc (Ejrnæs and Pörtner, 2004).

Booth and Kee (2009) support Blake's view that decomposing family size and birth order effects is necessary to ensure that the effects are not conflated: they state that it is important to know whether a sixth child performs poorly at school because he/she is one of six or if it is because he/she has a high birth position. Their method to separate the effect of family size and birth order is to create a birth order index which is independent of family size (Booth and Kee, 2009). Black et al. (2004) estimate birth order effects for given family sizes, a method also adopted by Iacovou (2001, 2008) who creates dummy variables which capture both family size and birth order. The estimates pick up the effect of being the middle or youngest within the family relative to being the eldest child in the same family size. This method increases the number of predictive variables which can create small cell sizes. Ejrnæs and Pörtner (2004) adopt a strategy which estimates intra-household allocation using family fixed-effects with both absolute birth order and relative birth order measures.

The strategy adopted in this thesis follows Booth and Kee's birth order index (Booth and Kee, 2009) as it efficiently separates the effects of family size and birth order while retaining the predictive power. This will be explained in more detail in the data and methods section of this chapter.

The empirical tests of birth order have yielded quite interesting results. Booth and Kee (2009) find that higher birth order children receive a lower share of family resources and that this translates into lower educational attainment. They argue that this is the case for a number of reasons: parents have more time with early-born children compared to later-borns. In addition to this they develop a greater sense of responsibility with their early-born children and by the time they have their later-born children, mothers are older and have less time and energy relative to the family size. However it is suggested by Ejrnæs and Pörtner that although early-born children in the family might receive more parental attention, the standard of living may be higher for later-born children (Ejrnæs and Pörtner, 2004). They find that later born children have an advantage over early born children as a result of the additional resources which have come about as a result of the mother's advanced age.

Iacovou finds there is a negative correlation between number of siblings and educational achievement, however she finds that lone children perform less well in education than those from a two-child family (2001).

*Other Considerations for Testing the Resource Dilution Model*

As discussed briefly in the introduction, there are a number of other family composition factors which may influence the way that resources are allocated in the home. Age spacing among children is important as siblings who are close to each other in age are competing more directly for the necessary resources than those with less similar demands who are distant in age. Siblings who have large age gaps between them tend to experience less detrimental effects of dilution (Powell & Steelman, 199; 1993; 1995). However the BHPS does not include age spacing measures and so this will be examined in chapter five with the LS Census data which has this detailed level of information about the family.

It is possible that parental investments in children varies by gender of the child, however the results are mixed. The Trivers-Willard Hypothesis outlines this thesis in the form of resource allocation biasing (RAB), as discussed in Keller et al. (Keller et al., 2001). The argument suggests that under different social conditions (e.g. social class) parents invest in their children differently by gender: under good conditions parents will bias their investments towards their son and in poor conditions they will bias them towards their daughters. However the evidence to support this hypothesis is mixed: Freese and Powell

(1999) found that parental status and parental investment for US eighth-graders did not support the investment expectations of the Trivers-Willard hypothesis. Keller et al.(2001) also found little evidence to suggest that parents in the US allocate their resources in the way predicted by this hypothesis. However Kanazawa found that there was evidence to support the Trivers-Willard hypothesis in the USA when examining investments made on children aged 5-18. He found that parents in poorer families in the USA favour daughters over sons, while those in wealthier families favour sons over daughters (Kanazawa, 2001). The difference in results can be explained by different operationalisation of the investments examined.

Conley (2000) makes the case that it is not about differential treatment of boys and girls instead it is an issue of minority representation within the family which sees different investments. For example in a family with two girls and one boy, the boy will have some of his gender specific needs unmet and may experience sex-role socialisation within the family that is not compatible with educational expectations.

Due to data limitations, gender composition of the family will not be controlled for or tested in this thesis.

## Aims and Hypotheses

As the resource dilution model is central to this thesis, this empirical chapter seeks to situate the theory in the British context using the British Household Panel Survey (BHPS) data.

Given the points outlined in the literature review, this chapter has three main aims in order to begin to understand the nature of resource dilution in the UK. The first aim is to establish whether a relationship between family size and resources exists. The second is to establish whether, as a result of a dilution of resources, there is a correlation between family size and educational attainment. The third is to examine the extent to which the resource dilution model has changed for the cohorts studied. Lastly, the magnitude of the family size effect relative to other predictors for education effect will be identified.

The preceding sections of this chapter will test a number of hypotheses derived from observations from the literature. A useful starting point would be to disprove the null hypothesis and begin by claiming that there is no relationship between family size and resource dilution. If this hypothesis can be rejected, we can then move on to assessing what relationships between family size and educational outcomes do exist, establish the magnitude of this effect in relation to other socio-economic variables and whether these effects have changed over time. Specific hypotheses are set out below:

H1 There is no relationship between family size and available family resources

H2 There is evidence of resource dilution in the UK: there is a negative relationship between family size and educational attainment net of family background controls

H3 The strength of the resource dilution model has changed across birth cohort net of family background controls

H4 Family size is a stronger predictor of educational outcome compared with class background.

H5 Family size is a stronger predictor of educational outcome compared with parental education, family structure and number of books in the home.

## Contribution

The research presented in this chapter contributes to the field by aiming to provide a better understanding of family size and birth order effects in the UK. This study indentifies whether resources differ by family size. In addition to this, this chapter offers a more detailed descriptive picture of resource effects and challenges some of Booth and Kee's methodological approaches (Booth and Kee, 2009). Furthermore this study sheds light on interactions between particular familial resources and family size and examines the effects of changing resources, family size and educational expansion. This chapter also attempts to offer a context in which to situate the research of the remaining chapters.

## Data and Methods

The data used to test these hypotheses is from the British Household Panel Survey (BHPS). The BHPS is a nationally representative, random sample of households which are followed over a number of years in Britain. The study began in 1991 with 10,200 individuals, with additional samples from Scotland and Wales added in later waves. The BHPS currently has 18 available waves, but it is wave 13 which is of particular interest as it includes data about family size, birth order and other descriptive variables of the respondent's life aged 14/15 (including whether their mother worked when the respondent was younger, parent's occupational status and family structure). Wave 13 was collected in 2003-2004. In line with Booth and Kee's (2009) methods, the sample is restricted to individuals between the age of 28 and 55. This ensures that those included in the sample will have a completed family size and are likely to have completed their education by 2003, when wave 13 was collected. The final sample size with exclusions is n= 7,517[12].

The data offers an opportunity to analyse the respondent's highest educational attainment while also being able to identify the particular family attributes and parental characteristics. The family environment data was collected retrospectively and while this poses a risk for recall error, it is unlikely that respondents will incorrectly specify their sibship size and birth

12 Details about the exclusions made will be discussed later in this section.

position. The BHPS data does not include any information about the siblings of the respondent, beyond their number. This means that age spacing (including whether the respondent is a twin/triplet) and gender composition analysis is not possible with this data. Nor does the data allow identification of step siblings within the household. For the purpose of this analysis, the data is treated as cross-sectional. Therefore this work cannot satisfy authors such as Alwin & Thornton (1984) who believe that changes over time should be recorded as the family exerts different pressures over an individual's lifetime. The dependent variable is highest educational attainment of the respondent; there can be no analysis of information on grades or type of institution attended.

There are a number of additional methodological challenges, including the possibility that the relationship between family size and educational outcomes is a spurious one. This may be a result of unobserved characteristics. However given the consistency of evidence for the resource dilution theory across multiple tests, it is reasonable to assume that at least part of the effect cannot be explained away as an artefact of a spurious relationship. This issue will be revisited in chapter five.

### *Operationalising the Resource Dilution Model*

The resources that comprise the resource dilution model are: parental skill, human capital; and physical resources (Blake, 1989). Using the data from the BHPS, the variables which indicate whether both the mother and father worked while the respondent was 14 will be used as a guide to parental availability. Whether either of the respondent's parents attained degree level education captures elements of human capital in addition to controlling for some aspects of heritable intelligence and aspiration. For cultural resource, the number of books in the home when the child was aged 14 will be used as this indicates the types of educational resource available to the child. Importantly, socioeconomic status will also be included in the model, as this will indicate physical and economic resources available to the family and may say something about parental preferences when it comes to accessing educational and cultural experiences. The BHPS offers no information about house tenure while the respondent was a child, instead the type of neighbourhood[13] the respondent 'mostly lived when young' will be included, in order to control for community resources available to the child during their secondary education. Parental age when the respondent was born enables differences in family climate to be taken into account, which may result from older parents being able to offer more resources to their children. Parental skill is not easily measured using the variables in this data. Parental skill will be examined in more detail in chapter four of the thesis using an alternative dataset.

Additional controls will be included in the model including ethnicity, gender, family structure and birth cohort. Ethnicity and gender are included as they are likely to be predictors for educational outcome and therefore when testing the resource dilution model, these differences should be adjusted for.

Dummy variables for birth cohort were created to identify whether the resource dilution model is experienced differently by different cohorts. Three cohort categories were created: '1950s' which includes those born 1948-1959; '1960s' which includes those born 1960-1969; and '1970s' which includes those subjects born 1970-1976.

Adjustments should be made when testing the resource dilution model for family structure, as this may dictate the size of the absolute familial resource. Seltzer (1994) argues that poverty increases with single parenthood as the cost of maintaining two-households

[13] The neighbourhood type is not an objective measure; the respondents select a category from a list of choices, outlined later in this section.

increase the financial pressures. Furthermore growing up with a single parent may reduce the time and attention parents spend with their children.

### *Treatment of Birth Order*

Booth & Kee (2009) create a birth order index to capture the fact that resources are assigned to children differently by birth order and to reduce the correlation between birth order and family size. This addresses the issue that those who are eighth born are more likely to come from a larger family whilst those who are first born have a higher probability of coming from a smaller family. They take N to mean total number of siblings in the family including the respondent; phi (Φ) is given the value of absolute birth order or their position in the family; and A is the within-family average birth order[14], which is calculated by (N+1)/2. Their birth order index (B) consists of a ratio; B= Φ/A. Deflating the absolute birth order in relation to the average birth order within a family creates an index which is independent of family size. The birth order index used by Booth and Kee (2009) measures the effect of birth order monotonically, which eases interpretation and reduces the possibility of an identification problem.

### *Survey Questions and Independent Variables*

Question D108 in Wave 13 of the BHPS data relates to the main dependent variable, family size: "How many brothers and sisters have you ever had?", followed by a

[14] For a one-child family, average birth order A=1, for a two-child family, A=1.5, for a three-child family A=(3+1)/2=2, and so on, up to a total value for the ten-child family of A=(10+1)/2=5.5.

clarification question: "So including yourself, there were [D108 + 1] children in your family?".

The question in the BHPS which yield data for birth order is: "Where were you born in relation your brother(s) and sister(s), that is, were you the first, second, third or subsequent child?" with up to ten possibilities (the tenth was coded "tenth (or later)". Following the convention set by literature birth order will be included separately and additively in the models.

Parents' occupations were captured by question D36: "Thinking back to when you were 14 years old, what job was your father doing at that time?" There was an open ended part to the question which asked the respondent to write in the job title. In addition to this, this question offered the response categories of: father not working; father deceased; father not living with respondent so don't know; and don't know. The same question was posed for mother's occupation at the time when respondent was 14 (question D40). The variable for mother's occupation has an 'inapplicable' response for 47% of the sample, therefore only father's occupation, which is coded to into socioeconomic categories by the BHPS is included in the analyses to represent the family's socioeconomic status. Including fathers' class in the resource dilution model allows for a comparison of the size of the effect with family size.

The family structure variable offers the opportunity to identify the impact of resources operationalised though the type of parental resource, skill and stability the respondent was offered as a child. Question D105 can be used to identify the family structure aged 14, it asks: "Please look at this showcard and tell me who you were living with when you were aged 14?" The showcard offers the following choices: Natural mother and father; adoptive mother and father; mother and stepfather; father and stepmother; mother/no father figure; father/no mother figure; case/foster home or other.

### *Dependent Variable*

The dependent variable is the highest level of education achieved. This variable was re-coded from fourteen categories to six ordered categories, ranging from the lowest to the highest: no qualifications; other qualifications (for example apprenticeships); GCSE or equivalent; A Level or equivalent; other higher qualifications (including teaching degrees, nursing degrees etc); and degree or above.

Since 1973 the British education system has offered free and compulsory schooling for those aged 5-16. Individuals within the sample will have experienced a number of educational policy changes and therefore may have had differing opportunities available to them. A brief time line of secondary, tertiary and higher education policy in the UK is noted below:

### *Key Education Policy Changes in the UK*

- 1944 Education Act (England and Wales) was implemented in 1947 and introduced a tripartite system of grammar schools, technical schools and secondary modern schools. Free secondary education was introduced
- 1960s saw a rapid expansion of universities in the 1960s and an increase in participation in higher education.
- 1964 the school leaving age was raised to 16 from 1 September 1973 onwards and work experience was introduced for final year students

- 1965 saw a move away from the tripartite system and the introduction of comprehensive schools – some grammar schools remained, but became fee paying, independent schools
- 1977-1984 university students received the most generous state support ever
- 1979-1997 Conservative government raised the importance of vocational training and introduced the Youth Training Scheme
- 1988 Act – the National Curriculum was introduced and Standard Assessment Tests (SATs) were introduced for 7, 11, 14 and 16 year olds.
- 1990 maintenance grants were halted and instead loans were introduced.
- 1992 Incorporation of polytechnics into the same funding practice of universities, which allowed polytechnics to be more flexible to the demands of further education.

### *Treatment of Missing Data and Sampling Weights*

In order to avoid dropping cases with missing or unknown information on family background variables, dummy variables were constructed for each relevant variable. The variables affected include: father's class (14% unknown); mother and father's employment status (both 2% unknown); and number of books in home (1% unknown). The coefficients for the missing variables are not reported in the tables. The advantages of this approach include avoiding the loss of statistical power due to reduced N, and capitalise on information present on other variables although missing for some subjects. However this approach has been criticised by Allison (2002) who considers this technique, which was widely used, remarkably simple and intuitively appealing but one which produces biased estimates of the coefficients. Allison notes an exception to this rule, he suggests that the dummy variable adjustment is optimal in the situation when the question has no relevance to the respondent, for example a question about father's characteristics when the father is absent thus the variable response is unknown rather than missing. Some of the BHPS data regarding fathers' characteristics are unknown rather than missing as some of the respondents reported having a complicated family structure, not living with their father or their father was deceased.

Following the BHPS user guidelines, sample weights were used which are suitable for a cross sectional analysis of individual respondents including temporary members which includes the Scotland, Northern Ireland and Wales extension samples. The calculation of these weights is discussed in more detail in the BHPS User Manual (Taylor et al. 2010).

## Results

### *Descriptive Statistics*

Table 2.1 shows the distribution of birth order by family size for the sample. There are 589 lone children in the data. For children from a two child family, the distribution shows that around half of them in the sample are first borns and half are second borns. Of those respondents from a three child family, the data is almost evenly split into thirds. There are 1,123 from a family with four children, 648 from a family of five children and 991 from a family with six or more children. Birth order by family size is evenly distributed in the sample; except for the birth position of sixth or more, which has three times the number of children in that category compared to the lower birth order categories. This is due to the nature of the grouping. There is evidence that larger families are relatively rare in Britain. In order to see how family size has changed over the study period, Figure 2.1 plots the mean of family size over the year of the respondent's birth, thereby averaging out the

***Table 2.1: Distribution of birth order by family size***

| | Only Child | Two Children | Three Children | Four Children | Five Children | Six or more Children | Total |
|---|---|---|---|---|---|---|---|
| First born | 589 | 1,150 | 671 | 308 | 124 | 132 | 2,974 |
| Second born | | 1,124 | 623 | 268 | 116 | 115 | 2,246 |
| Third born | | | 598 | 289 | 144 | 123 | 1,154 |
| Fourth born | | | | 258 | 123 | 128 | 509 |
| Fifth born | | | | | 141 | 120 | 261 |
| ≥ Sixth born | | | | | | 373 | 373 |
| Total | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

family size trends over the period 1948-1976[15]. There has been a reduction in family size over time from around 3.5 for those respondents born in the 1950s to 3 for those respondents born in the 1970s.

The results from the cross tabulation of family size and the respondent's highest level of education achieved is shown in Figure 2.2. The stacked bar graph shows that around 9% of lone children have no qualifications; 3% have 'other qualifications' which include apprenticeships; 24% have GCSEs or equivalent; 10% have A Levels or equivalent which are the most common qualification used to be accepted by university; 38% have other higher qualifications which includes teaching degrees and nursing degrees; while 16% have a degree or above. The bar indicating a two-child family shows that they have the largest percentage of people gaining a degree or above, followed by those from a three-child family with 19%. Further statistical tests will establish whether these descriptive differences are significant after appropriate education-enhancing controls are included in the model.

[15] It should be noted that the results in Figure 2.1 show the average family size over time, and not total fertility rate (calculated as a average number of children born to a woman over her life if she were to experience the age specific fertility rates and survive to the end of her reproductive lifetime) or birth rate (calculated as total live births divided by the total population (for the same area and time) multiplied by 1,000). This explains the discrepancy between the TPFR in 1964 which was 2.9 and 1977 which was 1.7.

**Figure 2.1: Linear Fit of Mean Family Size by Year of Birth, BHPS**

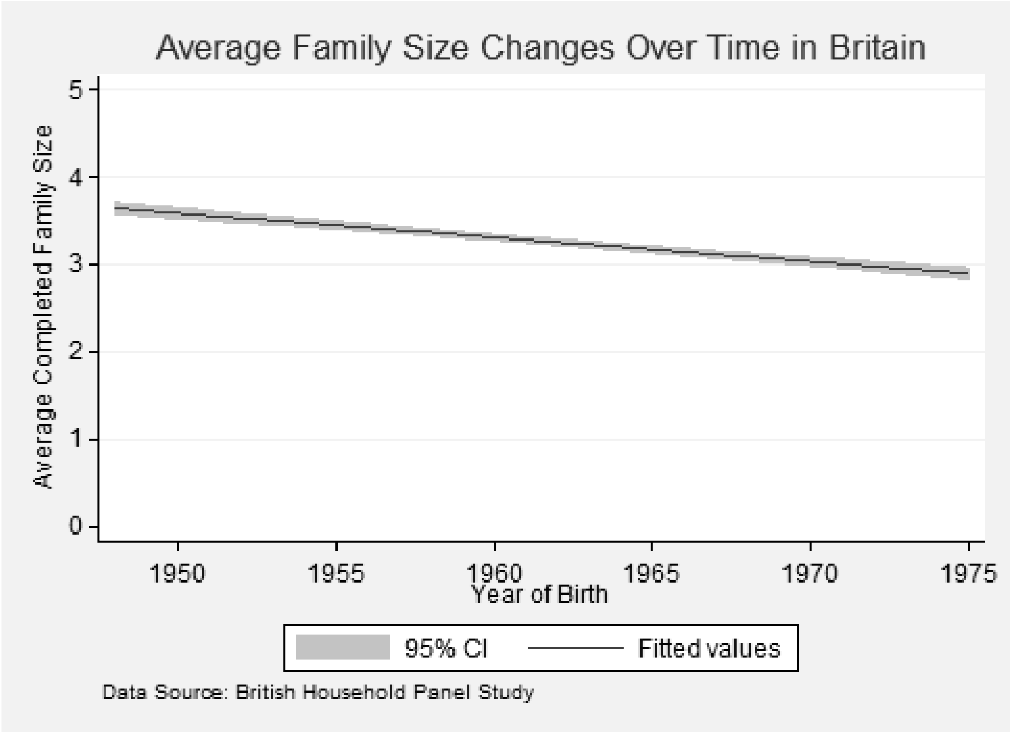
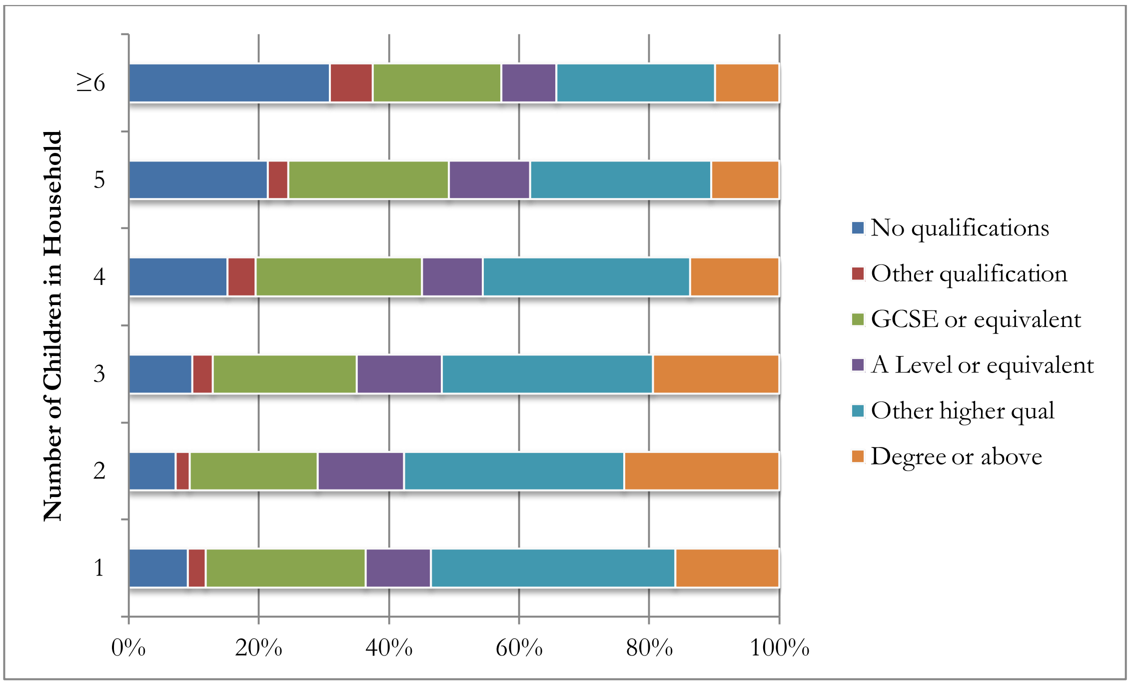



**Figure 2.2: Educational attainment by family size, BHPS**



There are a number of points to note here. Larger families are rare in the UK, so too are lone child families for the sample population. Family size is declining across cohorts. Furthermore there is evidence from these cross-tabulations that educational attainment declines as family size increases.

## Analysis

*H1 There is no relationship between family size and available family resources*

In order to establish whether there is evidence of resource dilution it is first important to identify whether the resources available to children differ by family size. This is difficult to capture as some resources are more divisible than others. For example, it is easier to measure dilution effects of material goods such as number of books in the home than it is to measure the dilution effects of parental education. In addition to the challenge faced in measuring dilution, there is also an issue of causal ordering as while family size may predict familial resources, familial resources may also predict family size. With these acknowledgements in mind, this part of the analysis seeks to capture whether the familial resources available to children differs by family size. The simplest method to establish whether there is a relationship between these two factors is to use cross tabulation. This offers the opportunity to identify any relationship between family size and a number of resource based outcomes as well as offering some descriptive analysis of the data.

The results of the cross tabulations are presented in Tables 2.2-2.8[16]. Table 2.2 provides evidence that those from a professional class background have the smallest proportion of larger families[17]. A similar trend is found in the intermediate class category. Respondents with a working class background form the biggest part of the sample and there is some evidence that they have a smaller proportion of small families. The resources associated with class may be intellectual, financial and cultural.

[16] A chi-squared test of independence yields highly significant results ($p<0.01$) based on their appropriate degrees of freedom indicating that we can be confident in rejecting the possibility that an association exists between the independent and dependent variables by chance variation.
[17] 'Large families' is used to describe families with more than three children in the household (> two siblings) and 'small families' is used to describe families with three or fewer children in the household (≤ two siblings).

***Table 2.2 Cross tabulation of family size by class-based resource***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Parental Class when Respondent was 14 | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 17 | 12 | 13 | 15 | 17 | 19 | **14** |
| Working | 15 | 13 | 15 | 19 | 18 | 22 | **16** |
| Intermediate | 43 | 46 | 45 | 44 | 45 | 39 | **44** |
| Professional | 25 | 30 | 28 | 22 | 21 | 20 | **26** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

***Table 2.3 Cross tabulation of family size by mother's education-based resource***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Mother's Highest Qualification | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| No degree | 82 | 77 | 78 | 85 | 88 | 90 | **82** |
| Degree | 18 | 23 | 22 | 15 | 12 | 10 | **18** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

***Table 2.4 Cross tabulation of family size by father's education-based resource***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Father's Highest Qualification | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| No degree | 69 | 62 | 64 | 74 | 77 | 83 | 69 |
| Degree | 31 | 38 | 36 | 26 | 23 | 17 | 31 |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

***Table 2.5 Cross tabulation of family size by mother's employment status***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Mother's employment status when the respondent was 14 | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 2 | 2 | 2 | 2 | 1 | 1 | **2** |
| Not working | 33 | 29 | 37 | 45 | 55 | 65 | **41** |
| Working | 61 | 69 | 60 | 52 | 43 | 32 | **56** |
| Mother deceased | 3 | 1 | 1 | 1 | 1 | 2 | **1** |
| Not living with mother | 1 | 0 | 0 | 0 | 1 | 0 | **0** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

***Table 2.6 Cross tabulation of family size by father's employment status***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Father's employment status when the respondent was 14 | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 4 | 2 | 2 | 3 | 2 | 3 | **2** |
| Not working | 4 | 2 | 3 | 4 | 7 | 7 | **4** |
| Working | 85 | 92 | 91 | 88 | 85 | 84 | **89** |
| Father deceased | 4 | 2 | 3 | 4 | 4 | 5 | **3** |
| Not living with father | 3 | 1 | 1 | 1 | 1 | 1 | **1** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

***Table 2.7 Cross tabulation of family size by number of books in the childhood home***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of Books in Childhood Home | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 2 | 1 | 1 | 1 | 1 | 1 | **1** |
| Not many books | 25 | 22 | 26 | 33 | 37 | 29 | **29** |
| Quite a few books | 35 | 38 | 38 | 34 | 36 | 36 | **36** |
| Lots of books | 38 | 39 | 36 | 32 | 26 | 34 | **34** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

***Table 2.8 Cross tabulation of family size by family structure***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Who the young person was living with age 14 | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Complete | 76 | 86 | 86 | 83 | 86 | 86 | **85** |
| Care/Adopted | 6 | 1 | 0 | 1 | 1 | 1 | **1** |
| Parent & step parent | 7 | 4 | 5 | 6 | 5 | 3 | **5** |
| Single Parent | 12 | 8 | 9 | 10 | 9 | 9 | **9** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

The results in Table 2.3 indicate that a higher proportion of mothers with a higher education qualification have smaller families, that is families with three or fewer children. Table 2.4 shows the results from a cross tabulation of father's educational resources by family size and a similar trend to mother's education is found.

Table 2.5 and 2.6 deal with parental employment status when the respondent was aged 14. The results indicate that working mothers have fewer children than non-working mothers however there is no clear evidence that family size predicts father's employment status.

Table 2.7 shows that there is a higher proportion of respondents who have 'lots of books' in their childhood home who have two or fewer siblings. A higher proportion of larger families have 'not many' books and the category indicating 'quite a few books' doesn't indicate a clear trend by family size.

Table 2.8 shows the relationship between family size and with whom the respondent was living with when they were aged 14.  There is a smaller proportion of lone children who live with both of their biological parents and a higher proportion of lone children were recorded as being adopted or in care at the age of 14. There is some weak evidence that a higher proportion of lone children lived with only one parent.

In summary, there is evidence that the null hypothesis (H1) can be rejected. Familial resources particularly class, parental education, mother's employment status, number of books in home and family structure vary by family size.

*H2 There is evidence of resource dilution in the UK: there is a negative relationship between family size and educational attainment net of family background controls*

There is evidence from the results presented in Table 2.9 that a higher proportion of children from larger families will achieve no qualifications than those from smaller families[18]. However the relationship between family size and educational outcome is not so clear for 'other qualifications', GCSE or equivalent or A Level categories.

***Table 2.9 Cross tabulation of family size by highest qualification achieved***

| % | Highest Qualification Achieved | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of siblings ever had | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| No Qualifications | 9 | 7 | 10 | 15 | 21 | 31 | **14** |
| Other Qualifications | 3 | 2 | 3 | 4 | 3 | 7 | **3** |
| GCSE or Equivalent | 25 | 20 | 22 | 26 | 25 | 20 | **22** |
| A Level | 10 | 13 | 13 | 9 | 13 | 8 | **12** |
| Other Higher Qualification | 38 | 34 | 32 | 32 | 28 | 24 | **32** |
| Degree or Above | 16 | 24 | 19 | 14 | 10 | 10 | **18** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 589 | 2,274 | 1,892 | 1,123 | 648 | 991 | 7,517 |

[18] A chi-squared test of independence yields highly significant results ($p<0.01$) indicating that we can be confident in rejecting the possibility that no association exists between the independent and dependent variables.

***Table 2.10 Ordered Probit Predicting Highest Level of Education Achieved***

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | | | |
| One sibling | 0.18*** | (0.05) | 0.13* | (0.05) | 0.04 | (0.05) | 0.01 | (0.05) |
| Two siblings | 0.03 | (0.05) | -0.05 | (0.05) | -0.12* | (0.05) | -0.14** | (0.05) |
| Three siblings | -0.20*** | (0.05) | -0.28*** | (0.06) | -0.27*** | (0.06) | -0.29*** | (0.06) |
| Four siblings | -0.37*** | (0.05) | -0.46*** | (0.06) | -0.41*** | (0.06) | -0.42*** | (0.06) |
| Five siblings | -0.58*** | (0.06) | -0.65*** | (0.06) | -0.56*** | (0.06) | -0.56*** | (0.06) |
| Birth order index | | | -0.11*** | (0.02) | -0.17*** | (0.03) | -0.18*** | (0.03) |
| *Class (Professional)* | | | | | | | | |
| Working class | | | | | -0.59*** | (0.04) | -0.58*** | (0.04) |
| Intermediate class | | | | | -0.40*** | (0.03) | -0.40*** | (0.03) |
| *Gender & Ethnicity (Male, White)* | | | | | | | | |
| Female | | | | | -0.16*** | (0.03) | -0.17*** | (0.03) |
| Not white | | | | | 0.44*** | (0.08) | 0.43*** | (0.08) |
| *Parental age (Five year increments)* | | | | | | | | |
| Mother's age | | | | | 0.08*** | (0.01) | 0.08*** | (0.01) |
| Father's age | | | | | 0.05*** | (0.01) | 0.05*** | (0.01) |
| *Family structure (Completed)* | | | | | | | | |
| Care/adopted | | | | | 0.22* | (0.11) | 0.22+ | (0.11) |
| Parent and Step parent | | | | | 0.08 | (0.06) | 0.04 | (0.06) |
| Single parent | | | | | 0.01 | (0.05) | -0.03 | (0.05) |
| *Neighbourhood (Town)* | | | | | | | | |
| Moved around | | | | | 0.19** | (0.06) | 0.20*** | (0.06) |
| Rural/country | | | | | -0.12** | (0.04) | -0.10* | (0.04) |
| Village | | | | | -0.02 | (0.04) | -0.02 | (0.04) |
| Suburb | | | | | 0.12*** | (0.03) | 0.13*** | (0.03) |
| Inner city | | | | | 0.01 | (0.05) | 0.02 | (0.05) |
| *Number of books in home (Not Many)* | | | | | | | | |
| Quite a few | | | | | 0.19*** | (0.03) | 0.18*** | (0.03) |
| Lots of books | | | | | 0.36*** | (0.03) | 0.34*** | (0.03) |
| *Parental education (no degree)* | | | | | | | | |
| Mother degree | | | | | 0.33*** | (0.04) | 0.32*** | (0.04) |
| Father degree | | | | | 0.16*** | (0.03) | 0.16*** | (0.03) |
| *Parents' status (Working Mum/Dad)* | | | | | | | | |
| Mother Not working | | | | | -0.10*** | (0.03) | -0.09** | (0.03) |
| Mother deceased | | | | | -0.14 | (0.12) | -0.11 | (0.12) |
| Not living with mum | | | | | -0.1 | (0.22) | -0.1 | (0.22) |
| Father Not working | | | | | -0.22* | (0.09) | -0.24** | (0.09) |
| Father deceased | | | | | -0.11 | (0.10) | -0.09 | (0.10) |
| Not living with dad | | | | | -0.24+ | (0.13) | -0.25+ | (0.13) |
| *Birth Cohort (1950s)* | | | | | | | | |
| 1960s | | | | | | | 0.14*** | (0.03) |
| 1970s | | | | | | | 0.20*** | (0.03) |
| Observations | 7517 | | 7517 | | 7517 | | 7517 | |
| ll | -12119 | | -12107 | | -11507 | | -11487 | |
| P-value | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Pseudo $R^2$ | 0.02 | | 0.02 | | 0.07 | | 0.07 | |

Standard errors in parentheses; Legend: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10; Cut points in Appendix 2.1

In order to test this hypothesis more carefully and to take into account familial resources, an ordered probit model is used to predict the highest level of education attained. This is an ordered categorical measure where one denotes no qualifications and six denotes first degree or above. In Table 2.10, there are four model specifications; Model 1 predicts the highest qualification achieved controlling for family size; Model 2 predicts educational level with family size and birth order; Model 3 includes independent variables for familial resource and individual characteristics; and Model 4 includes birth cohort. Coefficients from an ordered probit model have a complex meaning and are currently unstandardised which makes interpretation complex. In the first instance the results will be interpreted by significance, size and direction (-/+ sign) of the results. Thereafter results will be standardised in the form of average marginal effects.

In Model 1 the family size indicators show that a child with one sibling does significantly better than a lone child and not significantly differently to a child with two siblings. This finding does not meet the expectations of the resource dilution model which states that lone children should do better than children from all other sibship sizes. But for respondents with three, four, or five or more siblings there is evidence of resource dilution relative to a lone child. When birth order is added to the model, the family size results change significantly (Model 2) which suggests that some of the family size differences in educational attainment are driven by birth order. The birth order index yields a significant negative coefficient which indicates that as birth order increases there is a reduction in educational level achieved. This suggests that educational attainment is significantly lower for later born children compared to early born children.

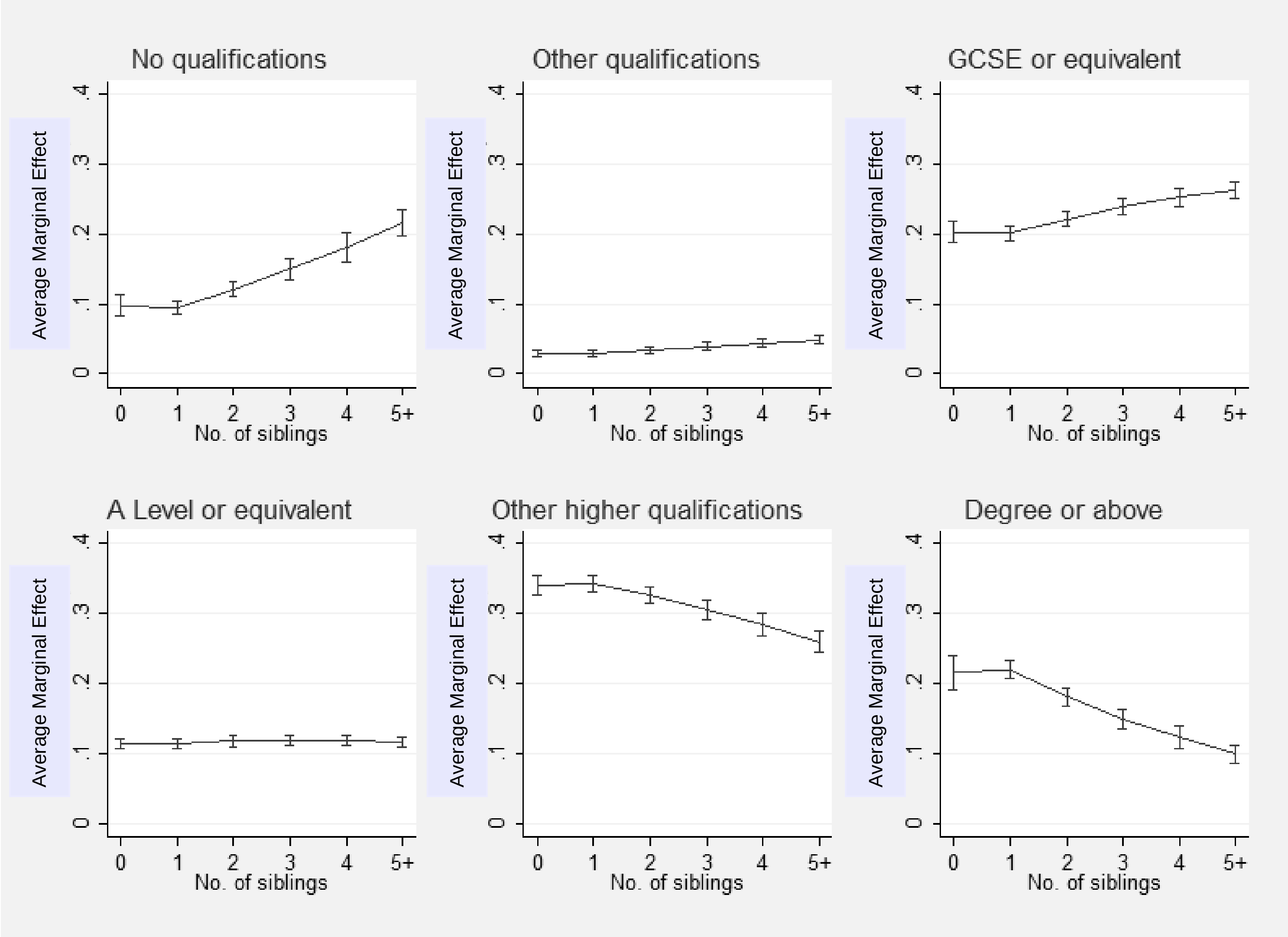
Model 3 provides support for the resource dilution model: the inclusion of independent variables for familial resource and individual characteristics mean having two siblings is significantly and negatively associated with educational outcomes relative to a lone child. The effect of having one sibling remains insignificant relative to a lone child. The remaining family size coefficients reduce in size with the inclusion of these controls but they remain significant. The birth order coefficient increases in size which indicates that not including familial resources would suppress the negative association of birth order.

All other predictor variables behave as we might expect. In brief, there is a significant positive association between class and educational outcomes. Parental education, number of books in the childhood home and if either parent is working is also positively and significantly associated with the highest qualification achieved. Girls achieve significantly less education than boys and ethnic minorities do better than whites. Family structure predictors suggest that those in care/adopted do slightly better than those from a completed family. Relative to living in a town, those who moved around a lot and those who live in the suburbs have a positive and significant association with educational outcomes.

Model 4 shows the results when birth cohorts are included in the model. The main family size and birth order associations do not change significantly. However there is some evidence that relative to those born in the 1950s, those born in the 1960s and 1970s achieve significantly higher levels of education.

The results from the ordered probit indicate that there are differential effects of resource dilution on educational qualification level achieved. It is useful to consider these associations graphically and with standardised measures. The graphs in Figure 2.3 show the standardised results for achieving each outcome of highest level of education by number

**Figure 2.3 Average Marginal Effects of Highest Qualification Achieved Calculated from the Ordered Probit (Model 4 Table 2.10)**



of siblings, based on the specifications in Model 4. Average Marginal Effects (AME) were calculated. AMEs represent how a change in family size influences the predicted probability of achieving a particular educational outcome, leaving all other independent variable values as they are. AMEs compute a marginal effect for each case, after which all the computed effects are averaged (Cameron and Trivedi, 2009; Long, 1997; Long and Freese, 2005).

The graphs indicate that there is evidence of resource dilution predicting no qualifications and GCSE or equivalent qualifications. As family size increases so too does that probability that the respondent will achieve these education levels. Other qualifications, which include apprenticeships and clerical qualifications sees a smaller increase in probability as family size increases. A Levels are not particularly influenced by family size, while other degrees (including teaching and nursing degrees) and degree or higher qualifications sees the probability of achieving that level of education reduce as family size increases, holding all other controls constant. This suggests that there is evidence to accept H2.

However when the proportional odds assumption of the ordered probit model was tested (brant test) and the results were significant, which indicates that the relationship between each pair of outcome groups is not the same. That is, the coefficients which describe the relationship between 'no qualifications' and a 'degree or higher' are not the same as those which describe the relationship between 'other qualifications' and a 'degree or higher' etc. This indicates that this method, which was used by Booth and Kee (2009), is not the best estimation strategy to test the resource dilution model as the results may not be reliable.

Given this finding, the remainder of this chapter will use binary logistic regressions to predict the attainment of a degree or higher. To achieve higher education qualifications requires particular resources which can be strongly influenced by the family. These resources include ability and skills, financial support, emotional support and aspiration.

***Table 2.11 Logistic Regression Predicting Degree or Above***

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | | | |
| One sibling | 0.50*** | (0.12) | 0.35** | (0.13) | 0.20 | (0.14) | 0.19 | (0.14) |
| Two siblings | 0.24+ | (0.13) | 0.03 | (0.13) | -0.11 | (0.14) | -0.12 | (0.14) |
| Three siblings | -0.18 | (0.14) | -0.42** | (0.15) | -0.44** | (0.16) | -0.44** | (0.16) |
| Four siblings | -0.48** | (0.17) | -0.72*** | (0.18) | -0.69*** | (0.19) | -0.69*** | (0.19) |
| Five siblings | -0.55*** | (0.15) | -0.74*** | (0.16) | -0.67*** | (0.17) | -0.67*** | (0.17) |
| Birth order index | | | -0.29*** | (0.06) | -0.47*** | (0.07) | -0.47*** | (0.07) |
| *Class (Professional)* | | | | | | | | |
| Working class | | | | | -1.27*** | (0.13) | -1.27*** | (0.13) |
| Intermediate class | | | | | -0.82*** | (0.08) | -0.82*** | (0.08) |
| *Gender & Ethnicity (Male, White)* | | | | | | | | |
| Female | | | | | -0.21** | (0.07) | -0.21** | (0.07) |
| Not white | | | | | 0.93*** | (0.17) | 0.92*** | (0.17) |
| *Parental age (Five year increments)* | | | | | | | | |
| Mother's age | | | | | 0.15*** | (0.04) | 0.15*** | (0.04) |
| Father's age | | | | | 0.15*** | (0.04) | 0.15*** | (0.04) |
| *Family structure (Completed)* | | | | | | | | |
| Care/adopted | | | | | 0.51+ | (0.30) | 0.51+ | (0.30) |
| Parent and Step parent | | | | | -0.30 | (0.19) | -0.31+ | (0.19) |
| Single parent | | | | | -0.21 | (0.14) | -0.22 | (0.14) |
| *Neighbourhood (Town)* | | | | | | | | |
| Moved around | | | | | 0.38** | (0.15) | 0.39** | (0.15) |
| Rural/country | | | | | -0.19 | (0.12) | -0.18 | (0.12) |
| Village | | | | | -0.09 | (0.10) | -0.09 | (0.10) |
| Suburb | | | | | 0.28** | (0.09) | 0.28** | (0.09) |
| Inner city | | | | | 0.22+ | (0.13) | 0.23+ | (0.13) |
| *Number of books in home (Not Many)* | | | | | | | | |
| Quite a few | | | | | 0.25** | (0.09) | 0.24* | (0.10) |
| Lots of books | | | | | 0.62*** | (0.09) | 0.61*** | (0.10) |
| *Parental education (no degree)* | | | | | | | | |
| Mother degree | | | | | 0.62*** | (0.08) | 0.62*** | (0.08) |
| Father degree | | | | | 0.22** | (0.07) | 0.22** | (0.07) |
| *Parents' status (Working Mum/Dad)* | | | | | | | | |
| Mother Not working | | | | | -0.08 | (0.07) | -0.07 | (0.07) |
| Mother deceased | | | | | -0.00 | (0.35) | 0.01 | (0.35) |
| Not living with mum | | | | | -0.38 | (0.82) | -0.38 | (0.82) |
| Father Not working | | | | | -0.15 | (0.26) | -0.16 | (0.26) |
| Father deceased | | | | | -0.06 | (0.28) | -0.05 | (0.28) |
| Not living with dad | | | | | 0.08 | (0.41) | 0.07 | (0.41) |
| *Birth Cohort (1950s)* | | | | | | | | |
| 1960s | | | | | | | 0.06 | (0.08) |
| 1970s | | | | | | | 0.10 | (0.09) |
| Constant | -1.66*** | (0.11) | -1.08*** | (0.16) | -1.50*** | (0.22) | -1.55*** | (0.22) |
| Observations | 7,517 | | 7,517 | | 7,517 | | 7,517 | |
| ll | -3426 | | -3414 | | -3024 | | -3023 | |
| P-value | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Pseudo $R^2$ | 0.02 | | 0.03 | | 0.14 | | 0.14 | |

Standard errors in parentheses Legend: *** $p<0.001$, ** $p<0.01$, * $p<0.05$, + $p<0.10$

Therefore the associations of the resource dilution are likely to be most identifiable for higher qualifications. In addition to this obtaining a degree or higher has a significant effect on life chances of achieving a particular occupational status, income bracket and being satisfied with life which makes it substantively more interesting than the other educational categories available in the BHPS.

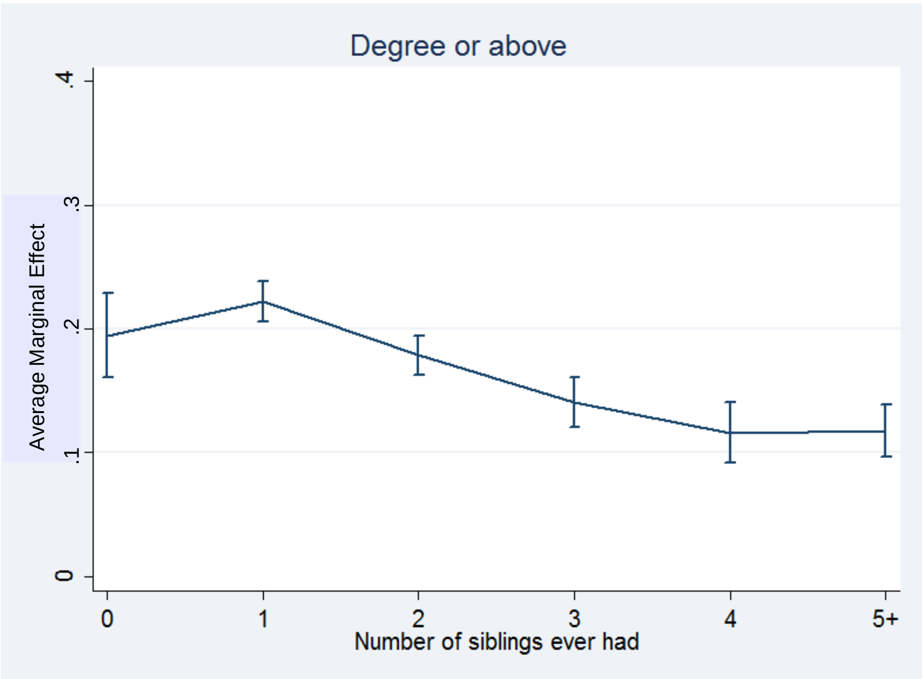
Results from the logistic regressions predicting the attainment of a degree or higher are shown in Table 2.11. The additive effects of each independent variable on the log odds of achieving a degree or above are discussed in the next paragraph. Thereafter average marginal effects and standardised coefficients are calculated and discussed.

The coefficients show the effects of a one unit difference in the independent variable on the log odds of achieving a degree or above, net of all other variables. The results in Model 1 show that the difference in log odds of a child with one sibling relative to a lone child is 0.50 ($p<0.01$): a child with two siblings sees an increase in log odds relative to a lone child but this is significant only to $p<0.10$. Thereafter as family size increases there is a reduction in the log odds of achieving a degree of higher. Model 2 includes the control for birth order which is negative and significant. In addition to this, the main effects for family size change substantively, a child with one sibling sees a slight fall in the log odds compared to those in Model 1 and the negative family size associations for a child with three or more siblings increases in magnitude and becomes more strongly significant. This suggests that family size should not be estimated without taking into account the position within the family.

In Model 3 there is evidence that when familial resources and individual characteristic are controlled for a child with one sibling is no longer significantly different to a lone child, and although the coefficient remains positive, all other family size associations remain relatively stable. The birth order coefficient increases in size, which suggests that later born children have lower log odds of achieving a degree or higher once resources are taken into account. The birth cohort coefficients in Model 4 indicate that there are no significant differences between those born in the 1950s, 1960s and 1970s net of background controls.

Although the interpretation is straightforward, log odds are not very intuitively meaningful. Hence average marginal effects are calculated for Model 4 and results are shown in Figure 2.4[19]. On average the probability of achieving a degree or above is 8% lower for children with five or more siblings compared to a lone child. The results support expectation of the resource dilution model.

***Figure 2.4 Average Marginal Effects of Achieving a Degree or Above Calculated from Table 2.11.***




[19] The following contrasts were significant to $p<0.05$; a lone child is significantly different to a child with three, four and five or more siblings; a child with one sibling is significantly different to a child with two, three, four or five or more siblings; and a child with two is significantly different to a child with one, three, four and five or more siblings.

Lone children break the otherwise linear negative relationship between family size and achieving a degree or higher as they have a lower chance than a child with one sibling and about the same chance as a child with two siblings, however these contrasts are not statically significant. There is evidence of a decline in the probability of achieving a degree or higher as family size increase, therefore there is support for H2.

*H3 The strength of the resource dilution model has changed across birth cohort net of family background controls*

The results so far indicate that there are no significant differences for achieving a degree or above by birth cohort. However because of changes in educational policy over the period under consideration it is reasonable to expect that the associations of family size may vary depending on the birth cohort in which the respondent was born. Therefore interactions are included in the model between birth cohort and family size in Model 2, Table 2.12. There are several issues to consider with this. Differences in the family size associations over time may arise through a reduction of family size; through changes in access to higher education - as a result of expansion for example; changes in educational policy; or through changes in access to familial resources. The results indicate that there are two negative significant interaction effects and they show that a respondent with one sibling or two siblings born in the 1970s have lower odds of achieving a degree compared to a lone child born in the 1970s. This finding suggests that educational outcomes do vary by family size and birth cohort giving rise to partial support for H3.

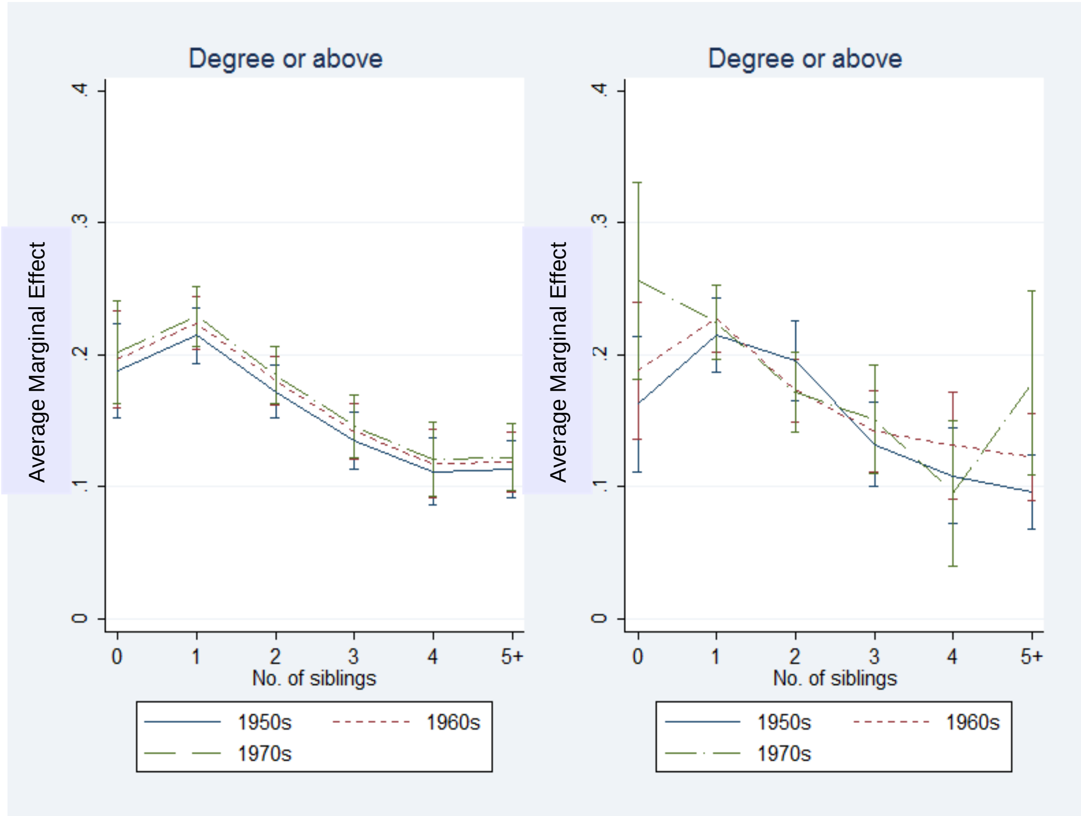
***Table 2.12 Logistic Regression Predicting Degree or Higher with Birth Cohort X Family Size Interactions***

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| *Family size (Lone Child)* | | | | |
| One sibling | 0.19 | (0.14) | 0.39+ | (0.24) |
| Two siblings | -0.12 | (0.14) | 0.25 | (0.24) |
| Three siblings | -0.44** | (0.16) | -0.28 | (0.27) |
| Four siblings | -0.69*** | (0.19) | -0.53+ | (0.31) |
| Five siblings | -0.67*** | (0.17) | -0.67* | (0.28) |
| Birth order index | -0.47*** | (0.07) | -0.48*** | (0.07) |
| *Birth Cohort (1950s)* | | | | |
| 1960s | 0.06 | (0.08) | 0.20 | (0.29) |
| 1970s | 0.10 | (0.09) | 0.66* | (0.31) |
| *Interactions Family size X Birth Cohort* | | | | |
| One sib X 1960s | | | -0.12 | (0.32) |
| One sib X 1970s | | | -0.59+ | (0.34) |
| Two sibs X 1960s | | | -0.37 | (0.32) |
| Two sibs X 1970s | | | -0.84* | (0.35) |
| Three sibs X 1960s | | | -0.11 | (0.36) |
| Three sibs X 1970s | | | -0.48 | (0.39) |
| Four sibs X 1960s | | | 0.04 | (0.41) |
| Four sibs X 1970s | | | -0.82 | (0.52) |
| Five or more sibs X 1960s | | | 0.10 | (0.38) |
| Five or more sibs X 1970s | | | 0.14 | (0.45) |
| Constant | -1.55*** | (0.22) | -1.73*** | (0.28) |
| Observations | 7,517 | | 7,517 | |
| ll | -3023 | | -3016 | |
| P-value | 0.00 | | 0.00 | |
| Pseudo $R^2$ | 0.14 | | 0.14 | |

Standard errors in parentheses
Legend: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for: Parental class, gender, ethnicity, parents' age, family structure, neighbourhood, no of books in home, parental education and work status.

The average marginal effects were calculated and are shown in Figure 2.5 alongside the baseline model. The baseline model shows that respondents born in the 1970s see a slight increased probability of achieving a degree or higher relative to those born in the 1960s and 1950s however these results are not statistically significant. The graphical representation of the interaction effects shows that the lone child disadvantage is driven by differences between those born in the 1950s and 1960s. Those born in the 1970s with one or two siblings yield significant and negative associations relative to a lone child. This suggests that resource dilution is more pronounced for those born in the 1970s into a small family.

**Figure 2.5: Average Marginal Effects of Birth Cohort on Achieving Degree or Higher by Family Size (Calculated from Table 2.12, Model 1 and Model 2 respectively).**




*H4* *Family size is a stronger predictor of educational outcome compared with class background.*

*H5* *Family size is a stronger predictor of educational outcome compared with parental education, family structure and number of books in the home*

Blake makes the claim that family size is as powerful as class as an explanatory variable for educational attainment (Blake, 1989). In order to identify whether this is the case when predicting the achievement of a degree or higher, and to consider the strength of family size in relation to other important educational predictors, coefficients from a logistic regression are standardised and the results are shown in Table 2.13[20].

[20] Independent variables were modelled using a continuous scale for the purposes of comparison. To get the X-standardized coefficient the beta coefficient is multiplied by the standard deviation. The dependent variable is not standardised.

***Table 2.13 Unstandardised and Standardised Estimates***

Latent Standard Deviation: 2.06
Observed Standard Deviation: 0.38

| | b | P>z | X-standardised coefficient | Standard deviation of X |
|---|---|---|---|---|
| Family size | -0.22 | 0.00 | -0.32 | 1.49 |
| Birth order index | -0.49 | 0.00 | -0.28 | 0.56 |
| Class | 0.40 | 0.00 | 0.39 | 0.97 |
| Female | -0.22 | 0.00 | -0.11 | 0.50 |
| Not white | 1.01 | 0.00 | 0.17 | 0.17 |
| Mum age | 0.17 | 0.00 | 0.22 | 1.25 |
| Dad age | 0.14 | 0.00 | 0.21 | 1.44 |
| Family structure | -0.03 | 0.41 | -0.03 | 0.94 |
| Neighbourhood | 0.06 | 0.02 | 0.08 | 1.33 |
| Books in home | 0.36 | 0.00 | 0.29 | 0.82 |
| Mum degree | 0.67 | 0.00 | 0.26 | 0.39 |
| Dad degree | 0.30 | 0.00 | 0.14 | 0.46 |
| Mum work | 0.05 | 0.39 | 0.03 | 0.56 |
| Dad work | 0.05 | 0.66 | 0.02 | 0.47 |
| Birth cohort | 0.06 | 0.18 | 0.04 | 0.77 |

b = raw coefficient
P>|z| = p-value for z-test

The independent variables are standardised to have a mean of zero and a standard deviation of one and the Y variable is in its original units in order to see the relative importance of the independent variables on the likelihood of achieving a degree or higher. The results from the shaded column show that a one standard deviation increase in family size produces, on average, a reduction in the log odds of achieving a degree by -0.32, this is only moderately larger than birth order (-0.28). Class yields the strongest association on the log odds of achieving a degree with a one standard deviation increase in class producing, on average, an increase by 0.39. This finding runs counter to Blake's assertion that family size is a stronger predictor than class (Blake, 1989) and so H4 is unsupported. A more detailed description of the effects of class follows. The other predictors which have a similar influence on achieving a degree or above to family size are parental age, number of books in the home, mother's education and father's education. Family size is found to be the strongest predictor among these variables. Therefore support is found for H5: family size is a stronger predictor of educational outcomes than parental education, family structure and number of books in the home.

To offer a more descriptive perspective of class, parental education and number of books in the home and the manner in which they vary with family size, interactions are included in the models.

Table 2.14, Model 1 is the baseline model with the class coefficients which indicates a positive relationship between class and achieving a degree or higher. When interactions between family size and class background are included in the model, the results change significantly (Table 2.14, Model 2). All of these interactions are insignificant which suggests that the family size associations do not vary significantly across social class groups. However the reference category for the main family size effects now represents the difference in log odds between a lone child with a professional class background. The results suggest that there are significantly lower log odds of achieving a degree of higher as family size increase although a child with either one or two siblings are not significantly different to a lone child. A child with three, four or five or more siblings does significantly worse than a lone child from a professional class background. The class coefficients now represent the difference between each class category and a lone child from a professional background. Both the working and middle class categories yield lower odds than the reference group of professional class background.

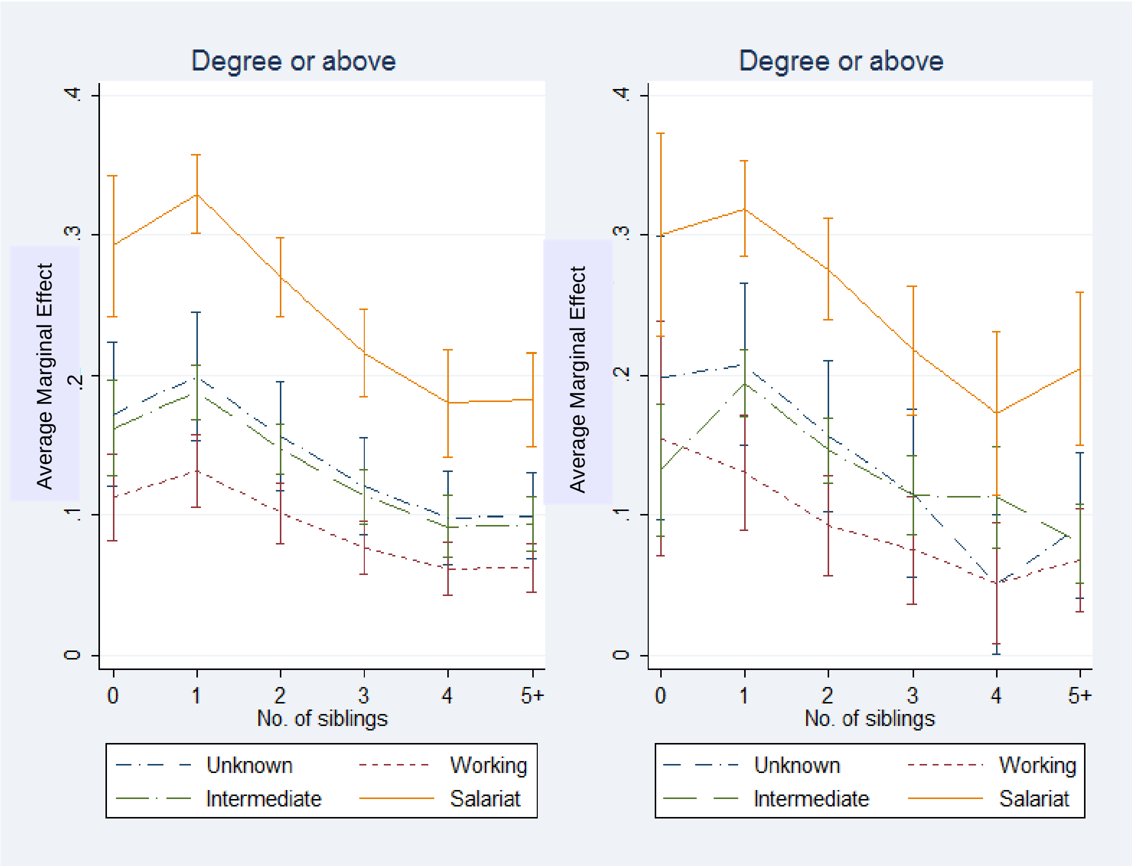
***Table 2.14 Logistic Regression Predicting Degree or Higher with Family Size X Class Interactions***

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| *Family size (Lone Child)* | | | | |
| One sibling | 0.19 | (0.14) | 0.09 | (0.21) |
| Two siblings | -0.12 | (0.14) | -0.13 | (0.22) |
| Three siblings | -0.44** | (0.16) | -0.47+ | (0.24) |
| Four siblings | -0.69*** | (0.19) | -0.78** | (0.30) |
| Five siblings | -0.67*** | (0.17) | -0.56* | (0.27) |
| Birth order index | -0.47*** | (0.07) | -0.47*** | (0.07) |
| *Class ((Professional) )* | | | | |
| Working class | -1.27*** | (0.13) | -0.92* | (0.39) |
| Intermediate class | -0.82*** | (0.08) | -1.12*** | (0.29) |
| *Interactions Family size X Class* | | | | |
| One sib X Working | | | -0.31 | (0.44) |
| One sib X Intermediate | | | 0.39 | (0.31) |
| Two sibs X Working | | | -0.48 | (0.46) |
| Two sibs X Intermediate | | | 0.26 | (0.32) |
| Three sibs X Working | | | -0.38 | (0.51) |
| Three sibs X Intermediate | | | 0.30 | (0.35) |
| Four sibs X Working | | | -0.49 | (0.64) |
| Four sibs X Intermediate | | | 0.59 | (0.41) |
| Five or more sibs X Working | | | -0.41 | (0.53) |
| Five or more sibs X Intermediate | | | -0.03 | (0.39) |
| Constant | -1.55*** | (0.22) | -1.50*** | |
| Observations | 7,517 | | 7,517 | |
| ll | -3023 | | -3018 | |
| P-value | 0.00 | | 0.00 | |
| Pseudo $R^2$ | 0.14 | | 0.14 | |

Standard errors in parentheses
Legend: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for: Gender, ethnicity, parents' age, family structure, neighbourhood, no of books in home, parental education, work status and cohort

Average marginal effects for class and family size are shown in Figure 2.6. The professional classes have a higher probability of achieving a degree or above compared to intermediate and working classes when interactions between family size and class are controlled for.

**Figure 2.6: Average Marginal Effects of Class on Achieving Degree or Higher by Family Size (Calculated from Table 2.14, Model 1 and Model 2 respectively).**




Turning to the influence of parental education on children's educational outcomes, mother's education is a stronger predictor of a child's educational outcome than father's education. This relationship is investigated further by examining family size and parental education interactions. Table 2.15 shows the results of parental education interacted by family size; Model 1 shows the baseline model, Model 2 shows the interaction between mother's education and family size and Model 3 shows the interaction between father's education and family size.

When interactions are included in Model 2 the main family size effect now represents the difference in log odds between a lone child with an educated mother and one without an

***Table 2.15 Logistic Regression Predicting Degree or Above with Parental Education and Family Size Interactions.***

| | Model 1 Baseline | | Model 2 Mother's Education | | Model 3 Father's Education | |
|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | |
| One sibling | 0.19 | (0.14) | 0.19 | (0.16) | 0.05 | (0.17) |
| Two siblings | -0.12 | (0.14) | -0.20 | (0.17) | -0.36* | (0.18) |
| Three siblings | -0.44** | (0.16) | -0.41* | (0.18) | -0.50** | (0.20) |
| Four siblings | -0.69*** | (0.19) | -0.72** | (0.21) | -0.91** | (0.23) |
| Five siblings | -0.67*** | (0.17) | -0.73** | (0.19) | -0.89** | (0.21) |
| Birth order index | -0.47*** | (0.07) | -0.47*** | (0.07) | -0.47*** | (0.07) |
| *Parent's education* | | | | | | |
| Mother Degree | 0.62*** | (0.08) | 0.78** | (0.28) | | |
| Father Degree | 0.22** | (0.07) | | | 0.43+ | (0.25) |
| *Interactions* | | | *Family size X Mother's Education* | | *Family size X Father's education* | |
| Lone child X degree | | | -0.26 | (0.38) | -0.61+ | (0.35) |
| One sib X degree | | | -0.23 | (0.30) | -0.24 | (0.27) |
| Two sibs X degree | | | -0.01 | (0.30) | -0.03 | (0.27) |
| Three sibs X degree | | | -0.38 | (0.34) | -0.48 | (0.31) |
| Four sibs X degree | | | -0.15 | (0.43) | -0.03 | (0.37) |
| Five sibs X degree | | | -0.01 | (0.00) | -0.01 | (0.00) |
| Constant | -1.55*** | (0.22) | -1.77*** | (0.40) | -2.00*** | (0.36) |
| Observations | 7,517 | | 7,517 | | 7,517 | |
| ll | -3023 | | -3021 | | -3019 | |
| P-value | 0.00 | | 0.00 | | 0.00 | |
| Pseudo $R^2$ | 0.14 | | 0.14 | | 0.14 | |

Standard errors in parentheses. Legend: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for: Gender, ethnicity, parents' age, family structure, neighbourhood, no of books in home, class, work status and cohort.

educated mother. The statistical significance and magnitude of the main family size effects remain after the interaction term between family size and mother's education is included. The main mother's education effect indicates that a lone child with a mother who has a degree increases the log odds of achieving higher levels of education significantly.

Average marginal effects are calculated and the interaction model is presented next to the baseline model in Figure 2.7 as shown below. There is some evidence that mother's education ameliorates the family size association and for all family sizes, those who have mothers with a degree have a greater probability of achieving a degree or higher.

**Figure 2.7: Average Marginal Effects of Mother's Education on Achieving Degree or Higher by Family Size (Calculated from Table 2.15, Model 1 and Model 2 respectively)**

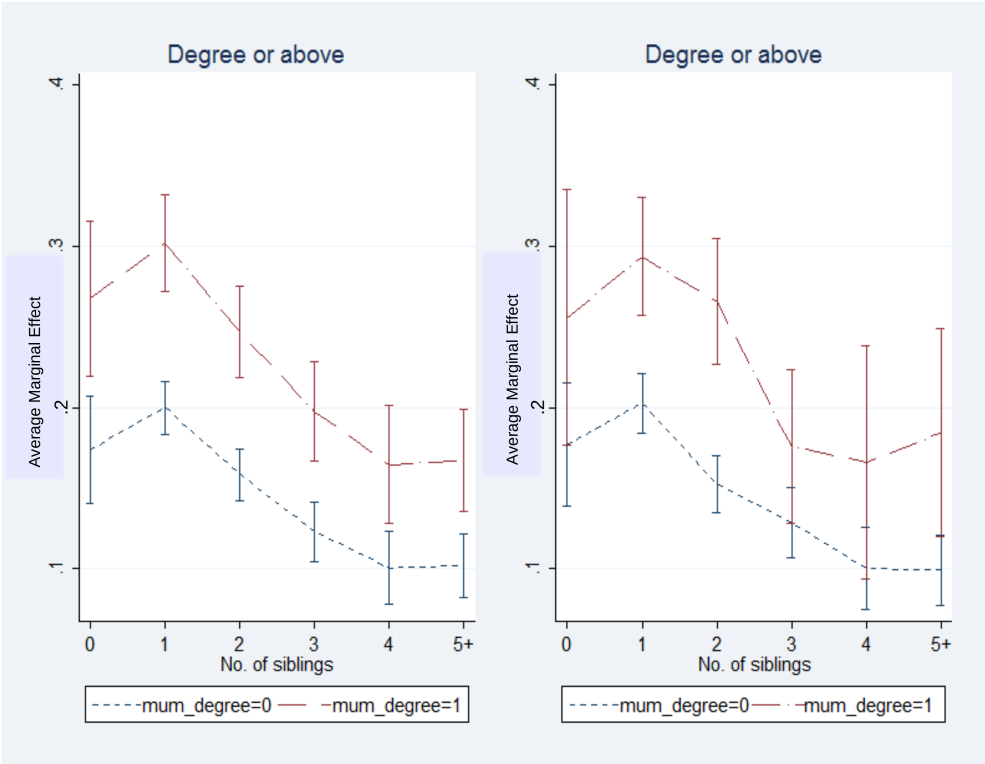



*Figure 2.8 Average Marginal Effects of Father's Education on Achieving Degree or Higher by Family Size (Calculated from Table 2.15, Model 1 and Model 3 respectively)*

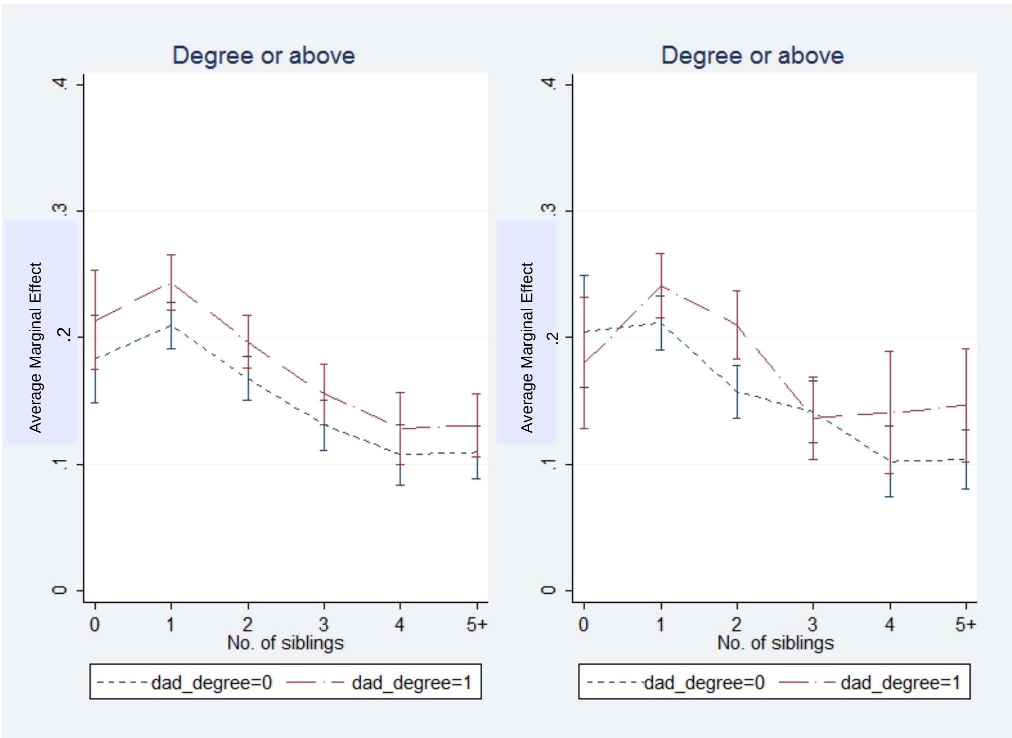


Table 2.15, Model 3 shows the results of including interactions between family size and father's education. The inclusion of interactions between family size and father's education increases the significance of the main family size effects, except for a child with one sibling relative to a lone child with a father who has a degree. However the main effect for parental education sees an increase in size and a reduction of significance level, which indicates a smaller effect of father's education compared to mother's education. The interaction terms themselves are insignificant, suggesting that the influence of father's education does not vary significantly by family size.

Figure 2.8 shows the average marginal effects for the baseline model next to the interaction model. Father's education increases the probability of the respondent achieving a degree or above but not significantly. Having a highly educated father is not as influential on educational outcomes as having a highly educated mother.

Turning now to the results for the interaction effects of number of books in the childhood home by family size, the baseline model (Table 2.16, Model 1) shows that there is a significant positive association of having 'lots of books' and 'quite a few books' in the home relative to 'not many'.

When interaction terms are included in Model 2, the main family size effects now represent the difference in log odds between a lone child with not many books in the home. The results suggest that there are significantly higher log odds of achieving a degree or higher for a child with one sibling; the other family size main effects are not significantly different. The main effects for the number of books in childhood home now represent the difference between each books category and a lone child with not many books. The inclusion of the interaction increases the log odds which suggest that there is a positive effect of this

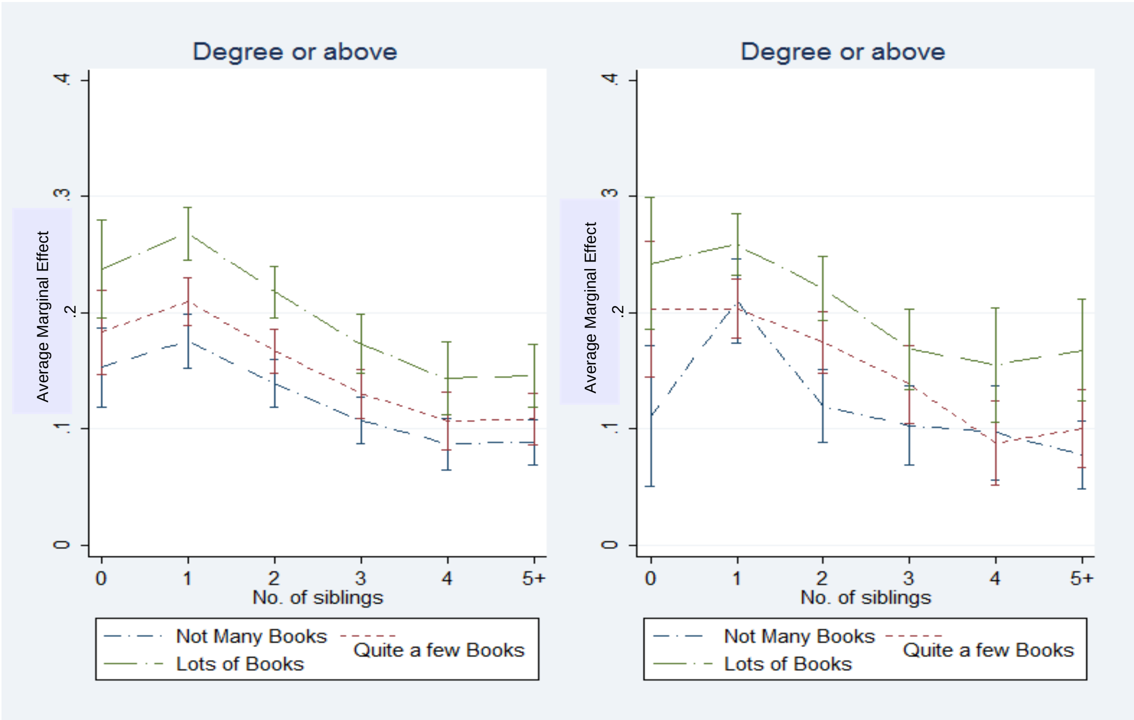
***Table 2.16 Logistic Regression Predicting Degree or Above with Number of Books in Childhood Home and Family Size Interactions***

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| *Family size (Lone Child)* | | | | |
| One sibling | 0.19 | (0.14) | 0.83* | (0.36) |
| Two siblings | -0.12 | (0.14) | 0.09 | (0.37) |
| Three siblings | -0.44** | (0.16) | -0.09 | (0.39) |
| Four siblings | -0.69*** | (0.19) | -0.16 | (0.42) |
| Five siblings | -0.67*** | (0.17) | -0.42 | (0.40) |
| Birth order index | -0.47*** | (0.07) | -0.48*** | (0.07) |
| *Books in Home (Not Many)* | | | | |
| Quite a few books | 0.24* | (0.10) | 0.79* | (0.39) |
| Lots of books | 0.61*** | (0.10) | 1.04** | (0.38) |
| *Interactions (Lone child X Books)* | | | | |
| One sib X quite a few | | | -0.83* | (0.42) |
| One sib X lots of books | | | -0.73+ | (0.40) |
| Two sibs X quite a few | | | -0.30 | (0.43) |
| Two sibs X lots of books | | | -0.23 | (0.42) |
| Three sibs X quite a few | | | -0.42 | (0.47) |
| Three sibs X lots of books | | | -0.42 | (0.45) |
| Four sibs X quite a few | | | -0.90+ | (0.52) |
| Four sibs X lots of books | | | -0.45 | (0.50) |
| Five sibs X quite a few | | | -0.49 | (0.49) |
| Five sibs X lots of books | | | -0.10 | (0.47) |
| Constant | -1.55*** | (0.22) | -1.94*** | (0.38) |
| Observations | 7,517 | | 7,517 | |
| ll | -3023 | | -3009 | |
| P-value | 0.00 | | 0.00 | |
| Pseudo $R^2$ | 0.14 | | 0.14 | |

Standard errors in parentheses
Legend: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for: Gender, ethnicity, parents' age, family structure, neighbourhood, class, parents' education, work status and cohort.

particular resource. The number of books and family size interactions yield significant negative results for those with one sibling relative to a lone child and those with four siblings relative to a lone child which provides evidence that this particular familial resource varies by family size. In order to view these findings graphically, the average marginal effects are calculated and results shown in Figure 2.9. The results show that the number of books in the childhood home does influence educational outcomes.

**Figure 2.9 Average Marginal Effects of Number of Books in Childhood Home on Achieving Degree or Higher by Family Size (Calculated from Table 2.16, Model 1 and Model 2 respectively)**




In summary, family size was not found to a stronger predictor than social class, but it is stronger than parental education, family structure and number of books in the home. When interaction effects are examined in more depth there is some evidence that coming from a salariat class, having a mother with a degree level qualification and having lots of books in the home increases the probability of achieving a degree or higher

## Summary

This chapter set out to explore the resource dilution model in the UK. This included an examination of dilution of familial resources as family size increases; an identification of a negative family size association on educational outcomes; an identification of any resource dilution changes over time; and the strength of the effect in relation to other important predictors for educational attainment.

The first key finding in this chapter is that there is some evidence that as family size increases there is a reduction in resources, particularly - class based resources, parental education, mother's employment status and number of books in the home. Resources associated with father's employment status and family structure do not vary by family size.

The second key finding from this chapter is that there is support for the resource dilution model in the UK: that as family size increases, the level of education achieved by an individual decreases for children with one or more siblings. There is evidence that lone children do worse than a child with one sibling and around the same as a child with two siblings, which does not conform to the expectations of the resource dilution model, although these findings are not statistically significant. The magnitude of the family size association is considerable - children with one sibling have a 22% probability of achieving a degree or above, while children with five or more siblings have an 11% probability. This finding is statistically significant.

The third key finding is that there is no evidence to support Blake's (1989) assertion that family size is as important as class as a predictor for educational outcomes. Class background is the strongest predictor for educational attainment, followed by family size and birth order when the independent variables are standardised.

The fourth key finding is that the resource dilution model has remained relatively stable for those born between 1948-1976 but the benefits are slightly greater for those born in the 1970s from a small family, although the results are not significant. The lone child disadvantage is driven by earlier cohorts which suggests that there is something different about lone children born in the 1950s and 1960s compared to those born in the 1970s. This finding may be an artefact of different family size decisions in earlier cohorts. Lone children born in the 1950s and 1960s may be a lone child as a response to different environments such as health or medical complications, parental preference or unobserved factors which are a result of changing social norms.

The fifth key finding is that when interactions by resource and family size are included in the models, there is some evidence that coming from a salariat background, having an educated mother or a lot of books in the childhood home increases the probability of achieving a degree or above for all family sizes. However the effects of father's education do not vary considerably.

Taken together these findings strongly suggest that there is a negative association between family size and educational outcomes in the UK.

There are a number of limitations of this chapter. The educational outcome of interest was the attainment of a degree or higher without any differentiation of the quality of this education. Neither gender composition nor age spacing was taken into account due to data limitations. Furthermore the issue of endogeneity - the possibility that parents select their family size based on unobserved characteristics - was not considered in this chapter. This may lead to an overestimation of the family size effect as patterns of educational outcomes could be incorrectly attributed to family size rather than these family size selection effects.

The remaining chapters will attempt to address some of the limitations of this chapter. In chapter three advantages and disadvantages of having siblings will be examined; chapter four addresses differential parenting skill and strategies by family size; and chapter five examines the issue of causation, using the exogenous variation in the incidence of multiple births to compare the educational outcome by family size.

This chapter sought to contextualise the resource dilution model in the UK, contributing to the literature by offering a more detailed descriptive analysis of the ways that resources are allocated by family size and the effects of this resource dilution on highest educational qualification achieved.

# Chapter 3: Exploring the educational advantages and disadvantages of having siblings in England

## Introduction

The results from the previous chapter show that there are persistent negative associations between family size and educational attainment in the UK. In this chapter, the resource dilution model is tested to identify if there are negative effects of family size on the quality of GCSE grades achieved, subjective measures of progress at school, social skills and emotional health. Therefore the aim of this chapter is to explore the advantages and disadvantages of having siblings in England.

The Longitudinal Study of Young People in England, 2003-2005 (Wave 1-3) is used for this analysis. This data set provides an opportunity to investigate aspects of young people's family characteristics which may be associated with their ability to participate in stimulating environments and with their educational outcomes aged 14-16. This chapter begins by reviewing the existing literature and discussing the importance of the variables of interest.

## Literature Review

### *The Resource Dilution Model & The Lone Child*

As we have seen Blake seeks to identify the advantages and disadvantages of coming from a family of a given size. She argues that as the number of siblings increases so too does the dilution of familial resources, which is detrimental to a young person's educational outcomes including IQ, educational attainment, aspiration, confidence and social skills

(Blake, 1989). According to this theory, lone children should have an advantage compared to children with siblings as they do not have to share their familial resources with siblings.

Blake finds that lone children are more likely to engage in cultural activities, be read to as a child and to spend time alone compared to those with siblings. Falbo (1978) suggested there may be additional advantages of being a lone child in addition to lack of resource dilution. He notes that for a lone child everyone in the immediate family is older and thus the home environment is intellectually and behaviourally more advanced. Similarly, Zajonc and Markus' (1975) argue that the negative family size association is not due to resource dilution but instead due to the confluence model whereby the intellectual climate of the family is reduced by an increase of number of children in relation to adults. This creates a less beneficial environment for children who are born into large families, particularly those with higher birth order, suggesting that lone children should be at an intellectual advantage compared to children with siblings. Linked to this is the evidence from Lewis and Feiring (1982) who argue that lone children should benefit more than children with siblings as they are the sole beneficiaries of parental attention. Parents of lone children may be able to interact with their child in ways that can improve the child's development. However this may increase the stress on the young person, as they may have higher expectations placed upon them (Roberts and Blanton, 2001).

There is no evidence from chapter two which suggests that lone children have an educational advantage over their peers with siblings. The results indicate that lone children do worse than a child with one sibling and around the same as a child with two siblings. While these contrasts are not statistically significant, the evidence does not suggest a clear lone child advantage either.

A theoretical indication that lone children may be disadvantaged comes from an amendment to the confluence model. Zajonc and Markus introduce the importance of birth order and argue that the educational expectations of lone children and last born children may be lower than children with younger siblings because they don't have access to a specific sibling teaching interaction (Zajonc and Markus, 1975). Sibling teaching benefits elder children by giving them an opportunity to experience abstracting and simplifying ideas, and actively teaching and responding to others. By this prediction lone children should do worse than children who are elder siblings. However as discussed in the introductory chapter, there is mixed support for the confluence model (for example Jæger, 2009), as it is difficult to adequately measure the intellectual climate of the home and whether sibling teaching actually takes place.

The view that lone children are more difficult and socially inept has been long recorded in the literature. G. Stanley Hall (1844-1924) has likened being an only child to a disease. He noted that lone children are at a disadvantage because they do not experience the life lessons they require in order to live with other children (reported in Fenton, 1928).

While there may be some outward signs that a lone child is different to children with siblings, these differences may disappear when family characteristics are taken into account. Downey (1995) argues that the nature of the differences between large and small families may not be captured by traditional social controls as there may be other drivers behind fertility decisions. For example some couples will actively choose to have fewer children as they place a higher value on educational outcomes. This presents a challenge as it suggests that there is something inherently different about the attitudes and motivations of parents who have small families, that is, their aim is to maximise their child's quality. One way to overcome some of these selection issues is to consider the family size effects in contexts where family size is strictly controlled. China's one child policy, introduced in 1979, restricts the number of children that urban couples can have to one (Cameron et al, 2013). This has led to widespread concern that the policy has resulted in a generation of 'little emperors' with poor social skills. Cameron et al. use experimental techniques from economics to measure the behavioural differences before and after the introduction of the one child policy. They find that lone children born under the one child policy in Beijing are less trusting, more risk adverse, less optimistic, more neurotic and less conscientious (Cameron et al, 2013).

### *Siblings as a Resource*

Downey (2001) argues that having siblings may not always be a disadvantage as siblings can be considered as a resource. Siblings may provide a young person with insight, protection or emotional support and being a sibling presents a social reality in which an individual can experience and address conflict and issues of fairness. Furthermore siblings can offer a different form of emotional support than parents, particularly as siblings closely share the experiences of life. Sorensen (2008) found that sibling children benefit from the experience of teaching their younger brothers and sisters, and that in addition to cognitive development, the experience of having siblings should provide self confidence and reinforce the child's own knowledge. Sorensen's work suggests that the differences go beyond objective educational attainment in the form of grades or highest education achieved and therefore it may be useful to examine issues relating to self concept, confidence, aspiration and belief in progress made.

However it is important to note that not all sibling relationships are positive and functional. Larger sibship sizes create complex human relationships which may hold negative social and psychological effects. Jealousy and rivalry may be a result of a lack of perceived equity regarding treatment from parents which may lead to difficult social relations both within and without the home (Irish, 1964).

### *The Social Child*

In Blake's own test of the resource dilution model she explores the effects of family size on a number of outcomes which capture the ability to participate in stimulating environments. She considers IQ, educational attainment, aspiration, personality, confidence and social skills (among others) as the dependent variable.

Blake finds that children from small families are more likely to engage in intellectual and cultural pursuits and spend more time alone. She also finds that children from lone children are more popular than children from larger families, which suggests that spending time alone is a matter of choice and not due to unpopularity (Blake, 1989). Related to this, Iacovou finds that the educational deficit for lone children is ameliorated if the child socialises with other children outside of school at the age of seven (Iacovou, 2001).

In addition to socialising with non family members, it is likely that the manner in which the young person spends their time with family members also differs by family size. Nisbet and Entwistle (1967) noted that when families grow, parents have less time to devote to higher birth order children, thus the younger children spend more time in the company of their siblings. They also found that small families require less investment of time on behalf of the parents than larger families. Furthermore in their study of American children Hofferth and Sandberg (2001) found that children from larger families take advantage of their readily available playmates, while lone children are more likely to spend time alone than children with siblings (Roberts and Blanton, 2001).

It is also useful to consider the young person's social skill, popularity, particularly as Blake finds that lone children are less likely to get on with peers that sibling children (Blake, 1981a). The incidence of being bullied goes some way to capture these elements of a young person's experience of their peers, however care must be taken to avoid blaming the victim.

Bullying behaviour can be described as any behaviour which causes intentional and repeated harm or distress to another (Olweus, 1993). More specifically, Mynard and Joseph (2000) find that threats of physical violence or actual physical violence as well as written or verbal abuse, social manipulation or attacks on property are forms of bullying behaviour.

Unfortunately being bullied is a common experience among young people (Hoover et al., 1993; Rigby and Slee, 1991; Slee, 1995; Whitney and Smith, 1993). Characteristics of bullies and the bullied as well as the social, psychological and educational outcomes associated with the experience have attracted a great deal of attention among academics (Cook et al. 2010, Farrington & Baldrey, 2010; Hawker & Boulton, 2000; Roland. 2002; Boulton et al. 2008).

The home environment has attracted attention from researchers with regards to those children who bully (e.g. Espelage & Swearer, 2003; and Duncan, 1999) however fewer studies have examined whether the home environment impacts those who have been bullied. An example of this type of research found that having supportive parents is associated with a reduced likelihood of being physically, verbally, relationally and cyber bullied and thus concluded that family factors can provide a manner of protection to the adolescents (Wang et al., 2009).

Cassidy (2009) examines the role of family situation and parental support for predicting victimisation. His UK based research found that victims of bullying received less parental support and exhibited more unhealthy behavioural styles. He controls for family size, the crowding[21] effect and a number of other home environment factors including degree of conflict within the home. Unfortunately he does not report the family size coefficients in his paper, leaving the results in this particular matter ambiguous. Therefore although family characteristics are used to predict victimisation, to my knowledge, no studies have directly examined whether family size and birth order is associated with the likelihood of being bullied.

The association between family size and the likelihood of being bullied may be negative and direct if the siblings attend the same school, or the presence of siblings in the home may offer the young person lessons in pro-social skills which reduce the likelihood of the young person being bullied. Alternatively there is a possibility that having siblings may increase the young persons' tolerance towards bullying behaviour and therefore reduce the likelihood that they report victimisation.

### *Emotional health and external locus of control*

So far this literature review has highlighted some evidence that lone children are disadvantaged because of additional stress due to higher expectations placed on them (Roberts and Blanton, 2001), poor social skills among peers (Cameron et al, 2013), inability to learn from siblings (Sorensen, 2008), lack of support from siblings (Downey, 2001) and an increased likelihood of spending time alone (Blake, 1989). If it is true that children have an increased possibility of experiencing these stresses, then it also may be likely that

[21] The crowding effect is calculated by taking the family size and dividing it by the number of bedrooms in the home.

wellbeing and emotional health may vary by family size. When Blake tested emotional health outcomes she found no evidence to suggest that lone children are lonely or depressed (Blake, 1989).

In addition to emotional health and wellbeing influencing educational outcomes, so too might a young person's perspective on life. These perspectives may also vary by family size as the family environment is shown to have an important influence on the young person's experiences. Rotter (1954) argues that people either believe that events come from their own actions and therefore have an internal locus of control; or they perceive events to arise from factors that are outside of their control that they cannot influence and are said to have external locus of control. This typology has consequences for motivation. Those with internal locus of control tend to have higher levels of academic achievement (Crandall et al. 1965; Stipek & Weisz, 1981), and those with external locus of control tend to feel like they have less control over their destiny, attribute success to luck and blame external factors for failure[22]. Coleman found that for ethnic minority pupils a sense of control of over their environment was more strongly related to academic outcomes than all other variables (Coleman et al. 1966). The expectation of external locus of control and the resource dilution model is that as family size increases young people are more likely to express feelings of having little control over their lives.

## Aims and Hypotheses

Given the points outlined in the literature review and the findings from the previous chapter, this chapter has one main aim: to identify whether there is evidence of the negative associations between family size and multiple measures of educational outcomes. This includes a test of the resource dilution model on GCSE grade attainment in England and

[22] It is plausible that this relationship works in both directions (Ames et al. 1976),

subjective measures of education. In addition to this the LSYPE data provides an opportunity to identify whether a change in resource availability between waves influences educational outcomes. Finally there will be an examination of whether socialising factors, emotional health and perspectives on life vary by family size.

The proceeding sections in this chapter will test a number of hypotheses derived from observations from the literature. These hypotheses are set out below:

H1a There is no relationship between family size and family resources

H1b There are no differences between the characteristics of parents with a lone child and parents with more than one child.

H2 There is a negative relationship between family size and GCSE achievement, net of family background controls and familial resources.

H3 Change in number of siblings in the household between wave one and wave three supports the predictions of the resource dilution model with respect to GCSE achievement, net of family size, birth order and family background effects.

H4 There is a negative relationship between family size and the young person's subjective experiences of education such as liking school, feeling like they are making progress at school, university aspirations and confidence of being accepted by university if they apply, net of family background controls and familial resources.

H5 There is a positive relationship between family size and poor emotional health, net of family background controls and familial resources.

H6 There is a positive relationship between family size and external locus of control, net of family background controls and ability.

H7a With whom the young person spends their time varies by family size, net of family background controls and familial resources, and this influences GCSE achievement.

H7b There is a positive relationship between family size and the frequency of socialising with others, net of family background controls and familial resources.

H8 There is a negative relationship between family size and birth order with regards to the incidence of being bullied, net of family background controls and familial resources.

## Contribution

The research presented in this chapter contributes to the body of literature by aiming to provide a better understanding of the associations between family size and birth order on educational outcomes in England for those born in 1990 and 1991. Specific attention is paid to resource dilution and the quality of GCSEs grades achieved and subjective measures of educational progress. Advantage is taken of the longitudinal design of the data which enables a closer examination of family size changes over time. In addition the relationship between family size and educational outcomes is examined along with the nature of the resource and the timing of the resources that are important for educational outcomes. This chapter also introduces a discussion about emotional health, locus of control and the incidence of being bullied as motivated by Blake (1989) who considers the whole educational environment of the young person in her analysis. This chapter builds on the analysis in chapter two by analysing a more recent cohort, examining lone children in more depth and examining the resource changes over time. Finally, this research can be used to support or reject some of the competing theories about lone children in particular, such as whether they are more likely to spend time alone and whether there is evidence that lone children have poor social skills as a result of having no siblings.

## Data and Methods

The Longitudinal Study of Young People in England (LSYPE) began in 2004 when the sample members were aged between 13 and 14. Each year the same young people and their parents are interviewed, resulting in seven waves of data. For the purpose of this analysis, Wave 1, Wave 2 and Wave 3 are used. Between Wave 2 and Wave 3, the young people sat their General Certificate of Secondary Education (GCSE) exams.

The sample includes young people who attended maintained schools, independent schools and Pupil Referral Units (PRUs) in England. The LSYPE uses a two-stage model design which presents a possible clustering effect due to between-school differences. All models are adjusted for 654 school clusters[23].

## Dependent Variables

The LSYPE data provides a number of opportunities to identify the advantages and disadvantages of having siblings. Therefore the dependent variables concentrate on objectives achievement (GCSE grades) and subjective outcomes (including liking school, feeling like progress is being made at school, aspirations to apply to university and confidence that they will be accepted if they apply). In addition alternative measures of the

[23] Multilevel models could serve the same purpose as adjusting for robust cluster variance around schools, but such an approach is not necessary as this paper neither specifically addresses school differences nor uses school difference explanations to elucidate substantive findings.

young person's educational environment are investigated, including socialising variables, emotional health and perspectives on life.

*GCSE results*

The LSYPE can be linked to The National Pupil Database (NPD) which provides information about the actual grades achieved at General Certificate of Secondary Education (GCSE). GCSEs are two-year courses which are taken towards the end of compulsory schooling[24] when the individual is aged 14-16. The grade scale runs from A*-G, with grade U (unclassified) signifying failure. Achieving at least five GCSEs at A*-C including English and Maths ('five good GCSEs') is a prerequisite to study A Levels in secondary school or sixth form college which is the traditional route to university. This measure is particularly useful because it has significance for education progression opportunities including studying A Levels and vocational qualifications and therefore is linked to status attainment. In addition the GCSE grades are used as a measure of school quality by governments.

As well as the measure of five good GCSEs, there are a number of other GCSE outcomes which can be used as robustness checks. These include binary variables for achieving: A*-C English; and A*-C Maths. There are also linear measures for which the grades have been allocated a numerical value[25]. The linear measures may include any points acquired through resists, and do not account for the total number of GCSEs taken, which may differ by school.

[24] In England education is compulsory for those aged between 5-16. GCSEs are subject specific courses, which are assessed by coursework, examination or a combination of both. GCSEs can be studied at both state and private schools. Usually between eight and ten subjects are studied, but this varies by the school provision and the ability of the students.
[25] G is the lowest grade achieved requiring 16 points. Each grade improvement, e.g. From G to F, C to B, or A to A* is equivalent to an additional six points.

### *Subjective measures of educational attainment*

Subjective measures of attainment, which relate to the plans or expectations of the young person, are used as dependent variables in order to test Blake's findings regarding confidence and aspiration. Binary variables were created which identify whether the young person feels like they are making progress in school (W1); whether the young person likes school (W3); whether they plan on applying to university (W3); and their belief that if they do apply, they will be accepted (W3). These variables capture the young person's perception of their educational outcomes, including satisfaction, aspiration and confidence.

### *Emotional health and attitudes towards life*

There is an opportunity to measure the emotional health of the young person. This measure is derived from the General Health Questionnaire-12 at Wave 2. This is a shortened form of questions from the GHQ12 which identifies non-psychotic psychiatric conditions. Young people who score four or more on this scale are said to have some emotional health concerns.

In addition to this, taken from Wave 2, the young person was asked to state to what extent they agreed with the statement, 'Even if I do well at school, I'll have a hard time' and 'how well you get on in this world is mainly a matter of luck'. These questions capture elements of locus of control (Rotter, 1954). Responses are scaled to compose a binary outcome.

### *Socialising and Time Spent*

The young person is asked 'how they mainly spend their free time' to which there are six responses: going out with friends; go to a friend's house or they come to you; spend time with your family; spend time with brothers/sisters; spend time by yourself; or none of these. In addition to this two questions ask how often in the last week the young person has spent time with their friends, either going out or staying in with friends. These measures may capture preferences of the child, social competence and parental permissiveness.

*Victimisation*

There has been much debate about the effectiveness of measures of victimisation (Leff et al, 1999; Espelage & Swearer, 2003; Cassidy, 2009; Theriot et al. 2005). It is a sensitive topic which therefore may be underreported by young people because of fear, shame or misunderstanding what constitutes being bullied.

The variable used came from the young person's report of whether they have ever been bullied since the start of the LSYPE study measured at Wave 3. In addition to this, a parental report of whether the young person had ever been bullied is captured at Wave 2.

### *Independent Variables*

The family size variable captures the complete family size at Wave 1 (composed of the number of dependent children in the household plus any older children who may be living outside of the home at Wave 1). Young people with five or more siblings were grouped together to avoid small cell sizes. The same strategy for measuring birth order seen in chapter one is adopted in this chapter. Booth & Kee's (2009) birth order index reduces the correlation between birth order and family size[26].

[26] This address the issue that those who are eighth born are more likely to come from a larger family, whilst those who are first born have a higher probability of coming from a smaller family.

Other family variables which may influence the educational outcomes and the familial resources will be taken into account including: parental education; family structure; mother's age; father's age; income and whether the household has a computer and internet access. The highest educational qualification achieved by either parent in the family was used. The family structure variable identifies whether parents are married; cohabiting; single; or whether the young person has neither biological parent in the household. In addition, there is a binary measure identifying whether the family is a step family or not. Parents' age when the young person was born is also included[27] along with ethnicity and gender of the young person. Total income from work, benefits, and anything else for main parent respondent and their partner is included in the analysis and a variable for log income was created.

Due to the longitudinal nature of the LSYPE data, there is an opportunity to identify whether there is a change in sibship size in the household. 72% if the sample has a family size which remains stable throughout the three waves under study, 26% have a siblings who leave, of which the majority of siblings are elder and therefore may signify leaving home to attend university or for employment. However there is a possibility that these siblings are no longer in the household because they have died or have left because of incarceration or family conflict. 2% of the final sample experience an increase in family size, of which, 22% are from step families and therefore it is reasonable to assume that the remainder are as a result of an additional birth.

[27] Note this is the mother/father's age when the young person was born. It does not capture parents' age at their first birth (who may not be the young person studied).

*Missing Variables*

Given the longitudinal study design, the LSYPE suffers from sample attrition.[28] In order to account for this, Piesse and Kalton (2009) created a series of weights for longitudinal analysis which will be applied as recommended.

Observations are included in the analysis when the dependent variable response is complete. Some independent variables also suffer for item non response. If a completed case analysis approach were to be adopted, this would result in a loss of over 2,000 cases; however for some variables exclusion was unavoidable[29].

In order to deal with the missing independent variables, multiple imputation was used. Multiple imputation is a complex approach which comes with a computational cost, but offers the best chance of reducing bias in the results (Treiman, 2009). However, Little and Rubin (1987) argue that even with multiple imputation, which is considered by some as the gold standard, if the researcher is naive about the imputation strategy it can create more problems than it solves. These problems include creating biases in estimates, standard errors and hypothesis tests.

The completed case analysis, single imputation (by subgroup mean) and multiple imputation approaches were tested and the estimates are shown in Table 3.1.1, Appendix 3.1. The results do not differ greatly between models and the coefficients lead to similar substantive conclusions, however significance levels vary somewhat. Given that the results do not vary substantively by imputation methods adopted, multiple imputation was used to

[28]At Wave 1 the response was N=15,770, at Wave 2 the response was N=13,539 and at Wave 3 N=12,439, a 21% reduction between Wave 1 and Wave 3.

[29] 145 young people were not able to be linked from Waves 1-3 to the National Pupil Database. 342 individuals were no longer at the same school which may deflate the socialising variables and educational outcomes. 87 respondents had missing data with regard to the number of children in the household, as this is a main variable of interest, they were excluded. 278 had insufficient data to code birth order so they were also excluded.

increase the number of observations in the model and to reduce bias slightly. A more detailed discussion and rationale of the multiple imputation strategy adopted can be found in Appendix 3.1.

### *Limitations*

Whilst the LSYPE is dataset is large and robustly sampled, there are some limitations for use. Firstly, it studies the educational outcomes of a single cohort of young people and therefore the patterns of behaviour may not be representative beyond this sample.

Secondly, although the LSYPE has seven available waves of data, which enables some analysis of post secondary education outcomes, this study concentrates on the young person's aspirations for further education and the actual GCSE grades achieved. This is a reasonable use of the data for two reasons: the information in waves 1-3 adequately addresses the research questions; and the later waves of the LSYPE data suffer from serious attrition as the young people were asked for consent when they were aged 16.

Thirdly, as was the case for chapter two, age spacing and gender composition effects cannot be taken into account in this analysis due to data limitations. Nevertheless this dataset provides an opportunity to study the resource dilution model on education when the young person is temporally close to the familial investments and environment in addition to providing detailed variables about the young person's educational environment.

# Results

## *Descriptive Statistics*

Table 3.1 shows the distribution of birth order by family size for the sample. There are 901 lone children in the sample. Just less than three quarters of children with one sibling are first born (2,257); of those respondents with two siblings 1,043 are first borns, 1,694 are second borns, and the remaining 521 third borns. There are 2,073 children with three siblings, 1,146 children with four siblings and 1,117 children with five or more siblings.

***Table 3.1 Distribution of birth order by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Birth Order | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| First born | 100 | 73 | 32 | 18 | 10 | 4 | **41** |
| Second born | | 27 | 52 | 43 | 32 | 13 | **34** |
| Third born | | | 16 | 30 | 32 | 20 | **15** |
| Fourth born | | | | 8 | 20 | 22 | **6** |
| Fifth born | | | | | 6 | 18 | **2** |
| ≥ Sixth born | | | | | | 23 | **2** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

Families with three children are the most common in the sample, and lone children are the least common after the families with six or more children have been aggregated. The results from a cross tabulation of family size and the respondent's GCSE attainment are presented in Figure 3.1. The stacked bar graph shows that around 54% of lone children achieve five good GCSEs. Children from a family with two children have the highest proportion who achieve five good GCSEs at 57%. Thereafter, as family size increases, the proportion of children achieving five A*-C GCSEs reduces; 53% for a child from a family

**Figure 3.1 Achievement of five A*-C GCSEs by family size**

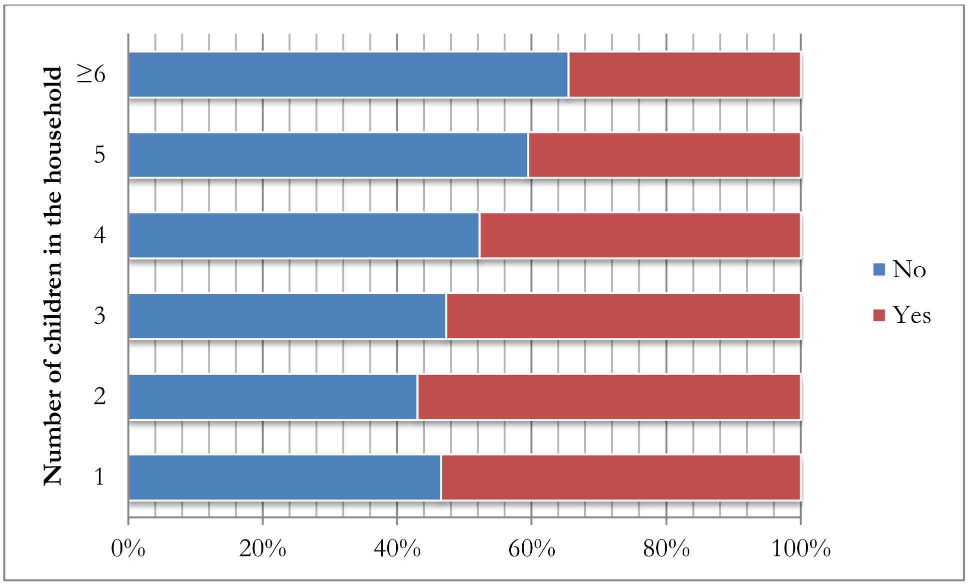
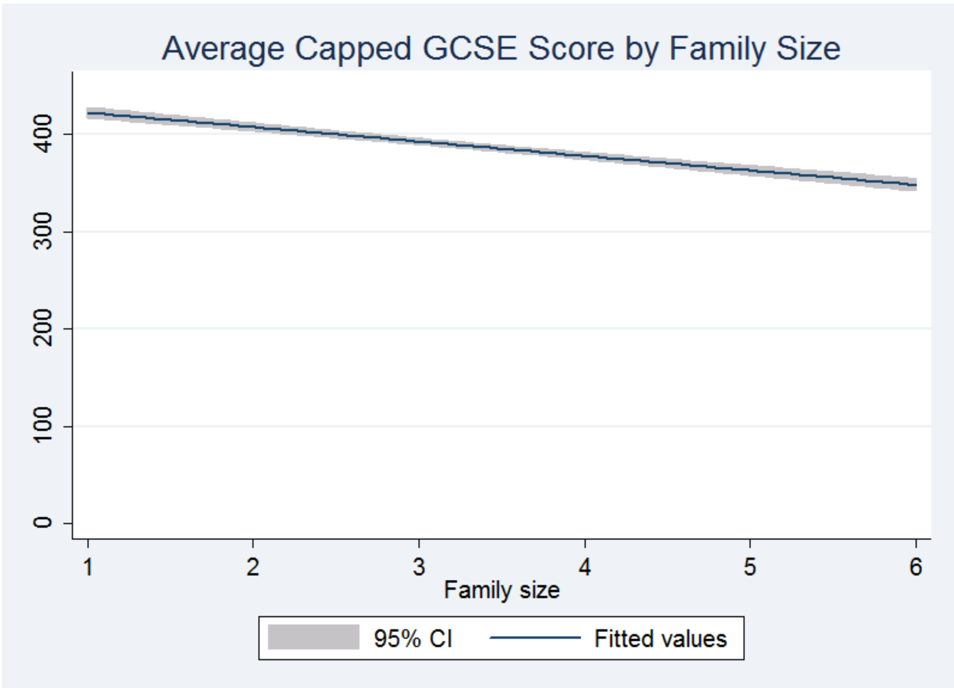



**Figure 3.2 Capped linear GCSE score by family size**



with three children; 48% for a child from a family with four children; 41% for a child from a family of five children and 35% for a child from a family with six or more children.

Figure 3.2 shows the relationship between family size and the capped linear GCSE score without any additional controls. This confirms the results from the relationship between family size and the binary GCSE measure seen in Figure 3.1 - that as family size increases, educational achievement reduces.

There are two points to note from the description of the data. Lone children are relatively rare in the UK, so too are larger families. GCSE attainment declines as family size increases without taking into account any controls for family background variables.

*H1a There is no relationship between family size and family resources*

It is important to identify whether there is evidence of resource dilution by family size with the LSYPE data. The resources considered are family class, family education, marital status of parents, whether the family is a step family, family income, parent's age and whether there is a computer and access to the internet in the home.

Table 3.2 identifies the relationship between family size and class. The results suggest that a higher proportion of the salariat have the smaller families[30]. A similar trend is found for the intermediate class, while a higher proportion of the working class category have larger families, which suggests that class related resources do vary by family size.

Table 3.3 shows the cross tabulation of parent's highest qualification by family size. The results indicate a higher proportion of parents with a degree have smaller families,

[30] 'Large families' is used to describe families with more than three children in the household (> two siblings) and 'small families' is used to describe families with three or fewer children in the household (≤ two siblings).

particularly two-child families. A similar trend is found for those with other higher qualifications and A Levels. Parents with no qualifications have the highest proportion of large families with 44% of those with no qualifications recorded as having six or more children.

Table 3.4 predicts the marital status by family size. Marital status gives an indication of the resources which may include parent time and attention as well as financial resources. The majority of children, regardless of family size , come from households where their parents are married, 68% of the sample. Marital status does vary by family size, although the most notable finding is that 49% of lone child households have married parents. The rest is made up of single parents (36%), no parents (5%) and cohabiting parents (10%).

Table 3.5 shows the proportion of step families by family size. The results do not indicate a large variation by family size.

As detailed in Table 3.6, the results from a cross tabulation between income and family size indicate that larger families are more likely to come from a household with an income of up to £20,799, while smaller families are more likely to come from a household with an income of more than £20,799. This suggests that larger families have access to less financial resources.

Mother's age and father's age are tabulated by family size in Table 3.7 and Table 3.8. The familial resources associated with age may include greater career stability and more experience of life (and childrearing). However the results do not suggest that age varies much by family size.

***Table 3.2 Cross tabulation of family size by family class***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Family Class | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 6 | 4 | 5 | 6 | 6 | 8 | **5** |
| Salariat | 12 | 13 | 13 | 10 | 8 | 5 | **11** |
| Intermediate | 38 | 43 | 40 | 32 | 30 | 18 | **36** |
| Working | 44 | 40 | 43 | 51 | 56 | 69 | **48** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.3 Cross tabulation of family size by highest educational qualification in family***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Parent's Highest Qualification | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 3 | 4 | 4 | 5 | 4 | 6 | **4** |
| Degree | 17 | 20 | 19 | 18 | 15 | 8 | **17** |
| Other Higher Ed | 17 | 17 | 18 | 14 | 12 | 7 | **15** |
| A Level | 17 | 20 | 18 | 16 | 15 | 10 | **17** |
| GCSE | 25 | 24 | 25 | 24 | 21 | 17 | **23** |
| Level1 | 8 | 5 | 5 | 6 | 6 | 5 | **5** |
| Other | 2 | 2 | 2 | 3 | 3 | 4 | **2** |
| None | 11 | 8 | 10 | 15 | 25 | 44 | **15** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,091 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.4 Cross tabulation of family size by marital status***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Family Type | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Married | 49 | 68 | 71 | 70 | 70 | 72 | **68** |
| Cohabit | 10 | 8 | 8 | 7 | 5 | 4 | **7** |
| Single Parent | 36 | 23 | 21 | 22 | 24 | 23 | **23** |
| No parents | 5 | 1 | 1 | 1 | 1 | 2 | **1** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.5 Cross tabulation of family size by step family***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Whether the household is a step family | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Not step family | 87 | 90 | 90 | 87 | 91 | 91 | **90** |
| Step family | 13 | 10 | 10 | 13 | 9 | 9 | **10** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.6 Cross tabulation of family size by household income***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Total income from work, benefits and anything else for respondent and partner | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 14 | 13 | 15 | 17 | 23 | 32 | **17** |
| Up to £10,399 | 14 | 10 | 9 | 12 | 16 | 17 | **11** |
| From £10,400 to £20,799 | 21 | 17 | 19 | 22 | 23 | 30 | **21** |
| From £20,800 to £31,199 | 17 | 18 | 18 | 17 | 14 | 9 | **17** |
| From £31,200 to £41,599 | 12 | 15 | 15 | 12 | 9 | 5 | **13** |
| From £41,600 to £51,999 | 10 | 11 | 9 | 8 | 6 | 3 | **9** |
| Over £52,000 | 12 | 15 | 15 | 12 | 9 | 4 | **13** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,091 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.7 Cross tabulation of family size by mother's age***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Mother's Age | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 8 | 3 | 3 | 2 | 3 | 3 | **3** |
| 20s | 0 | 0 | 0 | 1 | 0 | 0 | **0** |
| 30s | 31 | 37 | 33 | 36 | 40 | 34 | **36** |
| 40s | 49 | 54 | 57 | 54 | 48 | 48 | **53** |
| 50s and over | 11 | 6 | 7 | 7 | 8 | 15 | **8** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.8 Cross tabulation of family size by father's age***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Father's Age | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 37 | 22 | 19 | 21 | 23 | 23 | **22** |
| 20s | 1 | 1 | 1 | 1 | 1 | 0 | **1** |
| 30s | 11 | 16 | 16 | 17 | 16 | 11 | **15** |
| 40s | 33 | 49 | 48 | 45 | 44 | 38 | **45** |
| 50s and over | 18 | 13 | 16 | 16 | 16 | 27 | **16** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.9 Cross tabulation of family size by computer in the home***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Computer in the home | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 1 | 1 | 1 | 1 | 1 | 2 | **1** |
| No computer | 7 | 4 | 5 | 6 | 9 | 12 | **6** |
| Computer | 92 | 95 | 95 | 94 | 90 | 85 | **93** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,091 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 3.10 Cross tabulation of family size by internet access in the home***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Internet in the home | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more | Total |
| Unknown | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
| No internet | 14 | 10 | 12 | 15 | 21 | 31 | 15 |
| Internet | 85 | 89 | 88 | 84 | 77 | 67 | 84 |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,091 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

Table 3.9 and Table 3.10 shows the cross tabulation between computer and internet by family size. There is an indication that access to these resources do vary by family size. A greater proportion of smaller families have a computer and internet access in the home compared to larger families.

In summary there is evidence that the H1a can be rejected[31]. There is support from the data that access to familial resources does vary by family size particularly class, parental education, income and computer and internet access in the home.

*H1b There are no differences between the characteristics of parents with a lone child and parents with more than one child.*

Before examining the advantages and disadvantages of having siblings in more depth, it is useful to identify whether there are statistically significant, observable characteristic differences between lone child families and families with more than one child. In order to do this a series of univariate logistic regressions were run using the characteristics of the parents to predict family size. The results in Table 3.11 report the log odds of being a lone child.

The coefficients show the effects of a one unit difference in the independent variable on the log odds of being a lone child versus being a child with at least one sibling. There is a reduction in log odds of being a lone child for children whose parents are from an intermediate class and working class relative to the professional class, however these results

[31] Based on the degrees of freedom in each cross tabulation and with an alpha = $p<0.01$, the values derived from the Pearson chi-squared test in all presented cross tabulations in this section are sufficiently extreme that we can say the probability of obtaining a value this large due to chance variation, is only 1 out of 100. Therefore we can accept that dependence among variables is unlikely to occur due to chance variation.

***Table 3.11 Logistic regressions predicting being a lone child by parental characteristics (Log Odds)***

| *Family Class (Ref. Salariat)* | | |
|---|---|---|
| Intermediate | -0.02 | (0.11) |
| Working | -0.17 | (0.11) |
| Constant | -2.38*** | (0.10) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

| *Family Structure (Ref Married )* | | |
|---|---|---|
| Cohabit | 0.76*** | (0.12) |
| Single Parent | 0.84*** | (0.08) |
| No Parents | 2.18*** | (0.20) |
| Constant | -2.83*** | (0.05) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

| *Ethnicity (Ref White)* | | |
|---|---|---|
| Ethnic Minority | -0.41*** | (0.08) |
| Constant | -2.36*** | (0.04) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

| *Family Structure (Non step family)* | | |
|---|---|---|
| Step family | 0.23* | (0.11) |
| Constant | -2.50*** | (0.04) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

| *Household Income (ref. Up to £10,399)* | | |
|---|---|---|
| From £10,400 to £20,799 | -0.20 | (0.17) |
| From £20,800 to £31,199 | -0.19 | (0.26) |
| From £31,200 to £41,599 | -0.31 | (0.33) |
| From £41,600 to £51,999 | -0.10 | (0.38) |
| Over £52,000 | -0.32 | (0.43) |
| Log income | 0.03 | (0.33) |
| Constant | -2.34*** | (0.45) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

| *Family's Highest Qual (Ref. Degree)* | | |
|---|---|---|
| Other high ed | 0.11 | (0.12) |
| A Level | 0.01 | (0.12) |
| GCSE | 0.09 | (0.11) |
| Level1 | 0.45** | (0.15) |
| Other | -0.11 | (0.25) |
| None | -0.29* | (0.13) |
| Constant | -2.50*** | (0.08) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

| *Mother's age (Ref; 20s)* | | |
|---|---|---|
| 30s | 0.38 | (0.72) |
| 40s | 0.38 | (0.73) |
| 50s and over | 0.82 | (0.73) |
| Constant | -2.89*** | (0.72) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

| *Father's age (Ref. 20s)* | | |
|---|---|---|
| 30s | -0.61+ | (0.34) |
| 40s | -0.72* | (0.33) |
| 50s and over | -0.39 | (0.33) |
| Constant | -1.86*** | (0.32) |
| N | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

**Figure 3.4 Average marginal effects of ethnicity, marital status, family type and parent's age predicting family size (lone child versus child with siblings)**

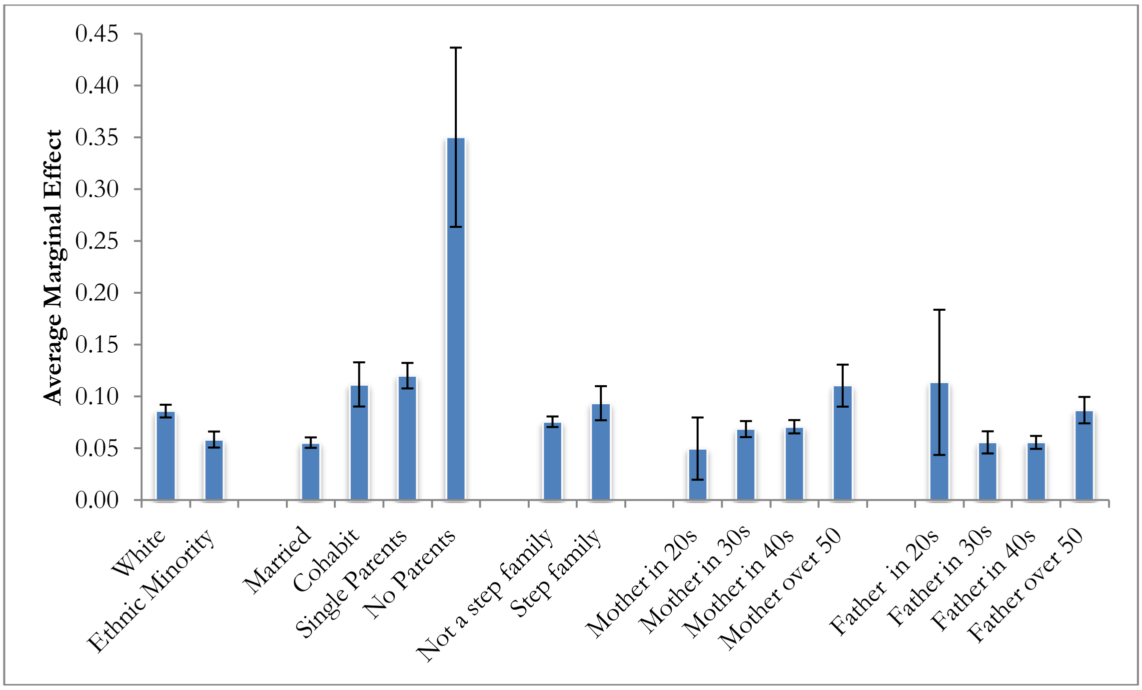
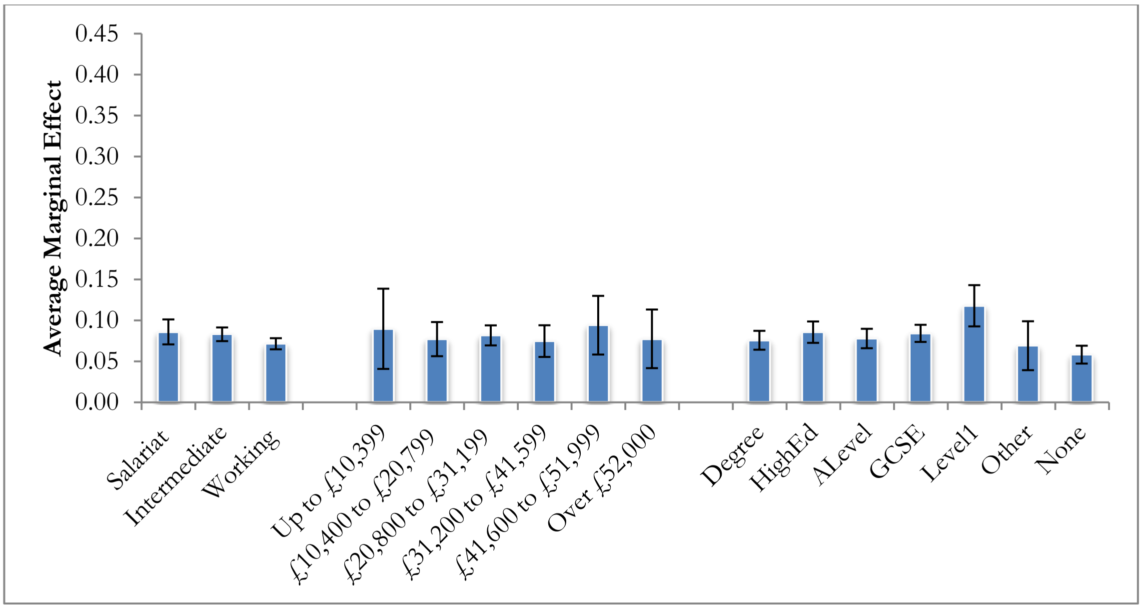



**Figure 3.3 Average marginal effects of class, income and education of parents predicting family size (lone child versus child with siblings)**



are not statistically significant. Marital status does yield significant results; there is an increase in log odds of being a lone child for children with cohabiting parents, a single parent or a child who does not live with either of their parents relative to married parents. A lone child is statistically less likely to have ethnic minority parents than white parents and are significantly more likely to come from a step family than not. Income is not a significant predictor for family size and education offers mixed results - lone children are more likely to come from families where the highest level of education is a level one qualification relative to a degree or higher. Mother's age is not a significant predictor of family size, and there is evidence that younger fathers are more likely to have a lone child.

In order to compare the magnitude of the results across models, Average Marginal Effects (AME) were calculated, the results are shown in Figure 3.3 and Figure 3.4.

In summary, the findings suggest that there are some observable differences between the characteristics of parents of lone children and children with siblings. More specifically, lone children are significantly more likely to come from white families, with lower levels of education, younger fathers and complex family structures (step families, cohabiting parents, single parent household and not living with either of their parents). As a result, there is no support for H1b.

*H2 There is a negative relationship between family size and GCSE achievement, net of family background controls and familial resources.*

The results from the logistic regressions predicting the likelihood of achieving five A*-C GCSEs are shown in Table 3.12. The tables present the log odds of achieving five good

***Table 3.12 Logistic regression predicting five A*-C GCSEs (including English and Maths)***

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | |
| One sibling | 0.11 | (0.08) | -0.03 | (0.08) | -0.12 | (0.09) |
| Two siblings | -0.05 | (0.08) | -0.20* | (0.08) | -0.31*** | (0.09) |
| Three siblings | -0.26** | (0.08) | -0.29*** | (0.09) | -0.39*** | (0.09) |
| Four siblings | -0.56*** | (0.09) | -0.51*** | (0.10) | -0.62*** | (0.10) |
| Five or more siblings | -0.79*** | (0.09) | -0.52*** | (0.10) | -0.61*** | (0.11) |
| Birth order index | -0.21*** | (0.06) | -0.15* | (0.06) | -0.69*** | (0.07) |
| *Gender and Ethnicity (White, Male)* | | | | | | |
| Ethnic minority | 0.07 | (0.04) | 0.43*** | (0.05) | 0.42*** | (0.05) |
| Female | 0.34*** | (0.04) | 0.41*** | (0.04) | 0.43*** | (0.04) |
| *Class (Salariat)* | | | | | | |
| Intermediate | | | -0.22** | (0.08) | -0.17* | (0.08) |
| Working | | | -0.59*** | (0.09) | -0.50*** | (0.09) |
| *Parent's highest qualification (Degree)* | | | | | | |
| Other Higher Education | | | -0.70*** | (0.08) | -0.63*** | (0.08) |
| A Level of equivalent | | | -0.89*** | (0.08) | -0.79*** | (0.08) |
| GCSE or equivalent | | | -1.09*** | (0.08) | -0.95*** | (0.08) |
| Level 1 | | | -1.53*** | (0.11) | -1.36*** | (0.12) |
| Other | | | -1.34*** | (0.15) | -1.25*** | (0.16) |
| None | | | -1.32*** | (0.09) | -1.30*** | (0.09) |
| *Income (Up to £10,399)* | | | | | | |
| From £10,400 to £20,799 | | | 0.15 | (0.10) | 0.13 | (0.10) |
| From £20,800 to £31,199 | | | 0.34* | (0.14) | 0.25+ | (0.14) |
| From £31,200 to £41,599 | | | 0.50** | (0.16) | 0.38* | (0.17) |
| From £41,600 to £51,999 | | | 0.67*** | (0.19) | 0.52** | (0.20) |
| Over £52,000 | | | 0.97*** | (0.21) | 0.76*** | (0.21) |
| Log income | | | 0.31+ | (0.16) | 0.30+ | (0.17) |
| *Family type (Not step family)* | | | | | | |
| Step | | | | | -0.31*** | (0.08) |
| *Marital status (Married)* | | | | | | |
| Cohabit | | | | | -0.32*** | (0.09) |
| Single Parent | | | | | -0.25*** | (0.06) |
| No parents | | | | | -1.11*** | (0.26) |
| *Parent's age (20s)* | | | | | | |
| Mother 30s | | | | | 0.27 | (0.40) |
| Mother 40s | | | | | 0.71+ | (0.41) |
| Mother 50s and over | | | | | 0.99* | (0.42) |
| Father 30s | | | | | 0.00 | (0.34) |
| Father 40s | | | | | 0.39 | (0.34) |
| Father 50s and over | | | | | 0.55+ | (0.32) |
| Constant | 0.10 | (0.10) | -0.12 | (0.28) | -0.36 | (0.60) |
| Observations | 11,587 | | 11,587 | | 11,587 | |
| Standard errors in parentheses | | | | | 0.1546 | |

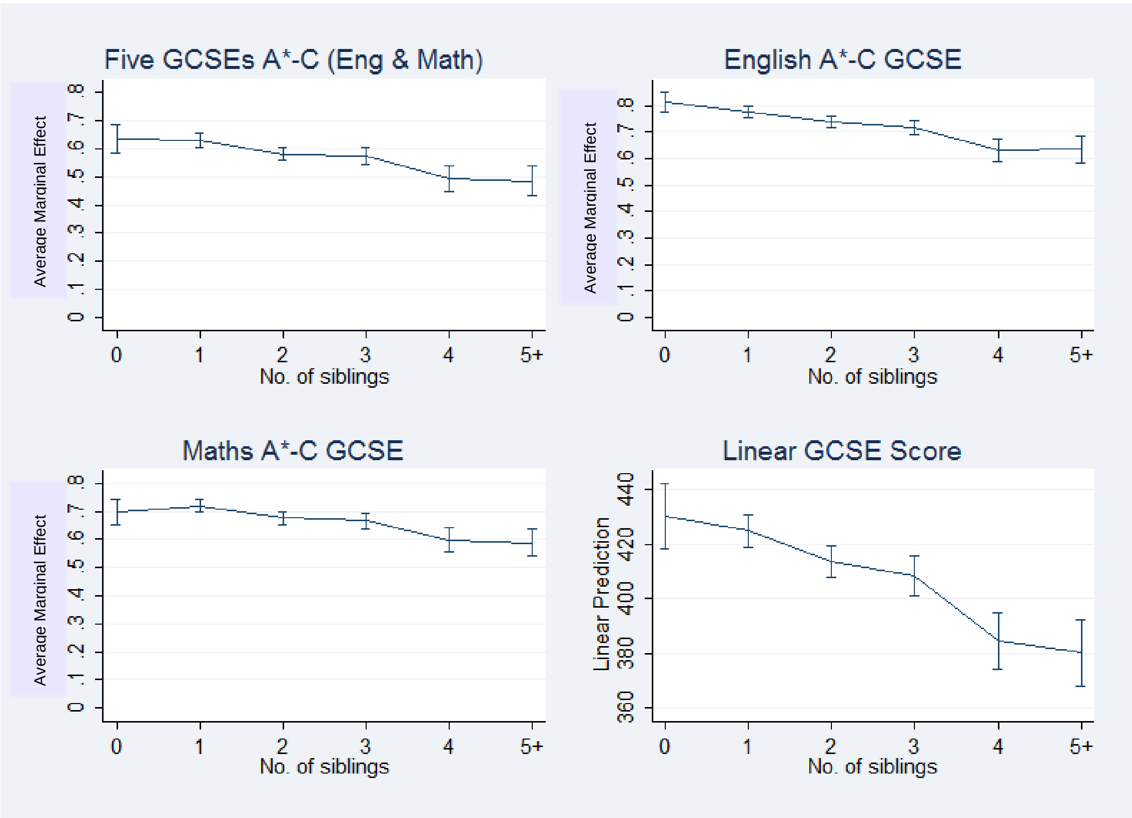
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

***Table 3.13 Alternative model specifications, predicting GCSE achievement***

| | Model 1 Five A*-C GCSE inc English & Maths | | Model 2 English GCSE A*-C | | Model 3 Maths GCSE A*-C | | Model 4 Linear GCSE score | |
|---|---|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | | | |
| One sibling | -0.12 | (0.09) | -0.20* | (0.09) | -0.07 | (0.09) | -11.41* | (5.19) |
| Two siblings | -0.31*** | (0.09) | -0.35*** | (0.09) | -0.28** | (0.09) | -20.52*** | (5.16) |
| Three siblings | -0.39*** | (0.09) | -0.47*** | (0.10) | -0.30** | (0.09) | -28.53*** | (5.47) |
| Four siblings | -0.62*** | (0.10) | -0.84*** | (0.11) | -0.51*** | (0.10) | -48.39*** | (6.12) |
| Five or more siblings | -0.61*** | (0.11) | -0.77*** | (0.11) | -0.58*** | (0.11) | -46.55*** | (6.37) |
| Birth order index | -0.69*** | (0.07) | -0.63*** | (0.08) | -0.62*** | (0.07) | -49.12*** | (4.41) |
| Constant | -0.36 | (0.60) | -0.24 | (0.55) | 0.68 | (0.58) | 356.22*** | (33.68) |
| N | 11,587 | | 11,587 | | 11,587 | | 11,587 | |
| Pseudo R2 | 0.1546 | | 0.1737 | | 0.1327 | | 0.1985 | |

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Figure 3.5 Average marginal effects of alternative GCSE outcomes by family size**



GCSEs. The results in Model 1 indicate that as family size increases, the log odds of achieving five good GCSEs decreases, however children with one or two siblings are not significantly different to a lone child. When controls for class, parental education and income are included in Model 2 the coefficients for larger families reduce in size. The coefficient for a child with two siblings increases in magnitude and becomes significantly different from a lone child. The independent variables behave as we might expect. The log odds of achieving five good GCSEs are 0.43 larger for ethnic minority children than for white children and 0.41 larger for girls than for boys. There is a negative relationship between GCSE achievement and decreases in class, parental education and income. When family structure and parent's age are included in Model 3 the coefficients for class, education, income, gender and ethnicity hardly change. The family size coefficients increase in size. So too does the birth order index which indicates that as birth order increases, the log odds of achieving five good GCSEs reduce by -0.67.

In order to test whether these findings are robust to alternative model specifications, the following dependent variables are predicted: achieving A*-C for a GCSE in English; achieving A*-C for a GCSE in maths; and a linear and continuous variable using the capped GCSE scores. The truncated models are shown in Table 3.13. The full estimations for these models can be found in Appendix 3.2.

The results suggest that there is evidence of resource dilution which is associated with GCSE achievement, net of family background controls, and that this is robust to alternative measures of GCSE. Table 3.13, Model 2 predicts the achievement of a A*-C grade in English and the results show that there are significant differences between a lone child and a child with one sibling, and that the dilution effect is stronger for English than for Maths (Model 3). Model 4 is an OLS regression predicting GCSE scores which have been converted to linear measure. The results show that a child with one sibling achieves -11.41 GCSE points less than a lone child (almost two grades lower), while a child with five or more siblings will achieve -46.55 less than a lone child (around seven grades lower). The coefficient for birth order is significant and negative across all models; later born children have lower log odds of doing well at GCSE or achieve -49.12 less GCSE points.

AMEs are calculated and shown in Figure 3.5. The results from the margins indicate that a young person with no siblings has 65% chance of achieving five good GCSEs, while an otherwise comparable child with five or more siblings has around a 50% chance. For English, it is around 82% chance for a young person with no siblings and 63% for a comparable young person with five or more siblings while for maths it is 70% for a lone child and 60% for a child with five or more siblings. However not all contrasts are statistically significant. When predicting five good GCSEs, lone children are not significantly different to children with one sibling; children with three siblings are not significantly different to children with two siblings; and children with five or more siblings are not statistically significant to children with four siblings. However all other contrasts are significant[32].

Overall there is enough support for H2. There is a negative relationship between family size and GCSE achievement, net of family background controls. As was the case in chapter two, there is a strong and significant negative birth order association. The finding that resource dilution is evident for the young person at this juncture has important implications because GCSEs influence subsequent educational choices significantly. GCSE grades, particularly including in English and Maths, are prerequisite to many types of

[32] The same contrasts are significant when predicting A*-C grades in English and linear GCSE scores. For Maths the same contrasts are statistically insignificant; additionally, lone children are not significantly different to children with two or three siblings.

further study, including A Levels and vocational courses which in turn influence the likelihood of attending university.

*H3 Change in number of siblings in the household between wave one and wave three supports the predictions of the resource dilution model with respect to GCSE achievement, net of family size, birth order and family background effects.*

There is an opportunity to measure the association between change in family size and educational outcomes as a result of the longitudinal design. This will help to identify if the type of resources that are required by a young person varies by age and stage in the education system (Alwin & Thornton, 1984). The family size variable is a measure of the complete family size at wave one which includes any siblings who may not be living in the home at that time. The family change variable is composed of the number of siblings in the household at wave three minus the actual number of siblings in the household at wave one. The change variable is coded as sibling left, stable, sibling new and captures the influence of resource dilution when the young person is aged 14 – 16 when family size and birth order are controlled for.

The expectation of family change with regard to educational attainment is complex. A change in number of siblings in the household can be either taken to represent a change in the resources that the young person has access to now, or the change in the resources that the young person had access to in the past. For example, on one hand a reduction in family size between wave one and wave three means that the young person has access to more resources in the home (in the short term) however it indicates fewer resources were available to them while they were growing up (in the long term). Controlling for family size in the model deals with this ambiguity, making the change variable capture the effect

***Table 3.14 Alternative model specifications, predicting GCSE achievement net of family size change between wave one and wave three***

| | Model 1 Logistic Regression Predicting Five A*-C (Eng & Math) | | Model 2 Logistic Regression Predicting A*-C English GCSE | | Model 3 Logistic Regression Predicting A*-C Maths GCSE | | Model 4 Linear Regression Predicting Capped linear GCSE | |
|---|---|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | | | |
| One sibling | -0.13 | (0.09) | -0.24* | (0.10) | -0.08 | (0.09) | -12.55* | (5.38) |
| Two siblings | -0.30** | (0.09) | -0.39*** | (0.10) | -0.27** | (0.09) | -19.91*** | (5.48) |
| Three siblings | -0.38*** | (0.10) | -0.46*** | (0.11) | -0.27** | (0.10) | -27.40*** | (5.95) |
| Four siblings | -0.56*** | (0.12) | -0.80*** | (0.12) | -0.47*** | (0.12) | -45.21*** | (6.83) |
| Five or more siblings | -0.60*** | (0.12) | -0.76*** | (0.13) | -0.60*** | (0.12) | -47.86*** | (7.19) |
| Birth order index | -0.69*** | (0.08) | -0.62*** | (0.08) | -0.63*** | (0.08) | -48.21*** | (4.76) |
| *Family Size Change (Stable)* | | | | | | | | |
| Sibling Left | -0.01 | (0.06) | -0.05 | (0.06) | 0.01 | (0.06) | -1.71 | (5.38) |
| Sibling New | -0.17 | (0.15) | -0.16 | (0.15) | -0.14 | (0.14) | -13.93 | (5.48) |
| Constant | -0.27 | (0.67) | -0.22 | (0.63) | 0.91 | (0.63) | 357.28*** | (5.95) |
| Observations | 11587 | | 11,587 | | 11,587 | | 11,587 | |

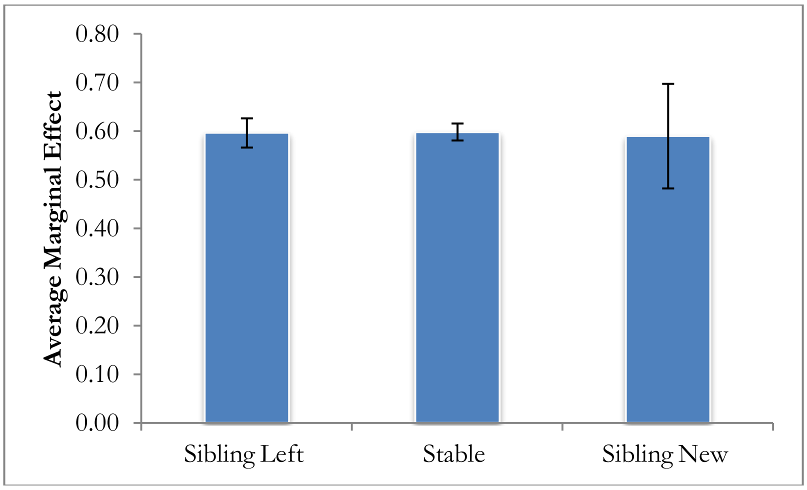
Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

of an additional sibling in the household or a sibling leaving the household over this period. Therefore we would expect a sibling leaving the home would influence GCSEs positively as their resources have increased between waves. A new sibling in the household indicates that the young person has less access to familial resources in the short term and so we would expect that there would be a negative relationship between family size and GCSE results, as a result of resource dilution.

Table 3.14 shows the alternative measures for GCSE achievement by change in family size, net of family background controls, family size and birth order. There is evidence that if a sibling of a young person leaves the home there is a reduction in log odds of achieving five good GCSEs (Model 1) and A*-C in English (Model 2), the capped linear score shows that there is a reduction in GCSE points if a sibling leaves the home (Model 4). These findings do not conform to the expectations of resource dilution. However there is an increase in log odds of achieving A*-C in Maths (Model 3) if a sibling leaves the home. These results are not significantly different to a young person who has a stable sibship size across waves which suggests that the additional resources gained by the young person as a result of a sibling leaving the home are not enough to significantly influence their GCSE results. There are stronger negative coefficients for when a new sibling joins the household, which suggests that resource dilution effects may operate in the short term, however these findings are not statistically significant. The family size and birth order coefficients do not change considerably when family change variables are included in the model.

Marginal effects were calculated from Model 1 and have been plotted in Figure 3.6. The results show that a young person whose sibling leaves the household has a 60% chance of achieving five good GCSEs, while an otherwise comparable child who has an additional sibling join the household is 59%. A young person whose household size is stable has a 60% chance of achieving five good GCSEs. However, as we might expect, none of the contrasts are statistically significant.

**Figure 3.6 Average marginal effects predicting five good GCSEs by family size change**



In summary, change in family size between wave one and wave three is not significantly associated with GSCE achievement. There is a small negative effect on GCSE achievement for young people whose sibling has left the home, and a larger negative effect for young people who have had an additional sibling join the household but neither result is statistically significant. There is insufficient evidence to say that these predictions for GCSE achievement support the expectations of the resource dilution model thus H3 must be rejected.

*H4 There is a negative relationship between family size and the young person's subjective experiences of education such as liking school, feeling like they are making progress at school, university aspirations and confidence of being accepted by university if they apply, net of family background controls and familial resources.*

Subjective measures of achievement offer insight into the perceptions and aspirations of the young person. Table 3.14, Model 1 details the results from a logistic regression predicting whether the young person reported liking school net of family background controls. There are no significant differences on the log odds by family size. With regard to family size change across waves, there is a reduction in log odds by -0.12 if a sibling left the home and an increase in log odds by 0.10 if a sibling joined the home; however neither of these results is statistically significant. This indicates that neither an increase nor a decrease in resources in the short term significantly influences the young person's enjoyment of school.

The degree to which the young person reports that they believe they are making progress at school (Model 2) yields negative log odds relative to a lone child as family size increases. A young person with three or more siblings yields coefficients which are significantly different to a lone child. If a sibling leaves the home, the log odds of reporting feeling like they are making progress at school reduces significantly and if a new child joins the home the log odds increase. This suggests that the short term increase or reduction in resource access does not influence the self perception of making progress at school in the manner that the resource dilution model predicts.

Model 3 and 4 predict the likelihood of the young person reporting that they will apply to university and their belief that they will be accepted if they apply. There are significant and negative log odds of applying to university by family size and birth order. Furthermore if a sibling leaves the home, the log odds reduce significantly, which suggests that the additional resources available to the child in the short term do not influence university aspiration and belief. If a sibling joins the household the log odds reduce compared to a young person who doesn't experience family size change in the home. This supports the expectation of the resource dilution model in the short term, but is not significantly different. The young person's belief of being accepted if they apply follows a similar pattern to the likelihood of applying to university, except a child with one sibling is not significantly different to a lone child and the negative association found for a new sibling is now weakly significant ($p<0.10$).

The birth order index is statistically significant for all models, which suggests that later born children have a less positive educational experience than early born children.

It is possible that these subjective measures of educational attainment will be influenced by ability. When controls for actual GCSE attainment (Table 3.15) are included in the model all family size coefficients remain negatively associated and all but one of the significant family size associations disappear (a young person with four siblings has significantly lower log odds of applying to university than a lone child remains significant). The birth order index remains statistically significant and negatively associated with the subjective outcomes and the family change indicators keep their significance and magnitude

***Table 3.14 Logistic regression predicting subjective assessment of school/progress, multiple measures***

| | Model 1 Like School | | Model 2 Self Perception of Progress at school | | Model 3 Apply to Uni | | Model 4 Belief they will be accepted by Uni if they apply | |
|---|---|---|---|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | | | | | |
| One sibling | -0.07 | (0.12) | -0.12 | (0.09) | -0.21* | (0.10) | -0.15 | (0.15) |
| Two siblings | -0.10 | (0.12) | -0.15 | (0.09) | -0.23* | (0.10) | -0.33* | (0.16) |
| Three siblings | -0.09 | (0.14) | -0.21* | (0.10) | -0.23* | (0.11) | -0.30+ | (0.17) |
| Four siblings | -0.05 | (0.16) | -0.30** | (0.11) | -0.51*** | (0.13) | -0.54** | (0.19) |
| Five or more siblings | -0.05 | (0.17) | -0.32** | (0.12) | -0.35** | (0.14) | -0.48* | (0.20) |
| Birth order index | -0.71*** | (0.11) | -0.45*** | (0.08) | -0.71*** | (0.09) | -0.65*** | (0.13) |
| *Family Size Change (Stable)* | | | | | | | | |
| Sibling Left | -0.12 | (0.08) | -0.14* | (0.06) | -0.14* | (0.06) | -0.23* | (0.09) |
| Sibling New | 0.10 | (0.20) | 0.12 | (0.15) | -0.11 | (0.16) | -0.41+ | (0.22) |
| Constant | 2.14** | (0.76) | 1.15* | (0.52) | -0.86 | (0.62) | 2.53* | (1.06) |
| Observations | 11,264 | | 11,251 | | 11,165 | | 8,702 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

***Table 3.15 Logistic regression predicting subjective assessment of school/progress, multiple measures – controlling for ability***

| | Model 1 Like School | | Model 2 Self Perception of Progress | | Model 3 Apply to University | | Model 4 Accept to University | |
|---|---|---|---|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | | | | | |
| One sibling | -0.04 | (0.12) | -0.09 | (0.09) | -0.18 | (0.11) | -0.05 | (0.17) |
| Two siblings | -0.03 | (0.13) | -0.07 | (0.09) | -0.08 | (0.11) | -0.13 | (0.17) |
| Three siblings | -0.01 | (0.14) | -0.11 | (0.10) | -0.06 | (0.12) | -0.06 | (0.18) |
| Four siblings | 0.07 | (0.16) | -0.16 | (0.12) | -0.30* | (0.14) | -0.28 | (0.20) |
| Five or more siblings | 0.07 | (0.17) | -0.17 | (0.12) | -0.13 | (0.15) | -0.21 | (0.21) |
| Birth order index | -0.57*** | (0.11) | -0.29*** | (0.08) | -0.48*** | (0.10) | -0.37** | (0.14) |
| *Family Size Change (Stable)* | | | | | | | | |
| Sibling Left | -0.11 | (0.08) | -0.15* | (0.06) | -0.14* | (0.07) | -0.22* | (0.10) |
| Sibling New | 0.13 | (0.21) | 0.18 | (0.15) | -0.04 | (0.18) | -0.37 | (0.24) |
| *GCSE (Not achieved 5 A*-C GCSEs)* | | | | | | | | |
| Five A*-C GCSEs | 1.10*** | (0.77) | 1.46*** | (0.05) | 2.11*** | (0.06) | 2.44*** | (0.10) |
| Constant | 1.72* | (0.75) | 0.62 | (0.56) | -1.87** | (0.66) | 1.55 | (1.08) |
| Observations | 11,264 | | 11,251 | | 11,165 | | 8,702 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Figure 3.7 Average marginal effects predicting subjective educational experience, multiple measures by family size**

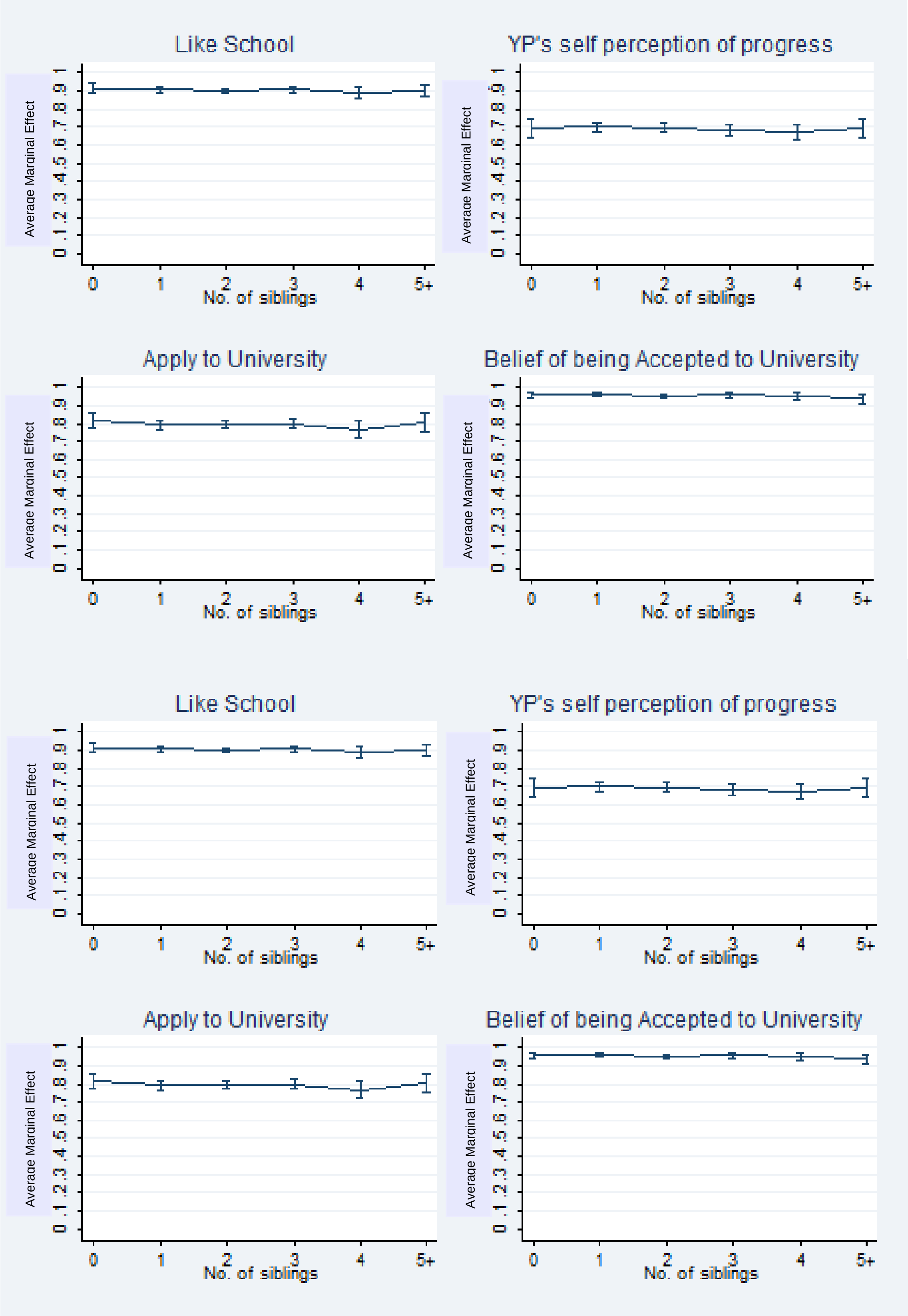
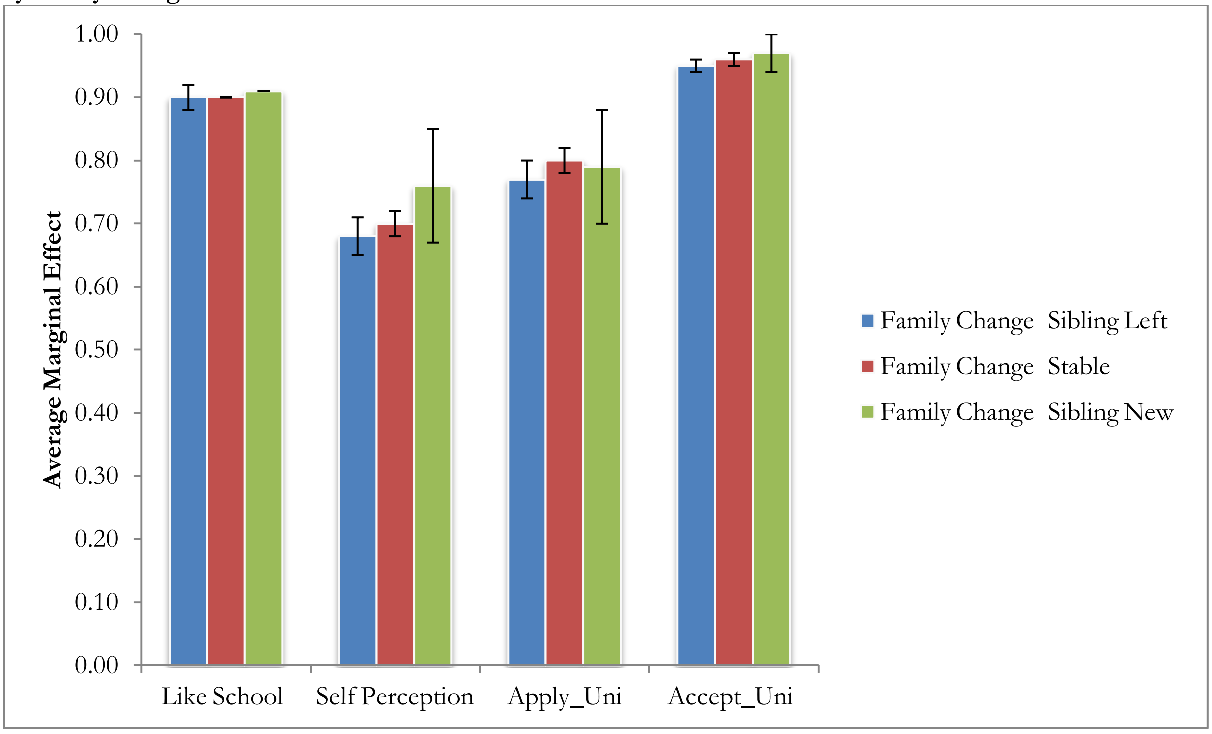


**Figure 3.8 Average marginal effects predicting subjective educational experience, multiple measures by family change**




except young people who experiences a sibling joining their household in Model 4, which loses its significance.

Marginal effects were calculated from the models in Table 3.15 by family size (Figure 3.7) and family change (Figure 3.8).

There are a number of interesting things to note from this analysis. Firstly that there is weak evidence that resource dilution predicts the likelihood of the young person reporting liking school; feeling like they are making progress at school; applying to university; and their belief that they will be accepted if they apply. However the magnitude of these differences is small as seen in Figure 3.6. Birth order is significantly and negatively associated with these outcomes, which suggest that for subjective measures position within the family matters, with later born children less likely to enjoy school, have confidence in progress and higher education aspirations. The changes in access to familial resource between wave one and wave three does not confirm the predictions of the resource dilution model. In summary, there is some weak evidence to support H4 when ability controls are not included in the model, however when they are included the family size association is small, meaning that H4 should be rejected.

The following hypotheses measure the influence of resource dilution on the overall educational experience. This includes emotional health, socialising variables and the incidence of being bullied.

*H5 There is a positive relationship between family size and poor emotional health, net of family background controls and familial resources.*

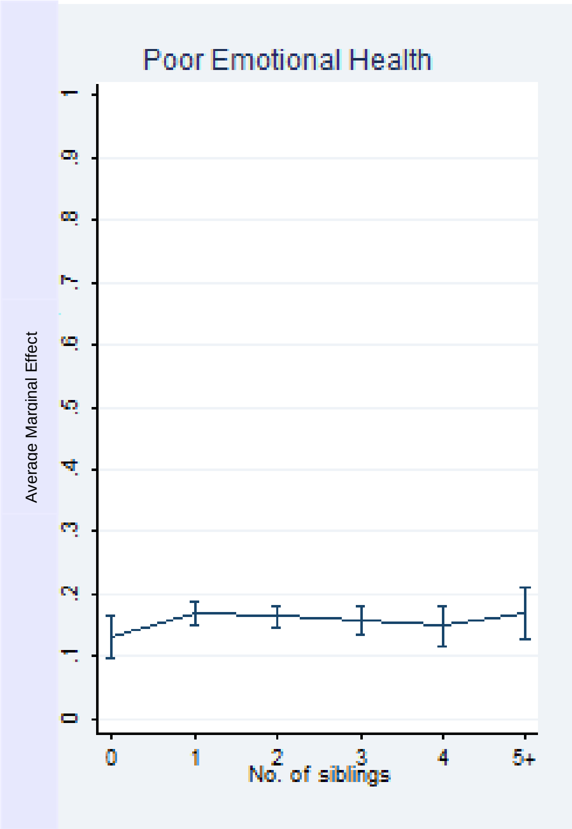
The emotional health variable is derived from the General Health Questionanire-12. Young people who score four or more on this scale are said to have some emotional health

***Table 3.16 Logistic regression predicting poor emotional health***

| | Emotional Health | |
|---|---|---|
| *Family Size (Lone Child)* | | |
| One sibling | 0.02 | (0.11) |
| Two siblings | 0.02 | (0.11) |
| Three siblings | -0.00 | (0.12) |
| Four siblings | -0.13 | (0.14) |
| Five or more siblings | -0.04 | (0.15) |
| Birth order index | -0.01 | (0.10) |
| Constant | -2.00** | (0.73) |
| Observations | 11,587 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Figure 3.9 Average marginal effects predicting poor emotional health by family size**




concerns. A binary measure was created which categorises young people as either having a score of four or more, or not. Table 3.16 shows the results from a logistic regression, net of family background controls, predicting the likelihood of reporting poor emotional health. The results suggest that there are no significant differences by family size relative to a lone child.

Average marginal effects are calculated and shown in Figure 3.9. The contrast between a lone child and a child with one sibling is statistically significant[33] and suggests that a child with one sibling has a higher probability of having poor emotional health than a lone child. This indicates that there is a lone child advantage with respect to emotional health

[33] The p-value here is different from the p-value in the original logit model because in the probability metric the values of the covariate matter (Statistical Computing Seminar, 2013).

outcomes. As family size increases there is a slight increase in the probability of having emotional problems. However these contrasts are not significantly different, therefore there is not enough evidence to be able to fully accept H5 despite the significant differences between a lone child and a child with one sibling.

*H6 There is a positive relationship between family size and external locus of control, net of family background controls and ability.*

The resource dilution model predicts that as a result of resource dilution, young people would express more feelings of external locus of control or a feeling of little control over their life outcomes. The results from the logistic regression are presented in Table 3.17. Both models support H6 - Model 1 identifies whether the young person believes that even if they do well in school they will have a hard time in life and Model 3 identifies whether

***Table 3.17 Logistic regression predicting degree of external locus of control***

| | Model 1 Even if I do well at school, I will have a hard time | | Model 2 Success in Life is a matter of Luck | |
|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | |
| One sibling | 0.10 | (0.09) | 0.24* | (0.11) |
| Two siblings | 0.22* | (0.09) | 0.22* | (0.11) |
| Three siblings | 0.20* | (0.10) | 0.21+ | (0.12) |
| Four siblings | 0.12 | (0.12) | 0.32* | (0.14) |
| Five or more siblings | 0.30* | (0.12) | 0.42** | (0.14) |
| Birth order index | 0.11 | (0.08) | 0.07 | (0.09) |
| *GCSE (Not achieving 5 A*-C GCSEs)* | | | | |
| Five A*-C GCSEs | -0.48*** | (0.05) | -0.94*** | (0.06) |
| Constant | -1.31* | (0.55) | -0.74 | (0.62) |
| Observations | 9,801 | | 10,240 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Figure 3.10 Average marginal effects of family size predicting degree of external locus of control**


the young person believes that success in life is a matter of luck. Birth order associations are positive but not significant in either of the models. These outcomes are negatively associated with ability controls; those who do well in school are less likely to feel like they have little control over their life, however the direction of causation is unclear. Tables of the logistic regressions without ability controls can be seen in Appendix 3.3. There are not differences in the significance of the coefficients and the sizes of the coefficients only change slightly.

Marginal effects were calculated and the results are presented in Figure 3. 10. The graphs indicate that these questions capture different elements of external locus of control, indicated by the differences in probabilities between graphs. For the 'I will have a hard time' graph the contrasts are statistically significant between a lone child and a child with two siblings, three siblings and five or more siblings. A child with one sibling is significantly different from a child with three siblings. For the 'Success in life is a matter of luck graph' relative to a lone child all contrasts are significant and relative to a child with five or more siblings all contrasts are significant except with a child with four siblings.

There is support for H6: there is a positive relationship between family size and external locus of control, net of family background controls and ability.

*H7a With whom the young person spends their time varies by family size, net of family background controls and familial resources and this matters for GCSE achievement.*

*H7b There is a positive relationship between family size and the frequency of socialising with others, net of family background controls and familial resources.*

Socialising factors, such as with whom a young person spends their time and how frequently they spend time with friends may vary by family size. To test some of the theories surrounding the way the young people spends their time a multinomial logistic regression is used. This predicts with whom the young person spends most of their time, net of family background variables. Results are presented in Table 3.18. The base category is set to time spent alone. The log odds of a young person going out with friend relative to spending time alone are greater as family size increases relative to a lone child, however only a young person with five or more siblings is significantly different. This indicates that there is some evidence that having a greater number of siblings increases the permissiveness of parents and /or raises preferences to socialise outside of the home.

A similar pattern is found for log odds of staying in with friends relative to spending time alone, although there are lower log odds for a person with one sibling staying in with friends than a lone child. None of these family size coefficients are statistically significant except a young person with five or more siblings relative to a lone child (0.47). Young people from very large families use the majority of their time more sociably than the rest.

***Table 3.18 Multinomial logistic regression predicting time spent***

| | Go out with friends | | Stay in with friends | | Family | | Brother/Sister | |
|---|---|---|---|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | | | | | |
| One sibling | 0.08 | (0.14) | -0.06 | (0.15) | -0.03 | (0.17) | 1.92*** | (0.53) |
| Two siblings | 0.18 | (0.14) | 0.05 | (0.16) | -0.04 | (0.17) | 2.20*** | (0.53) |
| Three siblings | 0.22 | (0.16) | 0.09 | (0.17) | -0.15 | (0.19) | 2.65*** | (0.53) |
| Four siblings | 0.25 | (0.19) | 0.33 | (0.21) | 0.11 | (0.22) | 3.02*** | (0.55) |
| Five or more siblings | 0.51* | (0.21) | 0.47* | (0.23) | 0.47+ | (0.24) | 3.49*** | (0.55) |
| Birth order index | 0.10 | (0.13) | 0.18 | (0.15) | -0.05 | (0.16) | -0.75*** | (0.19) |
| Constant | 1.56+ | (0.87) | 0.32 | (1.02) | -0.54 | (1.25) | -20.87 | (775.51) |
| Observations | 11,337 | | 11,337 | | 11,337 | | 11,337 | |

Base Category: Spending Time Alone
Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

***Table 3.19 Logistic regression predicting time spent alone***

| | Time Alone | |
|---|---|---|
| *Family Size (Lone Child)* | | |
| One sibling | -0.07 | (0.13) |
| Two siblings | -0.17 | (0.14) |
| Three siblings | -0.21 | (0.15) |
| Four siblings | -0.36* | (0.18) |
| Five or more siblings | -0.64** | (0.20) |
| Birth order index | -0.04 | (0.13) |
| Constant | -1.75* | (0.85) |
| Observations | 11,337 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Table 3.20 Logistic regression predicting GCSE results with time spent**

| | Model 1 Five A*-C GCSEs (inc English & Maths) | | Model 2 A*-C English | | Model 3 A*-C Maths | | Model 4 Capped Linear Score | |
|---|---|---|---|---|---|---|---|---|
| *Family Size (One sibling)* | | | | | | | | |
| Two siblings | -0.18** | (0.06) | -0.15* | (0.07) | -0.21** | (0.06) | -8.07* | (3.70) |
| Three siblings | -0.27*** | (0.08) | -0.24** | (0.08) | -0.22** | (0.08) | -15.87*** | (4.38) |
| Four siblings | -0.46*** | (0.10) | -0.59*** | (0.10) | -0.42*** | (0.09) | -34.20*** | (5.53) |
| Five or more siblings | -0.51*** | (0.11) | -0.56*** | (0.11) | -0.55*** | (0.10) | -38.45*** | (6.15) |
| Birth order index | -0.68*** | (0.08) | -0.61*** | (0.09) | -0.62*** | (0.08) | -46.92*** | (4.85) |
| *Time Spent (Alone)* | | | | | | | | |
| Go out with friends | -0.29*** | (0.09) | -0.23* | (0.09) | -0.39*** | (0.09) | -22.01*** | (5.02) |
| Stay in with friends | -0.24* | (0.10) | -0.16 | (0.10) | -0.35*** | (0.10) | -17.07** | (5.64) |
| Family | 0.01 | (0.10) | -0.02 | (0.11) | -0.18+ | (0.11) | -3.46 | (6.06) |
| Brothers/ Sisters | 0.19 | (0.13) | 0.18 | (0.14) | 0.13 | (0.13) | 9.84 | (7.35) |
| Constant | -0.09 | (0.71) | -0.15 | (0.66) | 1.43* | (0.63) | 365.67*** | (36.29) |
| Observations | 11,587 | | 11,587 | | 11,587 | | 11,587 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status, parent's age and family change.

**Figure 3.11 Average marginal effects by family size predicting time spent alone**

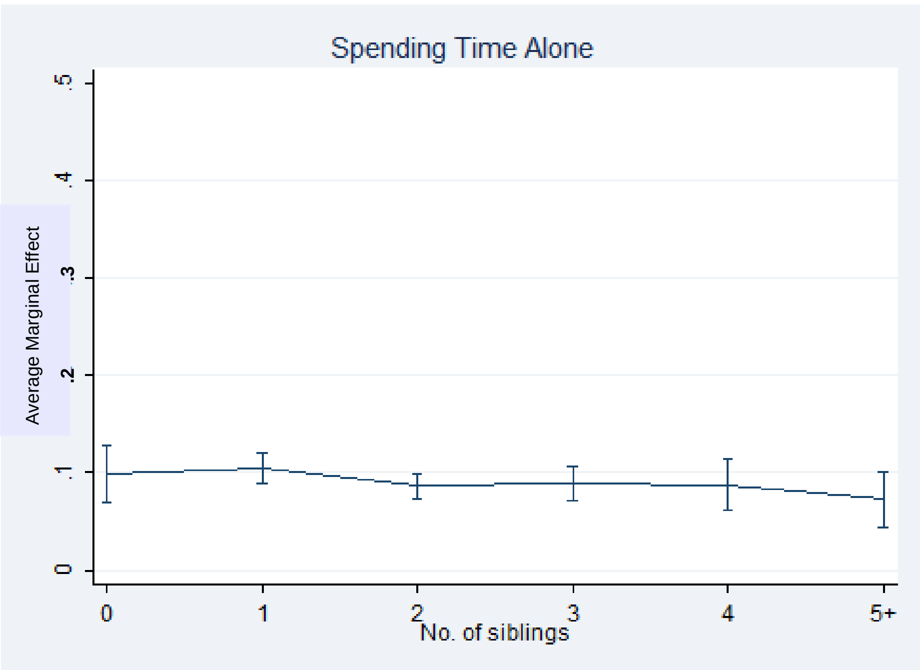
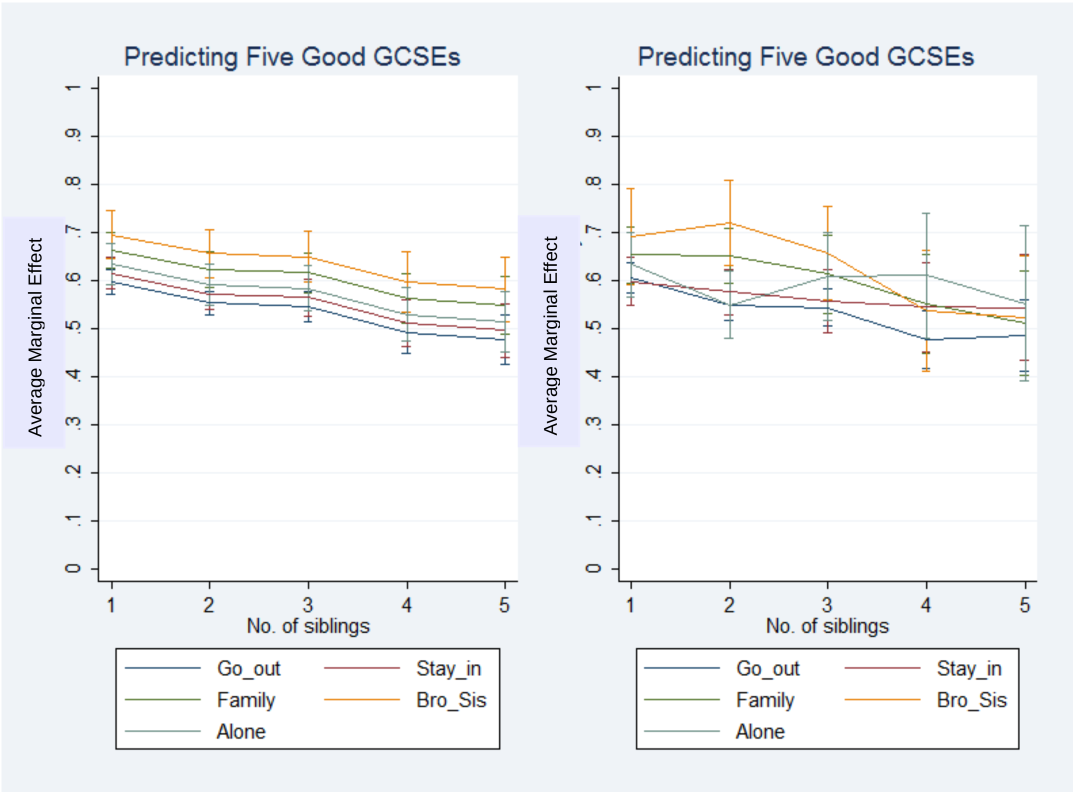


**Figure 3.12 Average marginal effects predicting GCSE results, by time spent**




Spending time with family is not significantly different from spending time alone, except for young people with five or more siblings who see an increase in log odds of spending time with the family relative to a lone child.

Relative to spending time alone, young people with siblings are significantly more likely to spend time with their siblings. The log odds increase as family size increases. Birth order yields significant negative log odds which indicates that later born children have lower log odds (-0.75) of spending time with their siblings than early born children.

To identify whether lone children are more prone to spending time alone than children with siblings, a logistic regression was run predicting a binary measure of time alone, which can be seen in Table 3.19. To ease interpretation, average marginal effects were calculated and are shown in Figure 3.11.  Only contrasts between a child with one sibling and a child with two siblings, and a child with one sibling and a child with five or more siblings are significantly different. As family size increases, the probability that the young person will spend time alone reduces. Furthermore there is no evidence that lone children are more likely to spend time alone than children with siblings, which supports Blake's finding (Blake, 1989).

The alternative GCSE specifications are shown in Table 3.20 which includes controls for with whom the young person spends their time. When the results in Model 4, Table 3.13 are compared with Model 4, Table 3.20 there is evidence that the family size association is ameliorated substantively when time spent controls are included in the model. This suggests that the manner in which the young person spends their time is important for objective educational measures. To examine this in more depth, marginal effects are calculated and are shown in Figure 3.12 where family size associations by socialising variables and the interaction effects can be seen. The results for lone children are not shown. Figure 3.12 indicates that a young person who spends most of their time with brothers/sisters have higher probabilities of achieving five good GCSEs; a young person with one sibling has 70% chance of achieving five good GCSEs, while an otherwise comparable child with five or more siblings has around a 58% chance. After spending time with siblings, spending time with their family or spending time alone are the next best socialising strategies. Spending time in with friends and spending time out with friends are the least effective socialising strategies for achieving five good GCSE results. However the nature of the activities that the young person may engage while spending this time with others is not known.

When interactions are included in the model, one of the most notable results is that spending time with siblings in a smaller family is more effective than spending time with siblings in a larger family for GCSE results. If the young person has four or more siblings, spending time alone yields a higher probability of achieving five good GCSE grades. This may be as a result of having more resources, for example, a big house which enables the young person an opportunity to spend time alone.

Turning now to the frequencies of the young person spending time socialising with friends either inside or outside of their home, which have ordered response categories running from: none; once or twice a week; three to five times a week; or six or more times a week. The ordered logit models are shown in Table 3.21. The coefficients are not standardised and so only the sign and significance of the results are considered in the analysis. In Model 1, the results indicate that there is a significant negative relationship between family size and the frequency of having friends over for each unit change on the unobserved, or latent, dependent variable, holding constant all other controls. Birth order is positively and

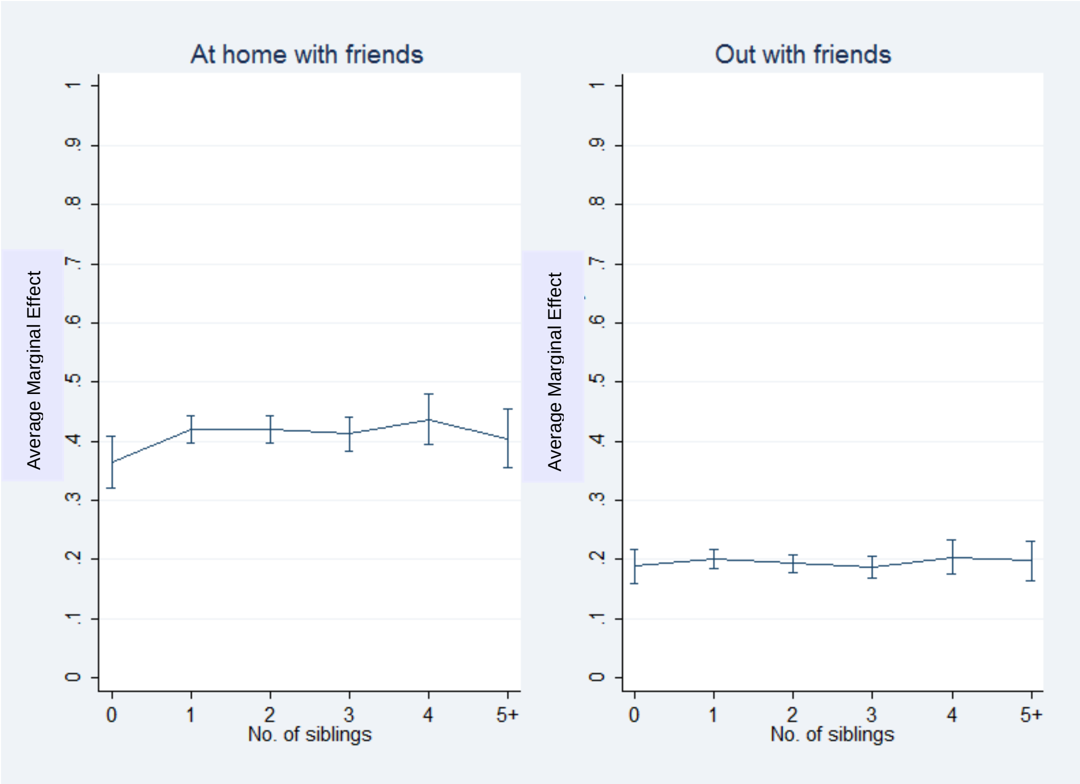
**Table 3.21 Ordered logit predicting the frequency of seeing friends in the last seven days**

| | Model 1<br>Friends Home | | Model 2<br>Friends Out | |
|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | |
| One sibling | -0.19* | (0.07) | 0.03 | (0.07) |
| Two siblings | -0.20** | (0.07) | 0.01 | (0.07) |
| Three siblings | -0.21** | (0.08) | -0.02 | (0.08) |
| Four siblings | -0.31*** | (0.09) | -0.22* | (0.09) |
| Five or more siblings | -0.27** | (0.09) | -0.39*** | (0.09) |
| Birth order index | 0.15* | (0.06) | 0.14* | (0.06) |
| Cut 1 | -0.45*** | (0.09) | -1.24*** | (0.09) |
| Cut 2 | 1.16*** | (0.09) | 0.30*** | (0.09) |
| Cut 3 | 2.36*** | (0.09) | 1.54*** | (0.09) |
| Observations | 11,441 | | 11,441 | |

Ordered Categories: None, Once or Twice, Three to Five, Six or more times a week.

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Figure 3.13 Average marginal effects by family size predicting frequency of spending time with friends in/out of the home**




significantly related to frequency of spending time with friends at home, which means later born children have higher frequency of having friends over than early born children. The same birth order association is seen in Model 2 - later born children seem to spend more time socialising with friends outside of the home compared to later born children. This finding may explain why later born children spend less time with their siblings than early born children. The family size association is less clear in Model 2, with children with four or more children yielding significant negative coefficients relative to a lone child. Marginal effects were calculated and are shown in Figure 3.13.

In summary there is some evidence that the manner in which the young person socialises varies by family size and birth order, therefore H7a is supported. There is also evidence that the manner in which the young person spends their time matters for GCSE achievement. Furthermore there is a positive relationship between family size and the frequency of socialising with others, net of family background controls and familial resources. However, this is significant only for the frequency of socialising with friends in the home. For socialising with friends outside of the home family size is neither a strong nor significant predictor.

*H8 There is a negative relationship between family size and birth order with regards to the incidence of being bullied, net of family background controls and familial resources.*

Lone children are perceived to be less socially adept than children with siblings. One way that this may be borne out is through experiences of victimisation. The results in Model 1, Table 3.22 show the young person's report of being bullied and Model 2 shows the parent's report by family size and birth order, net of family controls. The likelihood of the young person reporting being bullied is negatively associated with family size, however these results are not statistically significant, except for young people with three or four siblings

***Table 3.22 Logistic regression predicting being bullied by family size***

| | Model 1 Ever Bullied Young Person Report | | Model 2 Ever Bullied Parent Report | |
|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | |
| One sibling | -0.01 | (0.09) | -0.05 | (0.09) |
| Two siblings | -0.14 | (0.09) | -0.04 | (0.09) |
| Three siblings | -0.18+ | (0.10) | -0.12 | (0.10) |
| Four siblings | -0.19+ | (0.11) | 0.23+ | (0.12) |
| Five or more siblings | -0.05 | (0.12) | 0.03 | (0.13) |
| Birth order index | 0.01 | (0.08) | 0.10 | (0.08) |
| Constant | 2.07*** | (0.57) | 1.86** | (0.59) |
| Observations | 10,741 | | 9,465 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Figure 3.13 Average marginal effects predicting the incidence of being bullied, by family size**

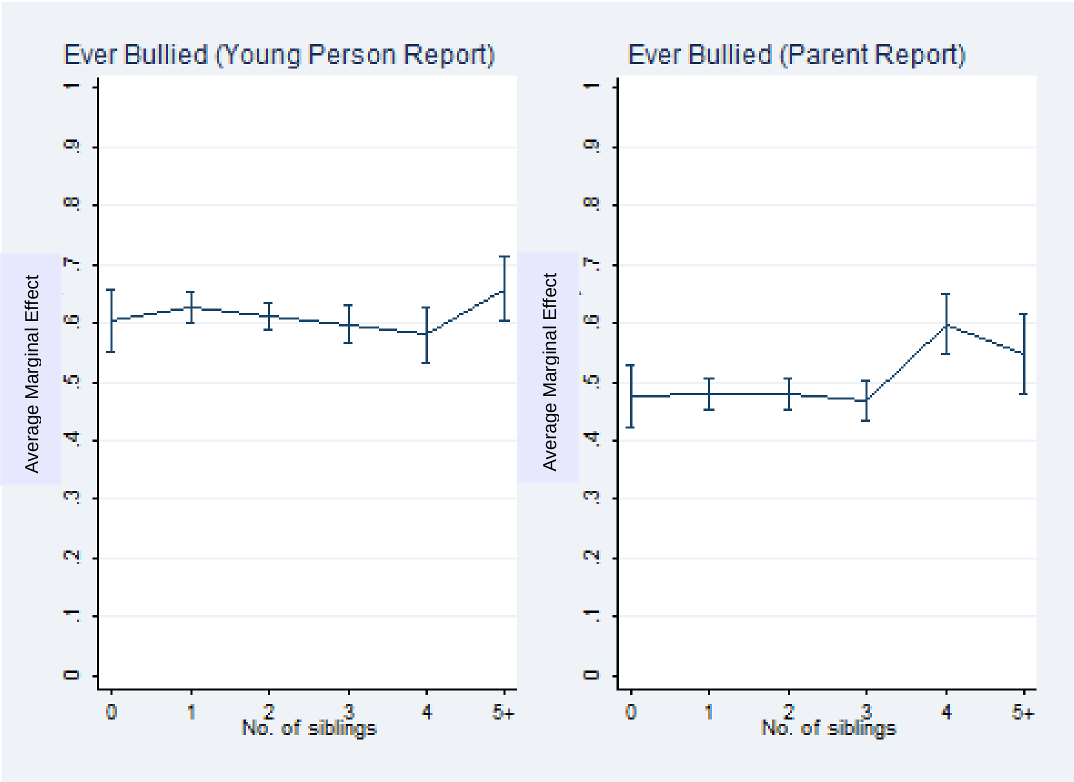


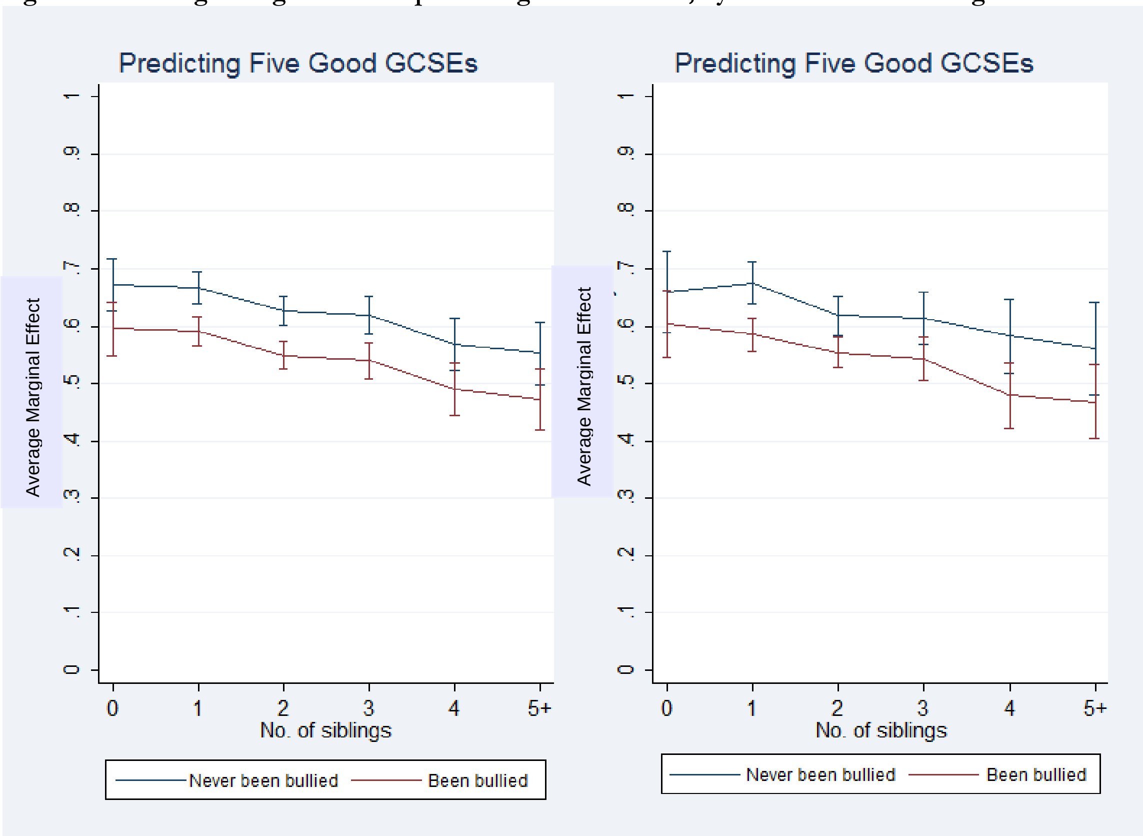

*Table 3.22 Logistic regression predicting five A*-C GCSEs including English and Maths, controlling for the incidence of being bullied*

| | Model 1<br>Young Person Report | | Model 2<br>Parent Report | |
|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | |
| One sibling | -0.14 | (0.10) | -0.17+ | (0.10) |
| Two siblings | -0.33*** | (0.10) | -0.33** | (0.10) |
| Three siblings | -0.45*** | (0.11) | -0.41*** | (0.11) |
| Four siblings | -0.61*** | (0.12) | -0.60*** | (0.13) |
| Five or more siblings | -0.70*** | (0.13) | -0.64*** | (0.15) |
| Birth order index | -0.69*** | (0.09) | -0.71*** | (0.09) |
| *Been bullied (Never)* | | | | |
| | -0.42*** | (0.05) | -0.61*** | (0.05) |
| Constant | 0.59 | (0.69) | 0.65 | (0.72) |
| Observations | 11,587 | | 11,587 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

**Figure 3.14 Average marginal effects predicting GCSE results, by the incidence of being bullied**




which is significant to p<0.10. The parental report yields slightly different results. The only significant effect is for young people with four siblings relative to a lone child which yields a positive coefficient which is significant to the p<0.10 level. The birth order coefficients are not statistically significant.

Marginal effects were calculated and are shown in Figure 3.13. For the young person report, the only contrasts which are significant are between children with five or more siblings and children with one, three and four siblings. For the parent's report all contrasts are significantly different to children with five or more siblings, except children with four siblings.

When the young person's report of being bullied is included in the model which predicts achieving five good GCSEs (Table 3.22, Model 1) it is clear there are negative effects of being bullied on educational outcomes. Also the family size coefficients increase in size as a result of the inclusion of the bullying variables, while the birth order coefficient remains the same. Model 2, which sees the inclusion of the parental report of the incidence of being bullied when predicting five good GCSEs yields similar results.

Marginal effects for the young person's report of being bullied by family size are shown in Figure 3.14. Interactions are shown in the graph on the right. The results indicate that family size remains a strong predictor for achieving five good GCSEs and that the incidence of being bullied reduces the probability of achieving five good GCSEs by around 10 percentage points.

In summary there are no birth order effects predicting the incidence of being bullied. Furthermore when examining the average marginal effects there is evidence that children with five or more siblings have a higher chance of being bullied relative to children with one, three or four siblings. This finding is supported by the parent report of the young person being bullied which sees significant positive effects for children with five or more siblings relative to all groups except those with four siblings. Therefore H8 is rejected; there is no evidence of a negative relationship between family size and birth order reporting the incidence of being bullied: in fact those from very large families have an increased probability of being bullied. Furthermore there is evidence that including controls for being bullied in the models which predict GCSE results increase the family size association and that being bullied reduces the likelihood of the young person achieving five good GCSE grades.

## Summary

The first key finding from this chapter is that for young people aged 13 and 14 in 2004 there is evidence that familial resources do vary by family size. Furthermore there are observable differences between the characteristics of parents of lone children and children with siblings. Lone children are significantly more likely to come from white families, have parents with lower levels of education, have younger fathers, and have complex family structures, such as be a member of a step family, have cohabiting or single parents or not live with either of their parents. However it is important to note that despite these observable characteristic differences there may also be underlying differences between parents who select to have large versus small families and these endogenous factors may be masked by the family size association, this will be addressed in chapter five.

The second key finding from this chapter identifies that family size is negatively associated with GCSE achievement: as family size increases the probability of achieving five good GCSEs fall. This finding is robust to a number of alternative GCSE result measurements including achieving A*-C in English and Maths and a linear GCSE scores measure. Birth order is also strong and significant and indicates that later born children have a lower probability of achieving five A*-C GCSEs including English and Maths.

The LSYPE data provides an opportunity to study the influence of change in resource allocation as a result of a sibling leaving or joining the household between wave one and wave three. Controlling for family size effects identifies the influence of a change in short term resources when the young person is a teenager. The results indicate that there is a negative association between a reduction in the number of siblings in the household and GCSE results, but this is neither large nor significant. This suggests that the increase in resources that the young person has access to as a result of a sibling leaving the home are not of the magnitude or the nature to be able to influence educational achievement positively. A new sibling joining the home may arise because of a birth of a new sibling, a new step sibling, or an older sibling returning to the family home. The results indicate a stronger negative association with the probability of achieving five good GCSEs, however this is not statistically significant. These findings offer some support to the argument put forward by Alwin & Thornton (1984) who suggest the type of resources required may vary by age of the young person and stage in their educational progression.

The third key finding is that there is little evidence that subjective educational outcomes such as attitudes towards school, themselves and aspiration are strongly associated with family size. Family size does seem to predict confidence of being accepted to university; a child with one sibling, and a child with two siblings yield lower log odds of confidence of being accepted to university relative to a lone child. Birth order negatively predicts university aspiration and confidence of being accepted if they apply as later born children are less likely to aspire to university than early born children. These findings contradict the expectations of the resource dilution model and the evidence presented by Blake (1989).

The fourth key finding is that a family size increase is associated with a slight increase in the probability of having emotional problems. However these contrasts are not statistically significant except between a lone child and a child with one sibling. In addition to this there is evidence that as the number of siblings increases young people are more likely to report external locus of control, and feel like they have little control over their life outcomes. These findings suggest that there may some disadvantages of having siblings on the young person's perspectives and experiences of life.

Blake (1989) found that lone children are more likely to spend time alone than children with siblings. This finding is not borne out with the LSYPE data: there is a negative relationship between family size and time alone, but it is not statistically significant. The results also indicate that there are differential socialising outcomes by family size. Children with siblings are more likely to spend most of their time with their friends than a lone child does. Higher birth order children more frequently socialise with friends both inside and outside the home, which may suggest that more freedom is offered to the younger children in the family. Furthermore higher birth order children are less likely to spend time socialising with siblings than early born children. There is a positive relationship between family size and the frequency of socialising with others, net of family background controls and familial resources, however this is significant only for the frequency of socialising with friends in the home. For socialising with friends outside of the home family size is neither a strong nor significant predictor.

Spending time with siblings is positively associated with good GCSE results; however this is not significantly different from spending time alone (but is significantly different from going out with friends). This may indicate the positive supportive effects of having siblings or it may capture elements of parental control and supervision.

The fifth key finding is that there is a significant increase in the likelihood of the young person reporting being bullied for children with five or more siblings relative to those with one, three and four siblings. This finding is supported by the parent's report. There are no significant associations for birth order. These findings are interesting as they do not conform to the expectations of the resource dilution model which predicts that social skill increases as the number of siblings increase. However there may be other confounding factors, for example the measure of being bullied may not cleanly capture social skill or bullying incidences are may be underreported.

It appears that lone children do not display evidence of feeling like they have no control over their life. Compared to their counterparts with siblings, lone children are more likely to take advantage of resources, less likely to display external locus of control tendencies and less likely to do poorly in their GCSEs. In addition they are significantly less likely to have poor emotional health than their counterparts with one sibling. There is no evidence that lone children are more likely to spend time alone or to be bullied and they are no less likely to like school, feel like they are making progress at school, apply to university, or feel like they may be accepted if they apply.

Having siblings is a disadvantage for achieving high quality GCSE results: as the number of siblings increases the log odds reduce. Furthermore having siblings increases the log odds of reporting that the young person has little control over life and experiencing poor emotional health. Young people with five or more siblings are more likely to experience bullying. However there are a number of observed benefits of having siblings. Having siblings increases the socialising opportunities and if the young person has siblings they also have an increased frequency of spending time with friends. Spending time with siblings if the young person is from a small family increases the probability of achieving five good GCSEs, and spending time alone if the young person is from a larger family is associated with an increase in educational outcomes.

This chapter sought to explore the advantages and disadvantages of having siblings by examining educational and social outcomes. Although there is some evidence that having siblings is associated with a reduction in familial resources and consequently educational outcomes, it is possible to consider siblings as a resource in terms of offering socialising opportunities and offering support to the young person. While this chapter concentrated upon the influence of having siblings, the next chapter examines the influence of parenting strategies as part of the familial resource and its impact on the young person's educational outcomes.

# Chapter 4: Do Parenting Strategies Differ by Family Size?

## Introduction

The results from the last chapter demonstrated that in relation to the young person's educational experience there are a number of advantages and disadvantages to having siblings. The aim of this chapter is to concentrate on parenting strategies which Blake argues are an important aspect of familial resource:

*"Paramount among the divisible resources are the parents' time, emotional and physical energy, attention, and ability to interact with children as individuals".*

Blake, 1989: page 11.

Therefore this chapter seeks to identify whether the parenting strategies vary by family size and whether this variation accounts for some of the differences in educational outcomes. This chapter uses the Longitudinal Study of Young People in England (LSYPE) data to test whether parenting strategies are effective and begins with a review of literature.

## Review of Literature

As we have seen, the resource dilution model, posited by Blake (1989), argues that as family size increases the share of familial resources decreases. The familial resources of particular interest in this chapter are those pertaining to parenting strategies. These strategies include parent's time and attention, emotional warmth and ability to interact with the child. A large body of research examines the link between parenting strategies and educational outcomes (for example Hess and Holloway, 1983; Kiernan and Huerta, 2008; Ermisch, 2008; Astone and McLanahan, 1991; Pong et al., 2005; Chan and Koo, 2011), but lesser attention has been given to the relationship between family size, parenting style and children's educational outcomes, particularly in recent years.

Nisbett and Entwistle (1967) found that in larger families, parents have less time to devote to their later children, due to a conflict of resources which has a negative effect on the young person. Nye et al. (1970) report that in larger families parents are more likely to adopt an authoritarian parenting style and that mothers have differing attitudes towards their childrearing role by family size. More recently, Sputa and Paulson (1995) identified that there are differences in the child's perception of parenting style and degree of parental involvement by family size and birth order, but did not find differences in parental perceptions of their parenting style by family size and birth order.

### *Parenting strategies*

Lareau (2003) studied interactions between the school, parents and the child in the USA. She argues that these interactions form parenting strategies, through which culture is transmitted, and which influence the child's education. For Lareau parenting strategies are demarcated along the lines of social class and these strategies operate on a spectrum of high and low levels of linguistic culture and communication; interventions in institutions; and organisation of daily life. She argues that middle class parents demonstrate high levels of each category and therefore labelled this parenting strategy the 'concerted cultivation' strategy, while working class parents demonstrate low levels of involvement denoting a 'natural growth' strategy.

## *Linguistic Culture and Communication*

The linguistic culture of the family is one element which contributes to Lareau's concerted cultivation and natural growth strategies. Lareau suggests that the language that middle class families use differs from the language used in working class families. More specifically, middle classes are more likely to use reasoning language and to negotiate with the child, whilst working class families are more likely to issue directives. She also notes that in middle class homes:

*"...there is a steady stream of speech, interrupted by periods of silence (as opposed to the pattern in working class and poor homes, in which periods of silence are punctuated by speech)".*

Lareau, 2003: page 110.

The relationship between family, language and schooling is not a new area of study and it is clear that Lareau has drawn on the work of writers such as Bernstein (1971) and Heath (1983). Bernstein was a proponent of the view that distinct linguistic codes are adopted by families from different social classes. His work concentrated on how this language differential explained the educational gap between working and middle class students. Bernstein's theory states that the working classes typically used restricted language codes which are dependent on and particular to the group using it. This means that because of the shared ideas and experiences, the speaker can express themselves by drawing on a limited number of alternatives of speech. The middle classes also used restricted codes, but additionally utilise elaborated language codes which are independent and universal. That means they assume no shared knowledge, in doing this the speaker expresses themselves in a way that can be understood by everyone and it is not in any way condensed. However critics such as Danzig (1995) suggest that Bernstein's work implies that the working class linguistic code was deficient in some way, although Bernstein maintained a functionalist view that working class language use was entirely suitable for their labour market position.

Lareau refers to the work of Heath (1983), and adopted her observational techniques to identify different manners of communication between parent and child. After comparing different speech patterns of a number of families, Heath concluded that the language strategies adopted by parents have implications for children's academic development. Lareau draws a similar conclusion, based on her identification of the functional style of language used in working class homes. Such functioning language was used to communicate clear preferences and to issue threats as a means of discipline. In stark contrast, middle class family members were observed discussing the meaning of the words and seeming to draw enjoyment from the language itself. Furthermore in the middle class homes, discipline is offered through verbal reasoning instead of directive instruction. This approach to language teaches middle class children to express themselves well and to develop negotiation skills. For Lareau therefore, it is both the frequency and the quality of intra-family communications which indicate linguistic culture. Higher frequency and better quality communication contribute to the concerted cultivation strategy.

### *Parental Involvement in Institutions*

There is a body of literature which links greater parental involvement in their children's lives with improved educational outcomes (Blau & Duncan 1967; Reay 2010; Vincent 1996; Crozier 2000). Lareau argues that some parents have certain skills or resources which help them to comply with the requests of the school and the expectations of their role as parents. She argues that the congruence between concerted cultivation parenting styles and school expectations provides middle class children with an educational advantage. The strategy of natural growth does not align as well with school expectations with differences in, for example, the discipline methods adopted at home, and in the school, and the attitudes to institutions.

An important resource for the child is the ability of their parents to intervene in institutions and to negotiate to find a better fit to suit the child's needs (Lareau 1989; Coleman 1988). The ability to intervene depends on social class (Vincent 1996, 1997). Vincent (1997) found that working class parents find it difficult to express their concerns because of the inequality of power between teachers and parents.

Parental intervention can be illustrated by the observed behaviours of a middle class mother who, in order to ensure that her child would be put on the gifted programme in school, made use of informal networks and acted as an advocate on behalf of her daughter (Lareau, 2003). In addition to this, Lareau presents evidence that middle class parents actively teach their children how to assert themselves to adults in authority. This cultivated behaviour is in direct opposition to working class parents' interactions with institutions. Lareau and Weininger (2003) argue that working class parents are unfamiliar with the middle class environment of school and so are uncomfortable dealing with authority and unsure how to comply with expectations.

These findings support Crozier's (2000) research which tests the efficacy of parental involvement in children's schooling. Her motivation is partly due to the increased emphasis by the British government to promote parent participation as a way to improve the educational experience and the life chances of their children. Her ethnographic study highlights the complex issues between parents and teachers. She found that there is no single explanation for the differing nature of the parent-teacher relationship across social classes, but she does consider that working class parents fear being humiliated or excluded from the process as they frequently reported not understanding what was being discussed. Furthermore among Crozier's working class subjects there was some resistance to being seen as a 'pushy parent'. They therefore preferred to maintain distance between home life and school life.

Implicit in both Crozier and Lareau's arguments is that the increased emphasis on parental involvement in a child's schooling is seen as a way to equalise the student experience. However given that parental involvement is more likely if they are from an intermediate or higher class background, it may exacerbate the inequalities in education, as the parents who are the most involved are often the ones whose children need the least assistance which creates a polarising effect.

*Organisation of Daily Life*

Lareau argues that one of the hallmarks of the middle class parenting style is that parents actively seek to cultivate their children through the organisation of daily life. She observed that middle class parents value organised activities as they believe it allows their children to shape the talents and skills that will help to develop a robust sense of self. The working classes, in contrast, are focused on feeding, housing and clothing their children. Lareau notes that some children find their highly scheduled life exhausting and stressful compared to the more relaxed lifestyle of working class children who have more unstructured time. This view is supported by Rosenfeld and Wise (2000) who suggest that pressure on children can cause anxiety and stress due to high expectations. However the work of Ardendell (2000) and Hays (1996) supports the view that participation in extracurricular activities impacts positively on the future success of children in terms of education and labour market outcomes. Participation in extracurricular activities requires economic, time and organisational investments, which may differ by family resources and consequently family size.

## Aims and Hypotheses

The aim of this chapter is to identify whether parenting strategies, including communication between parents and children, degree of parental involvement in schooling and the provision of cultural activities outside of school differ by family size and birth order. An additional aim is to identify whether the concerted cultivation strategies are effective for objective and subjective measures of education and whether these strategies ameliorate the differences in educational outcome by family size.

As a result of this literature review, the following hypotheses will be tested:

H1a Communication strategies between parents and child differ by family size net of family background factors.

H1b Parental involvement in the young person's schooling differs by family size net of family background factors.

H1c Organisation of daily life differs by family size net of family background factors

H2 Lareau's concerted cultivation parenting strategy is positively associated with GCSE results net of family background factors.

H3 Lareau's concerted cultivation parenting strategy is positively associated with subjective measures of education net of family background factors.

## Contribution

This chapter contributes to the literature in a number of ways. It uniquely combines the concepts of resource dilution, which considers parenting practices as part of the resource, with an established parenting strategies theory using the LSYPE data. This provides an opportunity to identify the manner in which parenting practices vary by family size and enables a test of the predictive power of concerted cultivation strategies. Furthermore the LSYPE data studies a recent cohort using objective and subjective measures of education to understand in what ways parenting is important for a young person's outcomes net of family background controls.

## Data and Methods

This chapter uses the LSYPE dataset. The same sample, multiple imputation approach and independent variables are used as outlined in the previous chapter.

The family size variable captures the total number of siblings that the young person has at wave one, including those who do not live with the young person. Young people with five or more siblings were grouped together in order to have a substantial category indicating a very large family. A family size change indicator was included in the analysis to identify if any children joined or left the household between wave one and wave three. Booth & Kee's (2009) birth order index was used in order to capture the fact that resources are assigned to children differently by birth order and to reduce the correlation between birth order and family size.

As before, family background characteristics which contribute to the resource captured in the household include parental class, parental education, family structure, mother's age, father's age, income and whether the household had a computer/internet. The highest educational qualification achieved by either parent in the family was used. The family structure variable was re-coded to include categories of: married; cohabiting; single parent; or no parents in the household. In addition, there is a binary measure identifying whether the family is a step family or not. Parents' age when the young person was born is also included in addition to the ethnicity and gender of the young person. The income control included captures total income from work, benefits, and anything else for main parent respondent and their partner. From this measure, a variable for log income was created. Individual characteristic controls are included for gender and ethnicity.

### *Operationalising Lareau's Parenting Strategies*

Seven variables were selected based on applicability for Lareau's theory of concerted cultivation. The survey questions and response categories for these variables are noted below (before scaling).

---

*Communication (Young Person's Report)*

1. How often would you say that your parents talk to you about the day's events at school? (Never, Sometimes, Often, Don't know)

2. How often do you talk to your mother/step-mother about things that matter to you? (Most days, More than once a week, Less than once a week, Hardly ever, Never / Not at all)

3. How often do you talk to your father/step-father, about things that matter to you? (Most days, More than once a week, Less than once a week, Hardly ever, Never / Not at all)

*Involvement in institutions (Parent's Report)*

4. I know all I need to know about how I can help with yp's education. (Agree strongly, Agree a little, Disagree a little, Disagree strongly)

5. How involved do you personally feel in young person's school life - would you say that you feel...? (Very involved, Fairly involved, Not very involved, Not at all involved)

*Organisation of daily life (Parent's Report)*

6. Whether in the last 12 months MP has paid for private classes[34] in subjects also taught in YP's school? (Yes, No)

7. Whether in the last 12 months MP has paid for supplementary subjects[35]? (Yes, No)

---

These variables were selected as they capture some of the theoretical aspects of concerted cultivation. A principal component analysis identified whether these variables share underlying characteristics. The results are shown in Appendix 4.1 and show that three components with shared underlying characteristics were found to correspond to the categories of communication, involvement in institutions and organisation of daily life.

However it should be noted that measuring communication in the manner which Lareau considers it using the LSYPE is a challenge. For Lareau, linguistic culture captures the use of positive language, negotiation and reasoning as well as the frequency of discussion and communication between parent and child. With this data the quality of communication cannot be captured, but it does adequately capture the frequency and ease of communication between parent and child assessed by the young person. Specifically the questions asked relate to how often they talk about school with their parents and how often the young person talks to their mother/father about things that are important to them.

For involvement in institutions Lareau's theory relates to the degree of parental intervention when seeking an advantage for their child and whether they actively teach their children that they should have a sense of entitlement when dealing with authority. Again, this measure is difficult to capture, however the LSYPE does ask questions about the

[34] Private lessons are related to the subjects offered at school, for example Maths
[35] This relates to extracurricular lessons for example piano lessons, boxing or horse-riding.

parents' feelings towards their involvement in their school life and whether they have the knowledge to be able to help with their child's education.

The measures which capture organisation of daily life are questions which relate to the frequency of attending private or supplementary classes. The private lessons support school subjects through additional tuition such as maths, and science. The supplementary lessons relate to extracurricular activities outside of lessons such as football or piano lessons. The frequency of these activities in the last 12 months enables us to get a sense of the degree of structure to the young person's time. These measures of organisation of daily life are not only cultural as they also involve some economic transfer either through direct payment for the lessons, or through travel costs or augmented costs, such as the cost of safety equipment, books or clothing. Parents with more economic resource are more able to afford to send their children to these classes than families with lower income. In order to try to address this, income is included as a control; however this is unlikely to completely factor out the economic variance of preference to behave in a particular way. Therefore caution must be exercised while interpreting these results. Each of these seven measures composing the concerted cultivation strategies are recoded to a binary response for analysis.

### *Limitations*

As noted, there are some limitations about the variables which are used to capture the elements of Lareau's theory. This is due to the adaptive requirements needed to operationalise a complex, qualitatively-derived theory so that it can be tested on a large and rich quantitative dataset. A further 'stretch' relates to the similarities and differences between the concepts of class and parenting that Lareau considered in an American context compared to an English one. Middle class parenting values in Lareau's theory focus on support through communication, intervention and organisation, however the degree to which this framework is a 'good fit' in the English context is a matter for debate. For the purpose of this transatlantic theoretical test, it is assumed that the abstract concepts are similar enough to at least warrant a test of their efficacy in England.

As outlined in the introduction, it may be considered a limitation of this work that for the purpose of analysis this thesis does not explore the parent-child relationship as a two-way process. Instead it is assumed that the parents-child relationship is stronger than the child-parent relationship. However it may be that these processes are much more dynamic and the nature of the child strongly influences the family environment. Therefore the results should be considered with this caveat in mind.

## Results

### *Descriptive Statistics*

The cross tabulations in Tables 4.1-4.7 show the distribution of concerted cultivation strategies by family size. Table 4.1, 4.2 and 4.3 present the results for communication with the young person. They show that as family size increases the proportion of young people who talk to parents about school and talk to their mother about things that are important to them reduces. However talking to their father about things that are important to them does not follow the same pattern. Lone children are the smallest proportion of young people who talk to their father, and the rest do not differ considerably.

***Table 4.1 Cross tabulation of talking to parents about school by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Talk to parents about school | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 4 | 4 | 4 | 4 | 7 | 8 | **5** |
| No | 3 | 5 | 5 | 7 | 7 | 8 | **6** |
| Yes | 92 | 91 | 92 | 88 | 86 | 84 | **90** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 4.2 Cross tabulation of talking to mother about things that are important to the young person by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Talk to mum about important things | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 12 | 8 | 7 | 7 | 9 | 10 | **8** |
| No | 13 | 16 | 18 | 19 | 18 | 17 | **17** |
| Yes | 75 | 77 | 75 | 74 | 73 | 72 | **75** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 4.3 Cross tabulation of talking to father about things that are important to the young person by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Talk to dad about important things | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 42 | 27 | 24 | 25 | 30 | 30 | **28** |
| No | 17 | 23 | 25 | 28 | 25 | 24 | **24** |
| Yes | 41 | 49 | 51 | 47 | 46 | 47 | **48** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 4.4 Cross tabulation of the parent reporting they have confidence to help with the young person's school work by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Confidence to help with school work | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 1 | 1 | 1 | 2 | 2 | 3 | **1** |
| No | 24 | 24 | 24 | 23 | 26 | 28 | **24** |
| Yes | 75 | 75 | 76 | 76 | 73 | 69 | **75** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 4.5 Cross tabulation of the parent reporting they feel involved in the young person's school life by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Involved in YP's School life | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 0 | 0 | 0 | 1 | 1 | 2 | **1** |
| No | 25 | 30 | 29 | 31 | 29 | 25 | **29** |
| Yes | 75 | 70 | 71 | 68 | 70 | 73 | **70** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 4.6 Cross tabulation of the private tuition by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Parents paid for private tuition | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 0 | 0 | 0 | 0 | 0 | 1 | **0** |
| No | 84 | 85 | 86 | 89 | 89 | 91 | **87** |
| Yes | 16 | 15 | 14 | 11 | 11 | 8 | **13** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

***Table 4.7 Cross tabulation of extracurricular activities by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Parents paid for extra curricular activities | Lone Child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 0 | 0 | 0 | 0 | 1 | 1 | **0** |
| No | 75 | 79 | 81 | 83 | 86 | 92 | **82** |
| Yes | 25 | 21 | 19 | 17 | 13 | 7 | **18** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 901 | 3,092 | 3,258 | 2,073 | 1,146 | 1,117 | 11,587 |

There is a small decline in the proportion of parents reporting that they feel confident in helping with the young person's school work (Table 4.4) and feel involved in their child's school as family size increases (Table 4.5). And both measures of organisation of daily life vary by family size. Lone children have the highest proportion of young people attending extra-curricular activities and private tuition related to their school work (Table 4.6 and Table 4.7).

Based on the degrees of freedom in each cross tabulation and with an alpha = p<0.01, the values derived from the Pearson chi-squared test are sufficiently extreme that we can say the probability of obtaining a value this large due to chance variation, is only 1 out of 100. Therefore we can accept that dependence among variables is unlikely to occur due to chance variation.

The next section identifies whether these relationships hold when controls for family background are included in the analysis.

*H1a Communication strategies between parents and child differ by family size net of family background factors.*

In order to identify whether there is evidence of resource dilution communication strategies, net of family background controls, logistic regressions were run predicting each component in turn. Table 4.8, Model 1 shows that there is a significant negative relationship between family size and whether the young person talks to their parents about school. The log odds reduce as family size increase relative to a lone child. Birth order does not yield a significant result but indicates that later born children have lower log odds of talking to their parents about school than early born children. Model 2 shows that there is also a negative relationship between family size and the young person feeling like they can talk to their mother about things that are important to them. However, the reduction in log odds as family size increases is only statistically significantly different from a lone child for a child with two, three or four siblings. The birth order coefficient is statistically significant and shows that as birth order increases, the log odds of a young person speaking to their mother about things that are important to them reduce. Model 3 yields similar results, however the significance level weakens for a child with two siblings relative to a lone child for the young person reporting that they can talk to their father about things that are important to them and the birth order coefficient is only significant to $p<0.10$.

As log odds are not intuitively meaningful, average marginal effects were calculated and are shown in Figure 4.1. The results show that on average the probability of a lone child achieving 5 A*-C is three percentage points higher than an otherwise comparable child with five or more siblings. This contrast is statistically significant[36]. Lone children have a probability of 85% while children with five or more siblings have a probability of 83% for talking to their mother about things that are important to them; however this contrast is not statistically significant. The only contrasts that yield significant results are between

[36] Lone children contrasts with all other family size groups are statistically significant. So too are contrasts between children with one sibling versus children with three and five siblings; children with two siblings compared to children with four siblings.

children with one sibling and children with three; children with two siblings and children with one sibling or lone children. The third graph shows the results of children talking to fathers about things that are important to them and the results suggest that on average the probability of a lone child is 7% higher than an equivalent child with four siblings[37].

There is some weak support for H1a: communication strategies do vary by family size, net of family background controls; however the magnitude of this difference is relatively small.

***Table 4.8 Logistic regression predicting communication strategies***

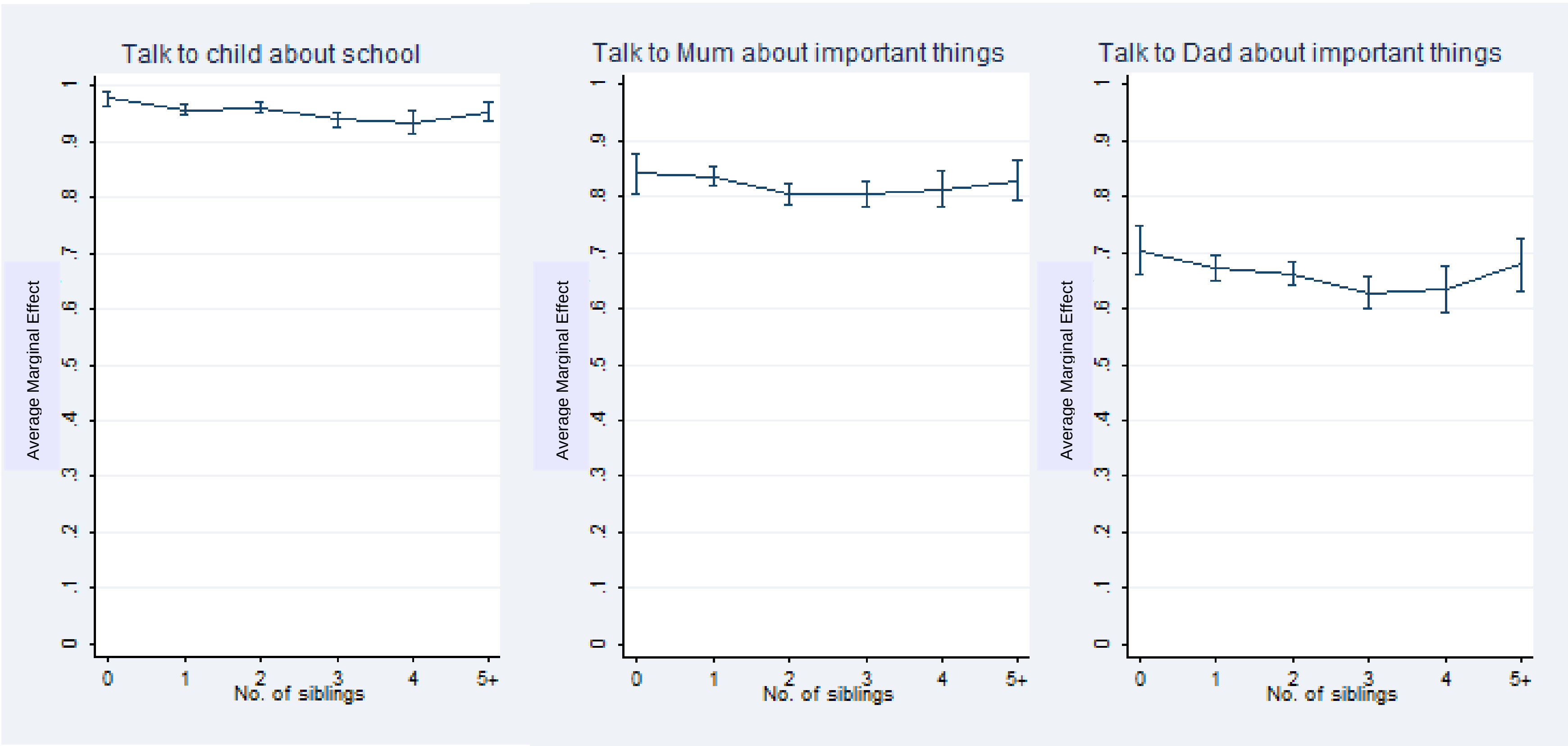
| | Model 1<br>Talk about school with parents | | Model 2<br>Talk to Mum about important things | | Model 3<br>Talk to Dad about important things | |
|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | |
| One sibling | -0.48* | (0.21) | -0.18 | (0.11) | -0.12 | (0.10) |
| Two siblings | -0.49* | (0.21) | -0.35** | (0.11) | -0.16+ | (0.10) |
| Three siblings | -0.84*** | (0.21) | -0.35** | (0.12) | -0.32** | (0.10) |
| Four siblings | -0.73** | (0.22) | -0.32** | (0.12) | -0.24* | (0.11) |
| Five or more siblings | -0.74** | (0.23) | -0.21 | (0.13) | -0.11 | (0.11) |
| Birth order index | -0.22 | (0.14) | -0.24** | (0.09) | -0.15+ | (0.08) |
| Constant | 4.19*** | (0.96) | 1.55** | (0.59) | 1.17* | (0.55) |
| Observations | 10,997 | | 10,618 | | 8,324 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age, family change.

[37] This contrast is significant, so too are contrasts between children with three siblings and children with five or more; children with four or more siblings with lone children, children with one, two and five or more siblings.

**Figure 4.1 Average marginal effects predicting communiaction with child by family size**



*H1b Parental involvement in the young person's schooling differs by family size net of family background factors*

Table 4.9, Model 1 shows the results from a logistic regression predicting whether parents report feeling confident about helping with the young person's education. There are no significant family size associations except for young people with five or more siblings who are significantly different to a lone child and have lower log odds (-0.30). As birth order increases by one the log odds increase by 0.11 but this is not statistically significant. Model 2 predicts parents feeling like they are involved in their child's school. As family size increases, relative to a lone child the log odds reduce significantly. As birth order increases by one the log odds reduce by -0.04 but this is not statistically significant.

***Table 4.9 Logistic regression predicting involvement in institutions strategies***

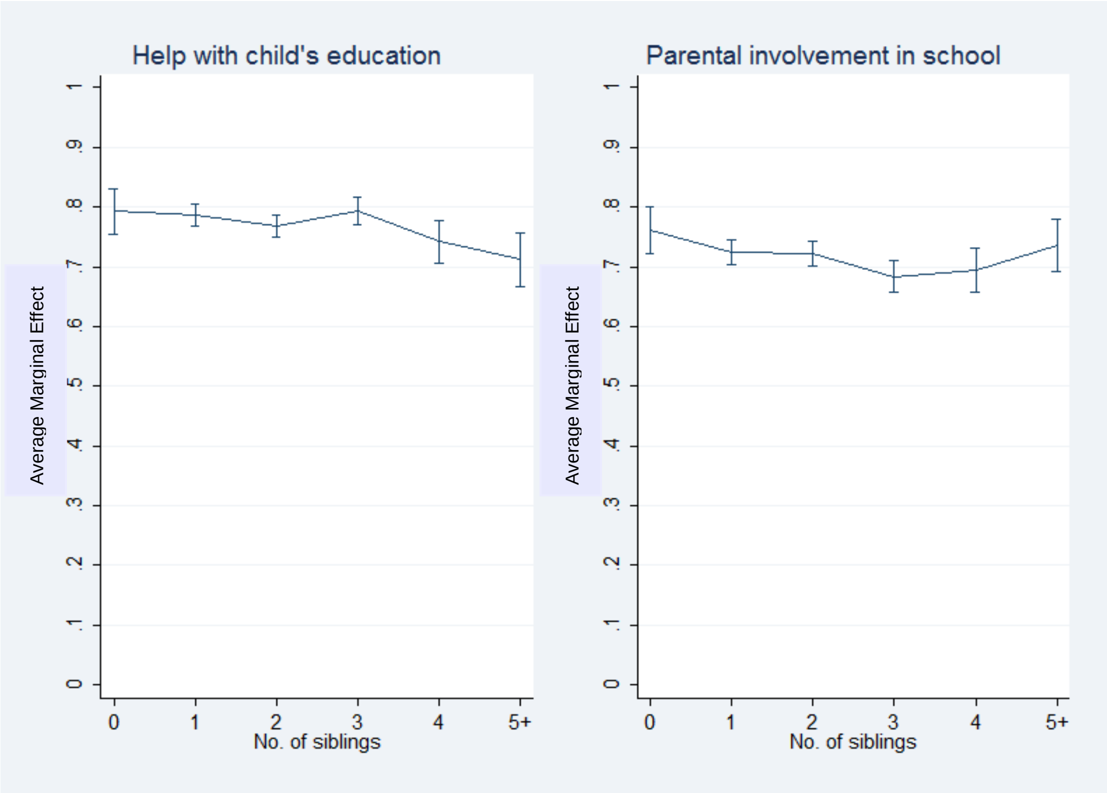
| | Model 1<br>Confident with helping child with education | | Model 2<br>Parents feel involved in schooling | |
|---|---|---|---|---|
| *Family size (Lone Child)* | | | | |
| One sibling | -0.07 | (0.09) | -0.29** | (0.09) |
| Two siblings | -0.05 | (0.09) | -0.27** | (0.09) |
| Three siblings | 0.01 | (0.10) | -0.43*** | (0.09) |
| Four siblings | -0.13 | (0.11) | -0.36*** | (0.10) |
| Five or more siblings | -0.30** | (0.11) | -0.28* | (0.11) |
| Birth order index | 0.11 | (0.08) | -0.04 | (0.07) |
| Constant | 1.15* | (0.51) | 0.29 | (0.48) |
| Observations | 11,356 | | 11,435 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age, family change.

**Figure 4.2 Average marginal effects predicting involvement in institutions by family size**




Marginal effects of the involvement in institutions are shown in Figure 4.2. There is some support that as family size increases the level of involvement that parents display reduces net of family background controls[38], however the results are not statistically significant, therefore H1b is rejected.

*H1c Organisation of daily life differs by family size net of family background factors.*

[38] For confidence in helping child with education, the significant contrasts are: five or more sibling children versus all other groups, except those with four siblings; lone children versus children with four siblings; and children with one sibling versus children with three siblings. For involvement in schooling the significant contrasts are for lone children versus children with four siblings, children with three siblings are significantly different to all groups except for children with four siblings; and lone children relative to children with two siblings are significantly different.

Table 4.10 includes the logistic regressions predicting parents paying for either private tuition or extracurricular activities as part of Lareau's concept of organisation of daily life. Both Model 1 and Model 2 reveal a negative association between organisation of daily life and family size and this is statistically significant. In addition to this there is a significant and negative birth order effect; for later born children the log odds of parents paying for these classes reduce significantly.

Marginal effects in Figure 4.3 reveal the magnitude of this effect by reporting the predicted probabilities. There is a cause to accept H1c: organisation of daily life differs by family size net of family background[39].

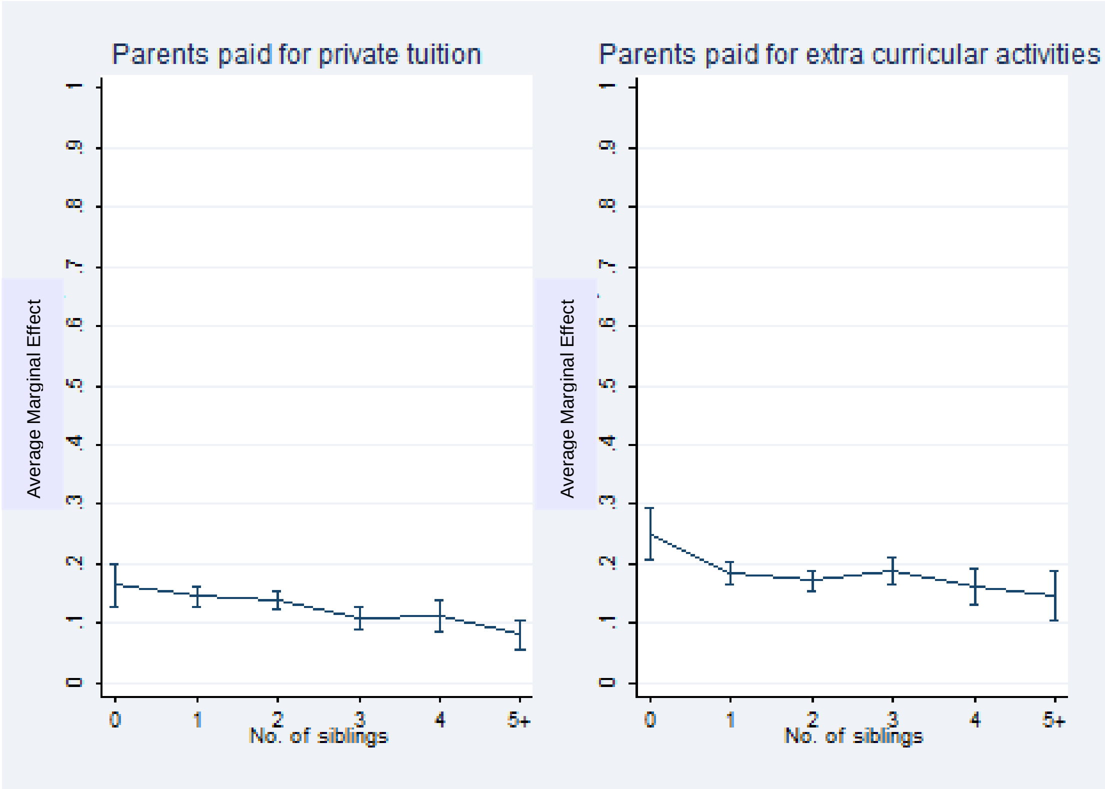
***Table 4.10 Logistic regression predicting organisation of daily life***

| | Model 1<br>Private tuition | | Model 2<br>Extracurricular tuition | |
|---|---|---|---|---|
| *Family size (Lone Child)* | | | | |
| One sibling | -0.20+ | (0.11) | -0.43*** | (0.10) |
| Two siblings | -0.28* | (0.11) | -0.53*** | (0.10) |
| Three siblings | -0.57*** | (0.12) | -0.50*** | (0.11) |
| Four siblings | -0.55*** | (0.14) | -0.59*** | (0.13) |
| Five or more siblings | -0.87*** | (0.16) | -0.82*** | (0.15) |
| Birth order index | -0.24* | (0.10) | -0.46*** | (0.10) |
| Constant | -4.11*** | (1.03) | -1.07 | (0.92) |
| Observations | 11,474 | | 11,470 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age, family change.

39 Significant contrasts are recorded for private tuition for the following groups: all groups in relation to children with five or more siblings; all groups in relation to children with four siblings except for children with three siblings; all groups in relation to children with three siblings except for children with four siblings; and children with two siblings in relation to children with three siblings. For extracurricular activities the children with five or more siblings are significantly different to children with three siblings; and lone children relative to all other groups are statistically significant.

**Figure 4.3 Average marginal effects predicting organisation of daily life by family size**




*H2 Lareau's concerted cultivation parenting strategy is positively associated with GCSE results net of family background factors*

There is some evidence that the parenting strategies, as part of parental resource, vary by family size. Those from larger families are less likely to have access to parents who can give attention to communicating with their children, being involved in their schooling and organising their daily life. This section now addresses whether or not these strategies make a difference to GCSE results. Achievement of five good GCSEs (five A*-C GCSEs including English and Maths) will be examined, the results from alternative measures of GCSE achievement are shown in Appendix 4.2. Table 4.11, Model 1 is the base model which predicts five good GCSEs. Model 2-4 includes each of the three aspects of concerted cultivation to identify the effect on the family size

*Table 4.11 Logistic regressions predicting five A*-C GCSEs including English and Maths with concerted cultivation*

| | Model 1 Base Model | | Model 2 Communication | | Model 3 Involved in School | | Model 4 Organisation of daily life | | Model 5 Concerted Cultivation (all) | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | | | | | |
| One sibling | -0.12 | (0.09) | -0.10 | (0.09) | -0.12 | (0.09) | -0.09 | (0.09) | -0.07 | (0.09) |
| Two siblings | -0.30*** | (0.09) | -0.29*** | (0.09) | -0.30*** | (0.09) | -0.26** | (0.09) | -0.25** | (0.09) |
| Three siblings | -0.39*** | (0.09) | -0.36*** | (0.09) | -0.40*** | (0.09) | -0.34*** | (0.09) | -0.32*** | (0.09) |
| Four siblings | -0.62*** | (0.10) | -0.60*** | (0.10) | -0.62*** | (0.10) | -0.57*** | (0.10) | -0.55*** | (0.10) |
| Five or more siblings | -0.61*** | (0.11) | -0.59*** | (0.11) | -0.59*** | (0.11) | -0.55*** | (0.11) | -0.51*** | (0.11) |
| Birth order index | -0.68*** | (0.07) | -0.67*** | (0.07) | -0.69*** | (0.07) | -0.65*** | (0.07) | -0.65*** | (0.07) |
| *Communication (not talk)* | | | | | | | | | | |
| Talk to mum | | | 0.04 | (0.07) | | | | | 0.02 | (0.07) |
| Talk to dad | | | 0.17** | (0.06) | | | | | 0.17** | (0.06) |
| Talk about school | | | 0.44*** | (0.10) | | | | | 0.40*** | (0.10) |
| *Involvement in School (not involved)* | | | | | | | | | | |
| Confidence to help | | | | | 0.38*** | (0.05) | | | 0.38*** | (0.05) |
| Feel involved with schooling | | | | | -0.03 | (0.05) | | | -0.04 | (0.05) |
| *Organisation of daily life (did not attend)* | | | | | | | | | | |
| Private lesson | | | | | | | 0.24*** | (0.07) | 0.24*** | (0.07) |
| Extracurricular activities | | | | | | | 0.46*** | (0.06) | 0.46*** | (0.06) |
| Constant | -0.27 | (0.57) | -0.88 | (0.58) | -0.54 | (0.57) | -0.42 | (0.57) | -1.24* | (0.58) |
| Observations | 11,587 | | 11,587 | | 11,587 | | 11,587 | | 11,587 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age, family change.

coefficients and the effect on the dependent variable. Model 5 shows the influence of the complete concerted cultivation strategies.

Model 2 shows the influence of communication on GCSE achievement. The inclusion of the communication measures in the model reduce the family size coefficients slightly compared to the base model. Furthermore if the young person reports being able to talk to their father about things that are important to them the log odds increase significantly by 0.17. Talking to their mother about important things is not statistically significant but if the young person reports talking to their parents about school the log odds increase significantly by 0.44.

Model 3 shows the effect of including involvement in schooling in the model. The family size and birth order coefficients do not change significantly, however there is evidence that if the parents report feeling confident to help with the young person's school work the log odds of achieving five good GCSEs increases by 0.38. Feeling involved in the young person's school is not significantly different.

Model 4 includes the variables related to organisation of the young person's daily life. The inclusion of private and extracurricular lessons reduces the family size and birth order coefficient. Access to private tuition increases the log odds of achieving five good GCSEs by 0.24 while access to extracurricular activity increases the log odds 0.46.

Model 5 shows the complete concerted cultivation effects. Associations for family size and birth order with GCSE achievement remain when concerted cultivation is taken into account, although the coefficients reduce in size. This suggests that parenting strategies are an important resource which can ameliorate the associations between family size and

**Figure 4.4 Average marginal effects predicting five good GCSEs by communication strategies**

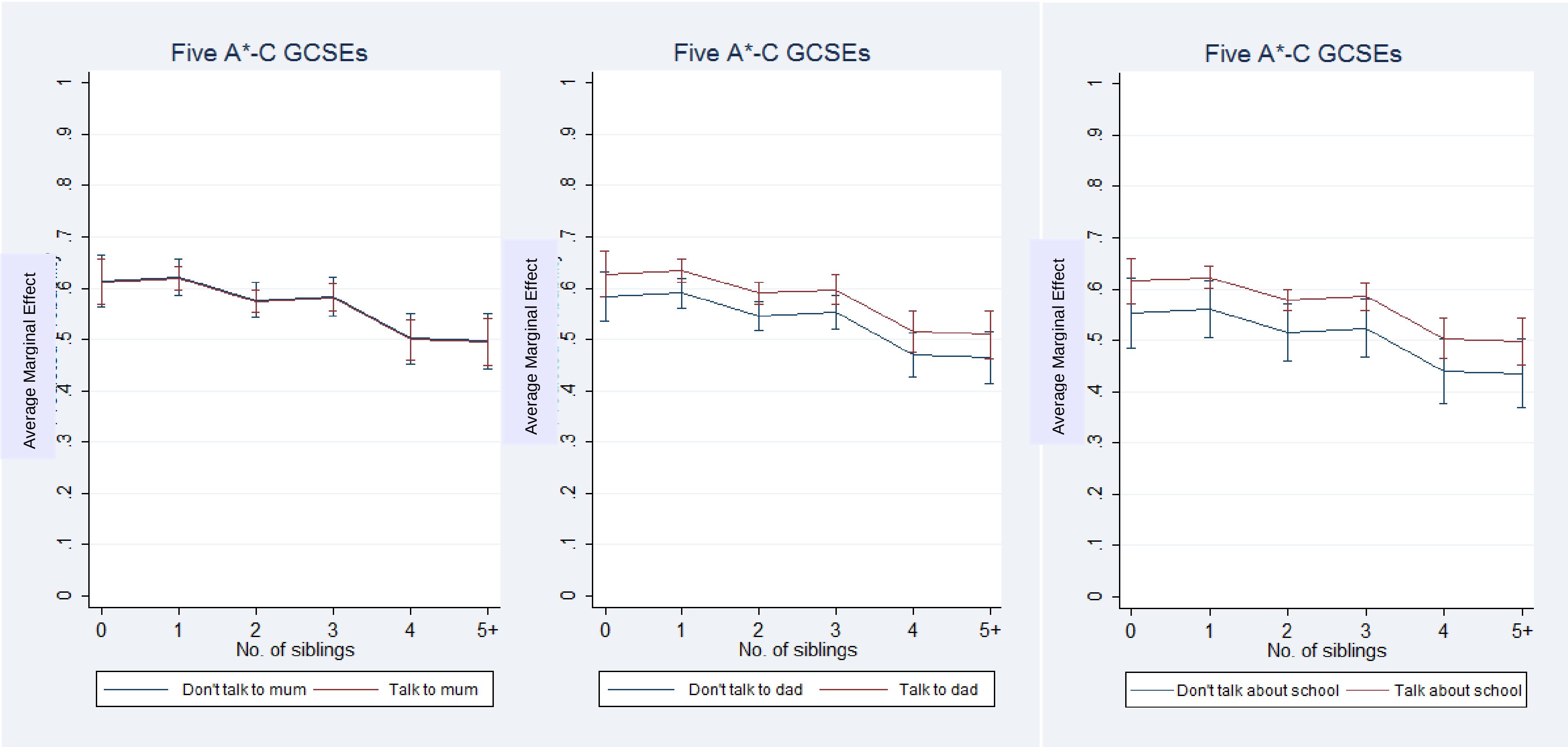


**Figure 4.5 Average marginal effects predicting five good GCSEs by involvment in institutions**

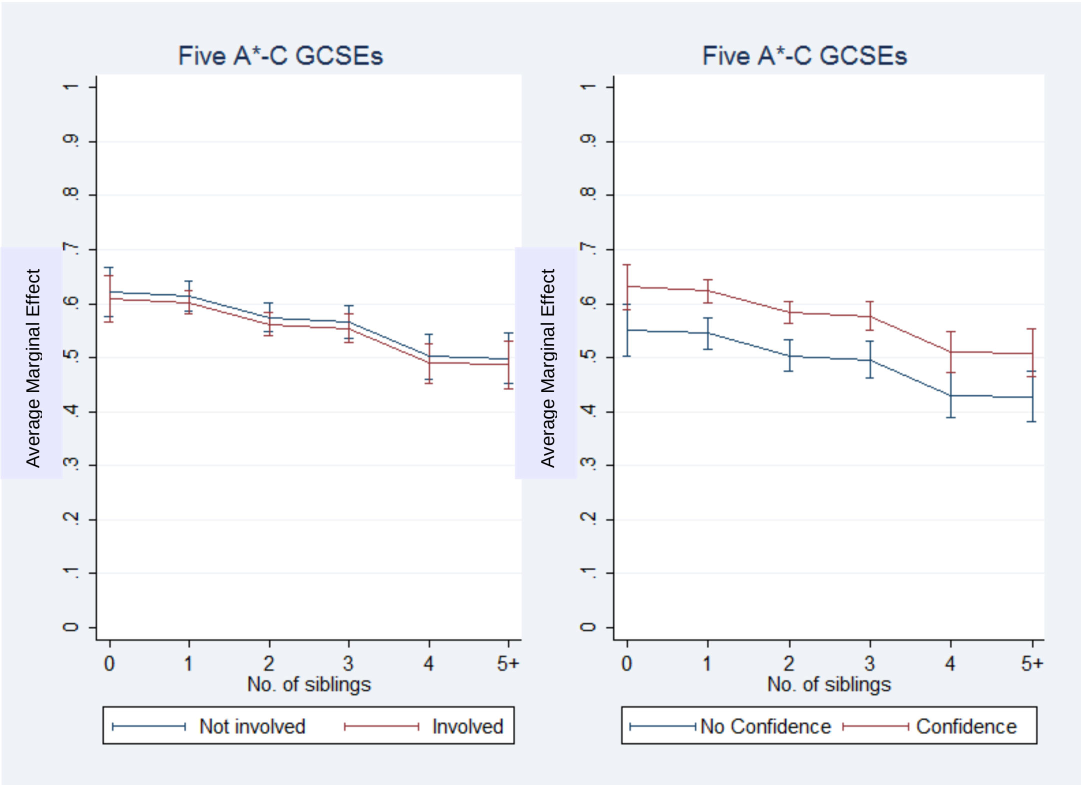
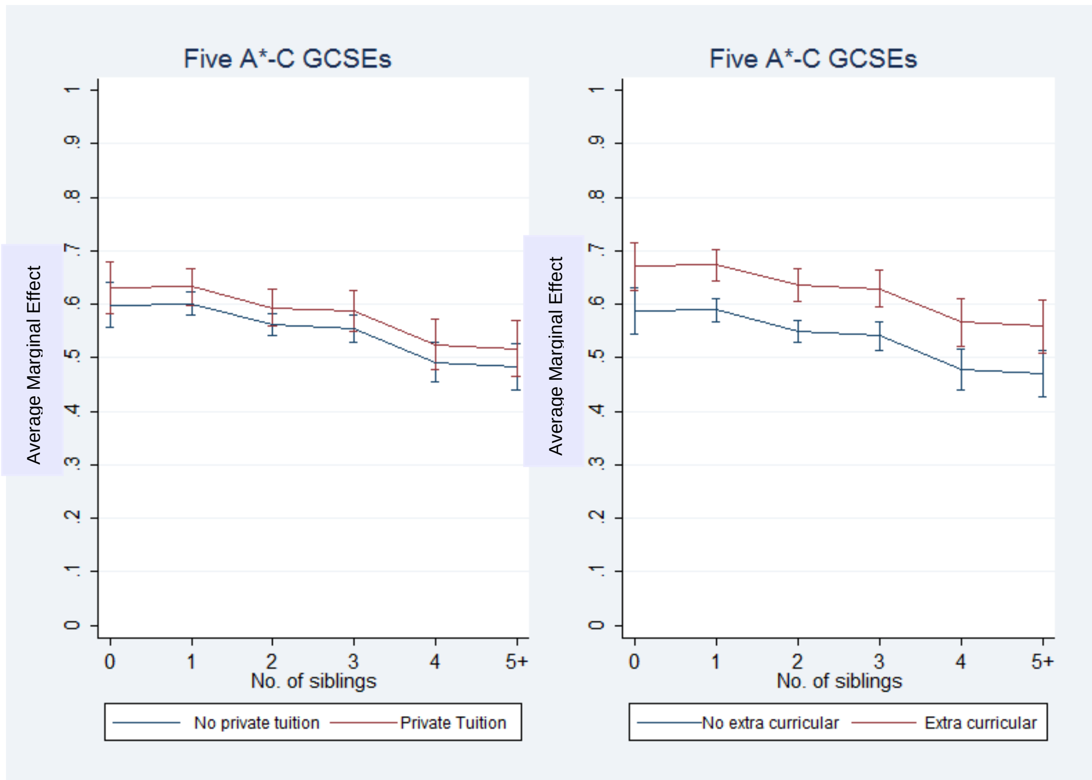



**Figure 4.6 Average marginal effects predicting five good GCSEs by organisation of daily life**



educational outcomes. The linear GCSE score can be used to identify the magnitude of the association by parenting strategies; these results are shown in Appendix 4.2. The size of the positive effect of concerted cultivation is equivalent to 48.74 GCSE points for communication strategies; 26.11 for involvement in institutions; and 36.32 for organisation of daily life. The total effects therefore are that concerted cultivation strategies increase GCSE achievement by 111.17 GCSE points. To contextualise this, 104 points are equivalent to two A grades at GCSE[40] which is no small effect.

The average marginal effects are shown in Figure 4.4 for communication strategies; Figure 4.5 for involvement in institutions; and Figure 4.6 for organisation for daily life. The results indicate that for all strategies, except talking their mother about things that are important to the young person and involvement in schooling, there are positive associations with five good GCSEs. Interactions between family size and the parenting strategies are shown in Appendix 4.3.

H2 is supported: concerted cultivation is positively associated with the achievement of five A*-C GCSEs including English and Maths. Further findings of note include the persistence of the negative family size associations when concerted cultivation controls are included as part of the familial resource. Communication has the strongest association with GCSE achievement, followed by organisation of daily life. Extracurricular activities yield higher GCSE scores compared to additional private tuition, which may be a result of two factors at play: 1) the young person is encouraged to enjoy learning through extracurricular activities or good students may be rewarded by this additional activity; 2) additional private tuition may be selected as a result of student weakness which may reduce the size of the

[40] The GCSE linear measure is calculated by giving each grade a numeric value. G is the lowest grade achieved requiring 16 points. Each grade improvement, e.g. From G to F, C to B, or A to A* is equivalent to an additional six points.

positive effect on grades slightly. Involvement in schooling has the least influence on GCSE results but still accounts for about four grade improvements.

*H3 Lareau's concerted cultivation parenting strategy is positively associated with subjective measures of education net of family background factors.*

Turning now to the influence of concerted cultivation strategies on subjective measures of education, Table 4.12 shows the results from logistic regressions predicting whether the young person likes school; whether they feel like they are making progress at school; and whether they will apply to university and if they believe they will be accepted if they apply. Model 1 indicates that there are no significant family size differences for the young person enjoying school, but there is a significant negative association for birth order: as birth order increases by one there are lower log odds of liking school. Communication strategies positively predict the log odds of a young person reporting that they like school. The parental report that they have confidence to help with the young person's schooling sees a significant increase in log odds. All other measures of concerted cultivation are not significant in this model. However it is worth noting that all of the concerted cultivation coefficients are positive except for young person attending private tuition which is insignificant and negative. This indicates that private tuition reduces the feeling of enjoyment of learning, perhaps as a result of increase in stress of the young person. There may be a selection effect operating here as young people who need this extra tuition may not be engaged and do not enjoy learning in the first place.

Model 2 shows the results for the young person reporting that they are making progress at school. There are no significant family size differences but there is evidence of a significant

***Table 4.12 Logistic regressions predicting subjective measures of education***

| | Model 1 Like School | | Model 2 Self Perception of Progress at School | | Model 3 Apply to University | | Model 4 Accept to University | |
|---|---|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | | | |
| One sibling | -0.01 | (0.13) | -0.05 | (0.09) | -0.13 | (0.11) | 0.01 | (0.17) |
| Two siblings | 0.01 | (0.13) | -0.02 | (0.10) | -0.02 | (0.11) | -0.08 | (0.17) |
| Three siblings | 0.05 | (0.14) | -0.05 | (0.10) | 0.03 | (0.12) | 0.02 | (0.18) |
| Four siblings | 0.12 | (0.16) | -0.11 | (0.12) | -0.23 | (0.14) | -0.21 | (0.20) |
| Five or more siblings | 0.11 | (0.17) | -0.13 | (0.12) | -0.04 | (0.15) | -0.16 | (0.21) |
| Birth order index | -0.57*** | (0.11) | -0.28*** | (0.08) | -0.45*** | (0.10) | -0.35* | (0.14) |
| *Communication (not talk)* | | | | | | | | |
| Talk to mum | 0.23* | (0.09) | 0.28*** | (0.07) | 0.22* | (0.09) | 0.13 | (0.12) |
| Talk to dad | 0.26** | (0.09) | 0.22*** | (0.06) | 0.06 | (0.07) | 0.21* | (0.10) |
| Talk about school | 0.40*** | (0.12) | 0.20* | (0.10) | 0.37** | (0.12) | 0.12 | (0.18) |
| *Involvement in School (not involved)* | | | | | | | | |
| Confidence to help | 0.18* | (0.07) | 0.19*** | (0.06) | 0.07 | (0.07) | 0.02 | (0.10) |
| Feel involved | 0.02 | (0.07) | 0.22*** | (0.05) | 0.04 | (0.06) | 0.17+ | (0.09) |
| *Organisation of daily life (did not attend)* | | | | | | | | |
| Private lesson | -0.07 | (0.10) | -0.09 | (0.07) | 0.47*** | (0.09) | 0.33* | (0.14) |
| Extracurricular act | 0.06 | (0.09) | 0.15* | (0.07) | 0.31*** | (0.08) | 0.11 | (0.12) |
| Constant | 0.45 | (0.85) | -0.51 | (0.58) | -2.82*** | (0.71) | 0.83 | (1.07) |
| Observations | 11,264 | | 11,251 | | 11,165 | | 8,702 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age, family change and ability.

negative birth order association. Communication and involvement in school are positively associated with the young person reporting that they are making progress at school. For organisation of daily life, attending private tuition reduces the log odds but not significantly while attending extracurricular activities increases the log odds of the student feeling like they are making progress significantly. This indicates that there are positive side effects of participating in extracurricular activities on the student’s attitudes to learning and awareness.

Concerted cultivation strategies are used to predict the young person applying to university in Model 3 and their belief that they will be accepted if they apply in Model 4. In both of the models there are no significant family size associations but there are significant and negative birth order associations, indicating that these aspirations reduce as birth order increases.

Communication strategies operate slightly differently with these outcomes. For applying to university the log odds of talking to mother is positive and significant so too is talking to parents about school, but talking to dad is positive and insignificant. When predicting the young person's belief that they will be accepted if they apply to university, only talking to their father about things that are important to them is significant, yielding positive log odds. Both of the indicators which capture involvement in institutions are positive and not strongly significant. For the measures which capture organisation of daily life, private tuition increases the log odds of applying to and believing that they will be accepted by university significantly. Attending extracurricular activities is positive for both university measures, but only the coefficient for the young person applying to university is significant.

In summary all concerted cultivation strategies are positively associated with subjective outcomes of educational achievement except for private tuition which yields lower log odds when predicting whether the young person likes school. Despite this, there is enough evidence to accept H3. Communication strategies are positive and significant predictors for the young person liking school and feeling like they are making progress at school. Involvement in the young person's schooling has significant and positive associations with the young person's perception of their progress at school. Organisation of daily life strategies behave slightly differently: private tuition is a significant predictor for both of the university measures while extracurricular activities are significant predictors for progress at school and university aspiration. This suggests that parenting strategies have a number of different influences on the young person's subjective educational outcomes.

## Summary

This chapter set out to explore the influence of parenting strategies, as part of the familial resource, which may influence the educational outcomes of young people. The first task was to consider what parenting strategies would be included as part of the familial resource. After a review of the available literature, Annette Lareau's conception of concerted cultivation was used and this was operationalised using the LSYPE data. In order to test whether Lareau's three components of concerted cultivation were adequately captured, a principal component analysis was used to identify the shared underlying components. Concepts of communication with the young person, involvement in schooling and organisation of daily life were identified.

The first substantive finding is that access to concerted cultivation parenting styles do vary by family size net of other family background controls. This is consistent with Blake's notion of resource dilution; the ability for parenting to provide these cultivating practices is reduced as family size increases. Birth order associations also vary for organisation of daily life and communication strategies.

Consistent with the second hypothesis is that concerted cultivation strategies are positively associated with the achievement of five good GCSE grades. Communication strategies have the greatest influence on GCSE achievement which emphasises the importance of talking to children about school and creating a home environment where the young person feels like they can talk to their parents about things that are important to them. Involvement in school has the smallest effect on GCSE grades of the concerted cultivation strategies, but parents reporting that they feel confident to help with their child's school work does yield positive log odds. Organisation of daily life is important too, and of particular note is that extracurricular activities are more positively associated with achieving five good GCSEs than private tuition. There may be a number of factors that influence this finding, such as the need for private lessons may arise because of a weakness in the subject or that it also comes with a higher level of stress for the young person. Also, engaging in extracurricular activities may increase the enjoyment of learning more generally. The magnitude of the concerted cultivation effect is significant, accounting for an additional two A grade GCSEs net of family background controls.

Unpacking the concerted cultivation components further, these findings suggest that the ease of communication between parent and child may encourage logic and reasoning of the child, providing an increased opportunity to develop analytical skills. Additionally, it may be the case that the ease and frequency of communication is evidence of parental support, warmth and interest in the child which improves the self-perception and confidence of the young person. Taken together these findings suggest that having strong parent-child relationships with easy and frequent communication is positively associated with educational attainment.

Although involvement in institutions is one of the least influential aspects of concerted cultivation it is still noteworthy. Parents who report feeling that they know all they need to know to help with their young person's education may be able to negotiate on their child's behalf, help prepare the young person for exams and assessment, and provide knowledge for certain subjects. Parents who report feeling involved in the young person's school have a positive but weaker association with GCSE results. The difference between these variables may capture some of the variation in the nature of the involvement in school, which may include the 'pushy parents' in addition to parents who are called to school because their child is problematic.

Organisation of daily life is strongly associated with GCSE results. The results suggest that extracurricular activities are more influential than private tuition. The reason for these differences may be due to the nature of the young person; those who attend private lessons may be falling behind or finding things difficult. There may be a number of reasons why extracurricular lessons have such a positive association: it may improve the young person's approach to learning new things; improve the balance in their life; and increase the opportunity to develop positive social ties through organised activities; encourages participation in goal-related activities and repetitive practice; and may reduce the opportunities of engaging in anti-social behaviour.

The third and final hypothesis set out earlier in this chapter stated that concerted cultivation strategies are positively associated with subjective measures of education. The results in this chapter support this hypothesis. The efficacy of the concerted cultivation strategies is dependent on the outcome being measured. Communication strategies are positive and significant predictors for the young person liking school and feeling like they are making progress at school and while the log odds remain positive for the university measures, only some are significant and they do not follow a consistent pattern. For example if the young person talks to their father about things that are important to them they have higher log odds of believing they will be accepted which is not the case for the young person reporting that they will apply to university. Furthermore involvement in the young person's schooling has significant positive association with the young person's perception of their progress at school and their enjoyment of school. Organisation of daily life strategies behave slightly differently: private tuition is a significant predictor for both of the university measures while extracurricular activities are significant predictors for progress at school and university aspiration.

The findings from this chapter show that there is some evidence that educational advantages for children can be conferred if parents adopt particular parenting strategies after taking into account family background factors. There is a negative association between family size and the adoption of concerted cultivation parenting styles; furthermore there is a negative association between family size and educational outcomes. The manner in which the parents select these strategies may be based on whether they are child centred or have high aspirations of their child's education. Concerted cultivation is found to have a positive association with children's educational outcomes. Underlying these findings is the argument that families, schools and formal examinations are not neutral institutions - they are orientated to value certain behaviours, skills and knowledge. This provides an educational advantage for those children who have been exposed to these behaviours from a young age and an exclusionary disadvantage to those who have not experienced these behaviours.

Many questions remain unanswered by this research and therefore further work is required in different cultural and geographic fields. Comparing different practices of parenting by ethnicity or religion would provide further insight into the influence of these cultural. In addition, more detailed analysis of the interactions between parent and child would provide a deeper understanding of dynamic nature of the relationship. Furthermore issues of causality need to be addressed, with particular reference to the selection effect – where parental preferences may be operating indirectly through their parenting behaviours. This will be addressed in the following chapter. Finally, future research should examine the association between family size and other parenting practices including aspects of parenting control.

# Chapter 5: Testing Resource Dilution Using Twins as an Exogenous Increase in Family Size

## Introduction

The results from the previous chapter show that parenting strategies vary by family size. Furthermore it identified that concerted cultivation strategies, as outlined by Lareau (2003), are positively associated with GCSE achievement and subjective educational outcomes. Evidence was also presented that when these resources are taken into account the negative association between family size and educational achievement remains, albeit with the results ameliorated slightly. So far this thesis has found evidence of resource dilution and a negative birth order effect using observation studies. However the main criticism directed towards the resource dilution model has not yet been addressed: that the relationship between educational outcomes and family size may be influenced by unobserved characteristics (Downey, 2001), and that people make fertility choices on the basis of expectations about their child's educational outcomes, it is to this issue we now turn. The current chapter seeks to identify if resource dilution is associated with educational outcomes for a child who experiences an exogenous increase in family size as a result of the birth of twins.

The ONS Longitudinal Study (LS) provides an opportunity to identify age spacing between siblings which identifies twins in the family. This can be used to establish whether resource dilution is evident or whether endogenous factors may drive the negative family size association with educational outcomes.

## Literature Review

The issue of causality is a major concern for any family size study, and non-experimental work more generally, as the results indicate association rather than a cause. The reason for this is that family size may be endogenously selected by parents (Downey, 2001) as they may make fertility decisions which correspond to their desire to invest in the child's education. This chapter makes use of the exogenous variation in family size due to the incidence of a twin birth to determine whether there is evidence of a causal relationship between family size and educational outcomes.

Endogenous effects occur in a situation where a particular outcome is dependent on an unmeasured variable (or set of variables). If the omission of the relevant variable is not acknowledged, effects can be mistakenly attributed to some other variable. For example couples who value their children's education may opt for a small family size in order to provide their children with more resources. Downey (2001) notes that statistical controls can take into account parental background, education level and class but these measures may not fully account for endogeneity or omitted variable bias.

Downey summarises the issue of causality thus:

*"Smart parents have small families, but small families do not make smart children"*

Downey (2001), pp501.

There have been a number of studies which try to deal with the problem of endogeneity regarding fertility decisions. Knodel et al. (1990) try to decompose the effects of family size and parental values towards education on children's educational outcomes. In their longitudinal study of Thai families they find that parental preferences for their child's educational outcomes predict the actual educational level achieved by their children.

However they also found that family size effects remain after controlling for theses parental values, which are not as strong a predictor of children's educational outcomes as either parent's education or socioeconomic status. Their study goes some way to try to deal with the endogenous factors, but only examines one particular variable that may influence family size effects.

Several others take a similar approach to establishing what factors correlate with family size decisions (Kiser and Whelpton (1958); Westoff et al. (1961); Westoff et al. (1963)). They find that when they measure parental ambition through characteristics such as 'drive to get ahead' and need for achievement they found that these factors are not associated with the number of children desired or fertility planning. In Blake's own analysis she finds that parental personality characteristics do not drive the differences by family size and therefore concludes that parents' personality and parenting values are not as important for children's educational outcomes as parental background characteristics (Blake, 1989). However this does not fully account for endogenous effects.

A more econometrically advanced approach is to estimate the effects of an exogenous increase in family size. While this does not identify the unobserved factors that may be at play (preference, personality, attitudes towards education etc.) it does identify if there are differences in educational outcomes of children by family size when fertility is exogenous to parental choice.

Rosenzweig and Wolpin (1980a) were the first to use twins as an instrument to test the quality-quantity model first proposed by Becker (Becker, 1960; Becker and Lewis, 1973; Willis, 1973; Becker and Tomes; 1976). This exogenous variation can be used to estimate the 'true' effect of family size on educational outcomes in order to find out the impact of family size on children's educational attainment. Their approach restricts the analysis to twins at first birth which includes twenty-five twin pairs in a national sample of 2,930 in India. They conclude that an exogenous increase in family size reduces both the average educational attainment of twin children and the educational attainment of non twin children, albeit with a slightly weaker association. This finding shows that an increase in fertility decreases the child quality measured by educational outcomes, which also supports the expectations of the resource dilution model. Rosenzweig and Wolpin (1980a) conclude that educational outcomes are sensitive to family size change and therefore note that an exogenous decrease in family size will improve the schooling levels in India. In another paper Rosenzweig and Wolpin (1980b) adopted a similar twin methodology and found that there is a negative impact of an exogenous increase in family size on women's labour market participation in the USA using a pooled sample from the Office of Population Research and the U.S. Department of Health, Education, and Welfare.

Black et al. also use multiple births as a natural experiment to model an exogenous shift in family size and test educational attainment (Black et al. 2004) and IQ scores (Black et al.2007a) by taking advantage of the detailed Norwegian registry data. They look at the educational outcomes of non twin children born prior to the twin birth. They find no adverse effects of increased family size on educational attainment[41] (Black et al. 2004), however they find significant effects for birth order which they argue are stronger than family size. Furthermore they find non-significant negative coefficients as family size increases as a result of a twin birth when twins are born at third, fourth and fifth birth. Black et al. (2004) argue that these findings show that endogenous factors may be at play and that the family size effect is weak. However when they examine the IQ scores (Black et al. 2007a) they find that an unexpected shock to family size induced by the birth of twins is

[41] More specifically, Black et al.(2004) find that there are no significant effects of family size when comparing a first born child in families where the second birth is a twin with first born children who do not have twin children.

associated with poorer IQ outcomes for existing children. These findings indicate that there may be different mechanisms at play for IQ scores and educational attainment.

Caceres' work may shed some light on these results which suggest that a one child increase does not yield significant effects for educational attainment (Caceres, 2004; Caceres-Delpiano, 2006). Caceres tests Becker's quantity and quality model by using multiple births as an exogenous shift in family size in a sample from US Census data. He finds that the presence of twins requires the family to reallocate resources, such as space within the home (Caceres, 2004). Additionally this exogenous increase in family size reduces the likelihood of parents investing in private education for their children, particularly for elder children. Caceres finds evidence that an exogenous increase in family size increases the likelihood of parental divorce and reduces the likelihood of the mother working (Caceres-Delpiano, 2006). However he finds little evidence to suggest that an exogenous change in family size reduces educational attainment, increases the chances of dropping out of school, or increases the chances of teenage pregnancy (Caceres, 2004). He concludes that parents are flexible and able to reallocate resources which can mitigate the effects of an increase in family size on a number of outcomes (Caceres-Delpiano, 2006). This explanation suggests that resource reallocation, a strategy adopted as a result of an increase in family size, may ameliorate the negative effects of a family size increase on educational attainment more so than on IQ scores[42].

There is mixed evidence that family size effects may be endogenous - Black et al. find no evidence of resource dilution effects on educational attainment in Norway when there is an exogenous increase of family size as a result of a twin birth (Black et al., 2004). However,

[42] Blake (1989) distinguishes between IQ and educational attainment in the resource dilution analysis. She notes that IQ is about ability which is an important predictor for educational attainment. She identifies both outcomes are negatively associated with family size but it may be the case that educational attainment is more sensitive to resources due to the costs involved in educational attainment.

they find that resource dilution factors are evident when predicting IQ scores (Black et al., 2007a). Resource dilution is evident from Rosenzweig and Wolpin's work (1980a) while endogenous factors are found by Caceres (2004) who cites resource reallocation as an explanation for these insignificant differences for educational outcomes.

Twin studies raise another interesting point about the manner in which the resources are allocated and diluted. Twins are competing directly for the same resources at the same time, while siblings with greater age spacing between them are competing for different resources. Previous research has indicated that age spacing is an important influence on the influence of resource dilution: siblings who have large age gaps between them tend to experience less detrimental effects of dilution (Powell & Steelman, 1990, 1993, 1995). According to Guo and Vanwey (1999) argue that age spacing is a stronger predictor for intelligence than family size. They find that family size effects disappear when age spacing is included in the model.

## Aims and Hypotheses

As a result of this literature review, the following hypotheses will be tested:

H1 There is evidence of an association between family size and educational attainment, net of family background controls.

H2 Age spacing between siblings reduces the strength of the association between family size and educational attainment, net of family background controls

H3 There is evidence of resource dilution for twin children net of family background, birth order and age spacing.

H4 There is evidence of resource dilution for non twin children who experience an exogenous increase in family size net of family background, birth order and age spacing.

## Contribution

To the best of my knowledge there has been no research which identifies the effect of an exogenous increase in family size to test the resource dilution model in the UK. Therefore this chapter contributes to the growing body of literature in a number of ways. It tests whether endogeneity drives the family size effect in a new cultural context using a large nationally representative dataset. It takes a longitudinal approach to the analysis and is able to control for age spacing effects. In addition it tests the strength of the resource dilution effect on siblings of twins and twins themselves to identify who is most influenced by the exogenous increase in the family which combines the methods used by Rosenzweig and Wolpin (1980a) and Black et al.(2004; 2007a).

## Data and Methods

The Office of National Statistics Longitudinal Study (LS) links census data[43] from 1971, 1981, 1991 and 2001 and represents 1% of the whole Census population of England and Wales[44]. Family background is measured in the LS dataset in 1971 and 1981, including family structure, parental class, parental age and parental education. Then controlling for these family background effects family size, birth order and age spacing are used to predict the highest educational outcome achieved by the LS member in 2001. LS members are selected if they were born on four specified dates in any year[45].

[43] The data variables are composed of the information from the Census form. The Census form includes descriptive information about people living in the household. However it is only for the LS member that the Census responses are linked to compose the longitudinal information.

[44] The permission of the Office for National Statistics to use the Longitudinal Study is gratefully acknowledged, as is the help provided by staff of the Centre for Longitudinal Study Information & User Support (CeLSIUS). CeLSIUS is supported by the ESRC Census of Population Programme (Award Ref: RES-348-25-0004). The author alone is responsible for the interpretation of the data. Census output is Crown copyright and is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland. The clearance number for this data is: 30138.

[45] These dates are confidential.

It is important to reiterate that the LS data is not a household panel study, while it offers information about the family in 1971 and 1981, it doesn't follow all family members in 2001, although it is possible that more than one individual from the same family may be LS members

In order for individuals to be included in the LS sample, the LS member must be living with their birth mother in 1971. This means that children who are living with their birth father or with extended family rather than their birth mother do not appear in the data. This has implications for the family structure controls included as only married parents or lone mothers can be identified in 1971. However a more detailed measure of family structure from 1981 can be used to identify the marital status of parents and with whom the young person lives in 1981.

In 1971 there were 94,715 sample members aged 0-15. This age range ensures that the members are likely to be still living at home and therefore receiving familial resources. 86,748 of these sample members could be identified in 1981 and were present in 2001[46]. In order to ensure that the family size measure was complete, two conditions were set. Firstly sample members were kept if there was no evidence of a sibling under 10 in 1981 signalling that family size in 1971 is complete. Secondly, the sample member was kept if their mother was older than 28 in 1971[47]. This reduced the sample size by 24,070. Furthermore 20 triplets were deleted, so too were 58 cases where there were multiple sets of twins to avoid complicating the interpretation of results[48]. 1,569 cases were dropped because there was insufficient data for birth order. Therefore the complete sample for analysis includes 61,031 observations.

[46] 7,967 sample members were dropped due to attrition. Attrition in the LS Census is rare and would only arise if the LS member had died, moved abroad between collection years or did not complete the census form, which is a legal requirement.
[47] Following conventions in the literature set by Aghajanian (1981) and Black et al. (2004)
[48] These families may provide an opportunity for future research.

If there is more than one LS member in the household, all LS members are included in the individual level analysis[49]. In order to control for the possibility that some LS members are from the same household, a household indicator was created and all models adjust for robust cluster variance around households.

*Dependent variable*

The LS member's highest educational qualification can be measured in 2001 when they are aged at least 30 years old. It is reasonable to assume that the sample members will have completed their education by this point. The dependent variable was coded to have five measures of educational attainment, which relate to the highest level of education achieved. The categories are: no qualifications; GSCEs grades D-G (or equivalent); GCSEs A-C (or equivalent); A Levels (or equivalent); first degree or higher.

***Table 5.1 Highest qualification level achieved by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Highest qualification achieved | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| No qualification | 12 | 10 | 14 | 21 | 27 | 35 | **16** |
| GCSEs G-D | 25 | 27 | 28 | 27 | 28 | 25 | **27** |
| GCSEs A-C | 24 | 25 | 24 | 22 | 19 | 17 | **23** |
| A Levels | 8 | 8 | 7 | 6 | 5 | 4 | **7** |
| Degree or higher | 30 | 30 | 27 | 24 | 21 | 19 | **27** |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

49 This means that a non twin child born on one of the four selected birth dates and a set of twins born on another of the selected dates who are from the same family may all appear as LS members in the sample. However it is possible that twins from the same family are not eligible to be LS members, as it is possible that one twin may have been born before midnight on a selected date and one after midnight.

Table 5.1 shows the distribution of educational achievement by family size[50]. The results indicate that there is a higher proportion of children from larger families with no qualifications and that there is a higher proportion of smaller families with a degree or higher.

### *Independent variables*

Family size was restricted to seven child families as the LS data doesn't record the children's dates of birth for families with eight or more children which means that multiple births cannot be identified. There are two ways to measure family size in 1971 - mother's fertility history and number of children in the household. Mother's fertility history is a retrospective report of all of the children the mother has given birth to inside of marriage – this measure does not capture children born out-of-wedlock, step children or adopted children. If there is a difference between the fertility history report and the number of

***Table 5.2 Distribution of Family Size***

| Number of siblings ever had | Frequency | Percent |
|---|---|---|
| Lone child | 4,736 | **8** |
| One sibling | 20,902 | **34** |
| Two siblings | 17,054 | **28** |
| Three siblings | 9,828 | **16** |
| Four siblings | 4,711 | **8** |
| Five or more siblings | 3,800 | **6** |
| **Total** | **61,031** | **100** |

***Table 5.3 Frequency of Twins who are LS Members***

| LS member is a twin | Frequency | Percent |
|---|---|---|
| Non twin | 59,787 | **98** |
| Twin | 1,244 | **2** |
| **Total** | **61,031** | **100** |

[50] The Pearson chi-squared test yields significant results.

***Table 5.4 Frequency of Twins in the Family***

| Twins in family | Frequency | Percent |
|---|---|---|
| No twins in family | 58,806 | **96** |
| Twins in family | 2,225 | **4** |
| **Total** | **61,031** | **100** |

children in the household is greater, then there is evidence of an additional sibling (coded extra sibling). This shows that there is a child within the family who was born out-of-wedlock, is a step child or an adopted child; however there is no way to identify which category these extra siblings belong to.

The distribution of family size in the sample can be seen in Table 5.2 and it shows that 34% have one sibling and 28% have two siblings, accounting for 62% of the total sample.

By matching household indicator, month and year of birth, it is possible to identify whether the LS member is a twin not. Furthermore the data can also identify whether the LS member's siblings are twins or not. Table 5.3 identifies the frequency of LS members who are twins and Table 5.4 identifies the frequency of LS members who have twin siblings.

As with the previous chapters, a birth order index is created in order to separate the effects of birth order from family size. The LS Census data does not identify which twin was born first, so the twins were coded with the same absolute birth order. For example in a family if Child A is firstborn, Child B and C are twins born second and Child D is lastborn; Child A is coded with an absolute birth order of one, Child B and C have an absolute birth order of two and Child D has an absolute birth order of three.

***Table 5.5 Family Size and Birth Order***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Birth order | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| First born | 100 | 43 | 25 | 16 | 10 | 6 | **33** |
| Second born | | 57 | 33 | 21 | 14 | 9 | **34** |
| Third born | | | 42 | 29 | 20 | 11 | **19** |
| Fourth born | | | | 35 | 25 | 17 | **9** |
| Fifth born | | | | | 30 | 21 | **4** |
| Sixth or more | | | | | | 35 | **2** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 38,00 | 61,031 |

***Table 5.6 LS Member is a Twin by Birth Order***

| % | Birth Order | | | | | | |
|---|---|---|---|---|---|---|---|
| LS member twin | First born | Second born | Third born | Fourth born | Fifth born | Sixth or more | Total |
| Non twin | 98 | 98 | 98 | 98 | 97 | 98 | **98** |
| Twin | 2 | 2 | 2 | 2 | 3 | 2 | **2** |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 20,165 | 20,589 | 11,433 | 5,278 | 2,244 | 1,322 | 61,031 |

***Table 5.7 Twins in Family by Birth Order of LS Member***

| % | Birth Order | | | | | | |
|---|---|---|---|---|---|---|---|
| Twins in family | First born | Second born | Third born | Fourth born | Fifth born | Sixth or more | Total |
| No twins | 97 | 97 | 96 | 95 | 93 | 93 | **96** |
| Twins | 3 | 3 | 4 | 5 | 7 | 7 | **4** |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 20,165 | 20,589 | 11,433 | 5,278 | 2,244 | 1,322 | 61,031 |

***Table 5.8 Class background by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Class | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Salariat | 6 | 7 | 7 | 7 | 6 | 5 | **7** |
| Intermediate | 31 | 34 | 30 | 23 | 15 | 11 | **28** |
| Working | 63 | 59 | 63 | 70 | 79 | 84 | **65** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

***Table 5.9 Father's education by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Father's education | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| None | 79 | 76 | 77 | 80 | 84 | 85 | **79** |
| A Level | 5 | 6 | 5 | 4 | 3 | 3 | **5** |
| Above AL | 6 | 8 | 6 | 4 | 2 | 1 | **6** |
| Degree | 3 | 5 | 6 | 5 | 2 | 1 | **5** |
| Missing | 7 | 5 | 6 | 7 | 8 | 10 | **6** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

***Table 5.10 Mother's education by family size***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Mother's education | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| None | 91 | 88 | 88 | 90 | 94 | 96 | **90** |
| A Level | 3 | 4 | 4 | 3 | 2 | 2 | **3** |
| Above AL | 5 | 7 | 7 | 5 | 3 | 2 | **6** |
| Degree | 1 | 1 | 1 | 1 | 0 | 0 | **1** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

***Table 5.11 Father's age when LS member was born***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Father's age when LS member was born | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Father over 30 | 71 | 63 | 65 | 68 | 70 | 77 | **66** |
| Father under 30 | 29 | 37 | 35 | 32 | 30 | 23 | **34** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

*Table 5.12 Mother's age when LS member was born*

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Mother's age when LS member was born | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Mother over 30 | 53 | 41 | 45 | 49 | 53 | 61 | **47** |
| Mother under 30 | 47 | 59 | 55 | 51 | 47 | 39 | **53** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

*Table 5.13 Father's age by twin birth*

| % | Twins in Family | | |
|---|---|---|---|
| Father's age | No twins | Twins | Total |
| Father over 30 | 66 | 74 | **66** |
| Father under 30 | 34 | 26 | **34** |
| Total | **100** | **100** | **100** |
| N | 58,806 | 2,225 | 61,031 |

*Table 5.14 Mother's age by twin birth*

| % | Twins in Family | | |
|---|---|---|---|
| Mother's age | No twins | Twins | Total |
| Mother over 30 | 47 | 56 | **47** |
| Mother under 30 | 54 | 44 | **53** |
| Total | **100** | **100** | **100** |
| N | 58,806 | 2,225 | 61,031 |

*Table 5.15 Marital status of parents and living arrangements in 1981*

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Marital status of parents in 1981 | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| Unknown | 2 | 2 | 2 | 3 | 4 | 4 | **2** |
| Married | 59 | 66 | 60 | 56 | 48 | 45 | **59** |
| Remarried | 8 | 5 | 5 | 5 | 6 | 5 | **5** |
| Single | 9 | 7 | 8 | 8 | 9 | 10 | **8** |
| Not living with parents | 23 | 21 | 25 | 28 | 34 | 36 | **25** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

A cross tabulation between family size and absolute birth order is shown in Table 5.5. The results indicate that birth order is relatively evenly spread in each family size category except for children with four siblings who have a lower proportion of low birth order children represented.

Table 5.6 indicates that LS members who are twins are evenly spread by birth order, accounting for 2-3% of the sample for each position in the family. Table 5.7 shows the birth order by LS members who have twin siblings.

Family social class is included in the model as a control variable; this is composed of the highest class of either parent. It is collapsed into three categories: salariat; intermediate and working class backgrounds. A cross tabulation of class by family size is shown in Table 5.8.

There is some evidence that there are a higher proportion of intermediate class parents who have small families compared to larger families and that the opposite is found for working class parents (Table 5.8). There is no family size variation for the salariat class. Parents' education is included as a statistical control in the models, when tabulated by family size (Table 5.9 and 5.10) there is some evidence that family size does vary slightly by parental education. Parent's age is also included as a control as this may be associated with additional family resources and the incidence of twin births (Table 5.11 and 5.12 show father's and mother's age by family size and Table 5.13 and 5.14 show father's and mother's age by twins in the family). A higher proportion of parents with large families are older, which is to be expected. Furthermore there is evidence that a higher proportion of older parents have twins.

Family structure in 1971 and 1981 are used as independent variables. In 1971 the mother's marital status can be identified; this is a simple measure which highlights whether they are single or married. In 1981 more detailed variables identify the marital status of the parents in the household including whether their parents are married, remarried, single or if the LS member is no longer living with either parent. Controlling for family structure is important as it is a strong predictor of educational outcomes (McLanahan and Sandefur, 1994; Jonsson and Gähler, 1997; Biblarz and Raferty, 1999; Case et al., 2001). A higher proportion of smaller families compared to larger have parents who are still married in 1981 and a higher proportion of children from larger families have left their family home as evident in Table 5.15.

The age spacing approach adopted in this chapter follows the convention set by Powell and Steelman (1990) which identifies sibling density in the family. They create use two alternative measures of age spacing, one which identifies the number of siblings who are at least three years older or younger than the respondent and the number of siblings one to two years older or younger on a linear scale. The second measure of age spacing they create is a dummy variable which captures the distance in age by identifying the presence of any sibling three years older or younger. The first method will be used to establish the age spacing effects in detail and the second method will be used as a control variable in the second part of the analysis which involves tests of an exogenous increase in family size.

Finally, individual characteristics of the LS member are taken into account; these are statistical controls for ethnicity and gender.

### *Estimation strategy*

The first part of the analysis in this chapter tests the resource dilution model and examines age spacing associations using the full sample. An ordered probit model is used to predict the highest qualification achieved. Thereafter logistic regressions are run to predict the attainment of a degree or higher. As before, average marginal effects are calculated to standardise the results to ease comparability.

In the second part of the analysis two tests are completed to establish if there is evidence that endogenous factors may be driving the family size effect[51]. The first test adopts an approach similar to that used by Rosenzweig and Wolpin (1980a). It compares the educational outcomes of twins at first birth with the educational outcomes of a lone child. This identifies whether resource dilution effects are evident as a result of an exogenous increase in family size for twin children. If there is no difference between the educational outcomes of lone children and twin children, then it is likely that there are endogenous factors are at play. To ensure that the resource dilution is evident for children who do not experience an exogenous increase in family size, lone children are also compared to children with one sibling. These comparisons are shown in Figure 5.1. The sample distribution of twins who are LS members at first birth is shown in Table 5.17.

**Figure 5.1 Comparison groups for the estimation of the effects of an exogenous increase in family size (Twin comparison)**

| | Twins as an exogenous increase (A) | Same number of pregnancies as A | Same number of children as A |
|---|---|---|---|
| Comparison 1 |  |  |  |

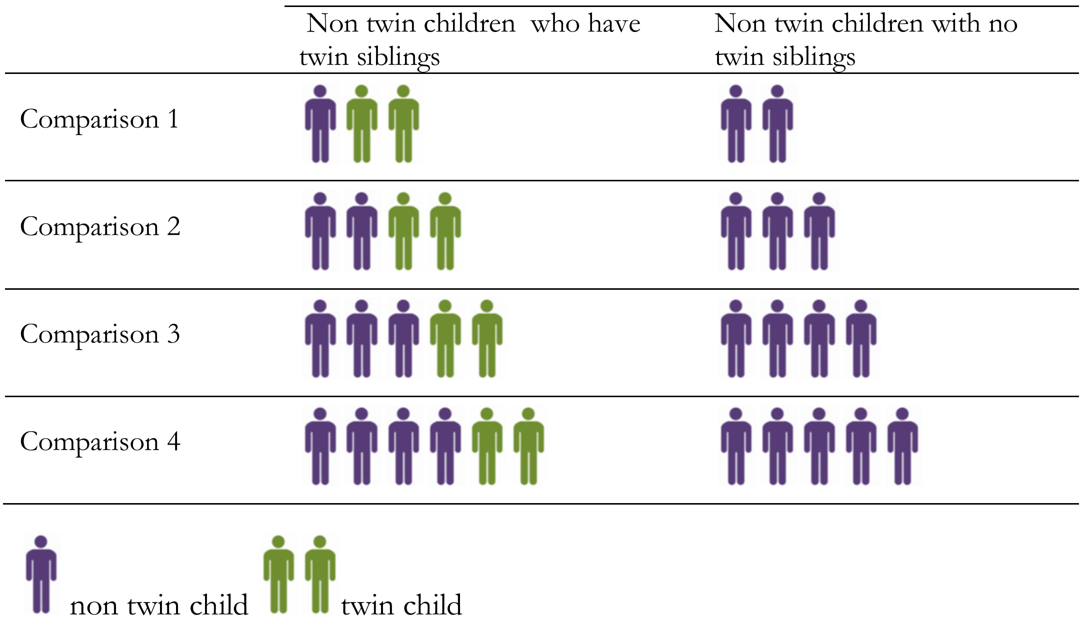
[51] 1,364 LS members with 'extra siblings' are dropped from the second part of the analysis to ease interpretation of the results.

***Table 5.16 Frequency of families who stop having children after the birth of twins when LS member is a twin***

| | Frequency of twins at first birth | Frequency completed families after twin births | Percentage of LS Twins as final birth |
|---|---|---|---|
| Twins at first birth | 366 | 222 | **61%** |

The second test in part two of the analysis uses non twin children. The educational outcomes of non twin children are compared if they have twin siblings and if they do not, as outlined in Figure 5.2. This means that with reference to Comparison 1, Figure 5.2, the educational outcomes of the first born child in each family are compared (the purple children). If LS members who have twin siblings have a lower probability of achieving a degree or higher, we can conclude that there is evidence of resource dilution effects. If there is no difference between these comparison groups, then there is evidence that endogenous factors may be driving the family size effect or that parents are able to reallocate resources as described by Caceres-Delpiano (2006).

**Figure 5.2 Comparison groups for the estimation of the effects of an exogenous increase in family size (Non twin comparison)**



In Comparison 2, the educational outcomes of the first and second born in families with twins are examined relative to the first and second born in families where the third birth is a non twin, controlling for absolute birth order and age spacing. Four comparisons will be made for this section as outlined in Figure 5.2. The sample of non twin children who have twin siblings is shown in Table 5.17. Only LS members whose family size is completed after the incidence of a twin birth are included in this analysis as those who continue to have more children are likely to differ considerably.

**Table 5.17 Frequency of families who stop having children after birth or twins when LS member is a sibling of twins**

| | Frequency of LS members who have twin siblings | Frequency of LS members who have twin siblings at final birth in family | Percentage of families who complete their family after the birth of twins |
|---|---|---|---|
| Twins at second birth | 273 | 132 | 48 |
| Twins at third birth | 220 | 134 | 61 |
| Twins at fourth birth | 138 | 93 | 67 |
| Twins at fifth birth | 78 | 53 | 68 |
| **Total** | **709** | **412** | **58** |

*Limitations*

There is evidence that twinning is a hereditary trait and therefore it is possible that a multiple birth may not be entirely unanticipated (Mittler, 1971). As a result of this parents may adapt their fertility behaviours based on the increased probability of having a multiple birth. However these heritable traits are poor predictors of having twins: Westoff and Ryder (1977) found that of the 142 parents who have a twin sibling in the National Fertility Survey, none went on to have twins themselves. Furthermore using twins as an instrument is possible as the completed family size was measured in 1971, seven years before the world's first birth using in vitro fertilisation (IVF) in Greater Manchester. Therefore these results have not been influenced by this medical advance which sees an increase in incidence of multiple births and an increase in anticipation of a multiple birth.

Twins may be measurably different to non twins and these differences may drive the educational outcomes making the comparison an unreliable one. For example according to the Multiple Births Foundation, on average twins weigh 2.5kg while non twins 3.5kg. This may be important for this study as birth weight is a powerful predictor of educational attainment and earnings (Black et al. 2007b). Also recent research has found that there are differences of birth weight between twins: the twin with the higher birth weight goes on to be taller, have higher educational outcomes and a higher wage (Behrman and Rosenzweig, 2004; Black et al., 2007b). The correlation between birth weight and adult outcomes may confound this test however concerns about this can be assuaged by comparing twins with non twins in the full sample and finding no difference.

## Results and Discussion

*Part 1*

*H1* *There is evidence of an association between family size and educational attainment, net of family background controls.*

*H2* *Age spacing between siblings reduces the strength of the association between family size and educational attainment, net of family background controls*

First an ordered probit is run to predict the highest qualification achieved by family size, birth order and family background. Before converting the coefficients to a standardised form, the sign and significance from the ordered probit models are discussed. Model 1, Table 5.18 indicates that there is evidence of resource dilution except that a lone child and a child with one sibling are not significantly different. When birth order controls

***Table 5.18 Ordered Probit Predicting Highest Qualification Achieved***

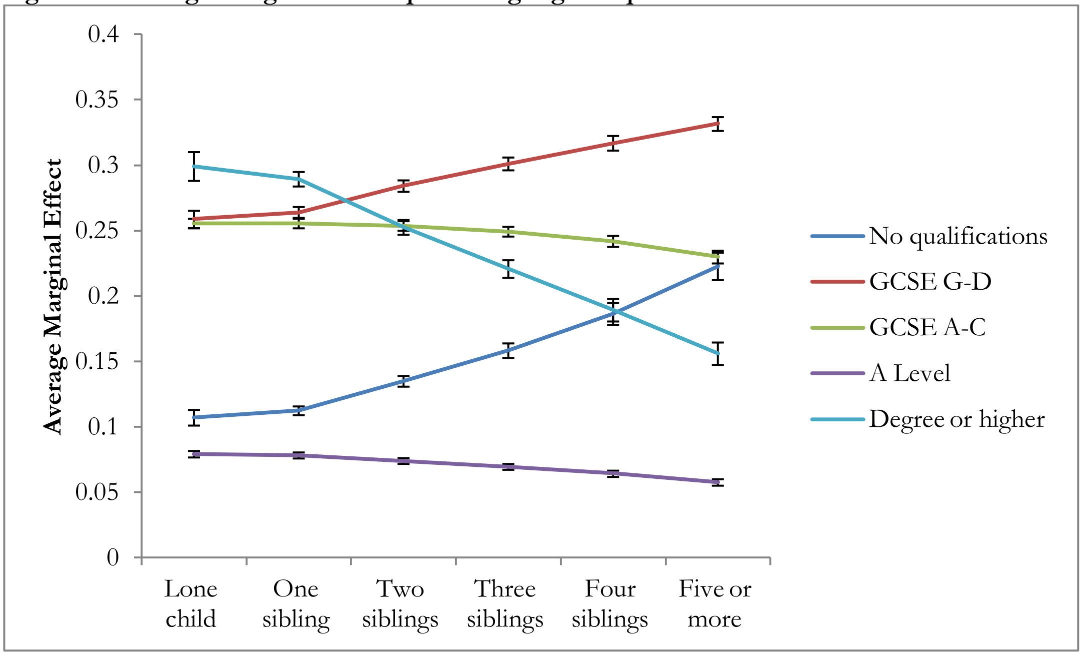
| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| *No of siblings (lone child)* | | | | | | | | |
| One sibling | 0.01 | (0.02) | 0.01 | (0.02) | -0.03 | (0.02) | -0.03 | (0.02) |
| Two siblings | -0.12*** | (0.02) | -0.12*** | (0.02) | -0.14*** | (0.02) | -0.14*** | (0.02) |
| Three siblings | -0.27*** | (0.02) | -0.26*** | (0.02) | -0.24*** | (0.02) | -0.24*** | (0.02) |
| Four siblings | -0.45*** | (0.02) | -0.43*** | (0.02) | -0.35*** | (0.02) | -0.35*** | (0.02) |
| Five or more siblings | -0.60*** | (0.02) | -0.58*** | (0.02) | -0.49*** | (0.03) | -0.48*** | (0.03) |
| Birth order index | | | -0.09*** | (0.01) | -0.20*** | (0.01) | -0.21*** | (0.01) |
| Extra sibs | | | | | -0.23*** | (0.03) | -0.23*** | (0.03) |
| *Gender and Ethnicity* | | | | | | | | |
| Female | | | | | -0.05*** | (0.01) | -0.05*** | (0.01) |
| White | | | | | -0.32*** | (0.04) | -0.32*** | (0.04) |
| *Class (Salariat)* | | | | | | | | |
| Intermediate | | | | | -0.01 | (0.03) | -0.01 | (0.03) |
| Working | | | | | -0.36*** | (0.03) | -0.36*** | (0.03) |
| *Mother's education (none)* | | | | | | | | |
| A Level | | | | | 0.29*** | (0.02) | 0.29*** | (0.02) |
| Above A Level | | | | | 0.52*** | (0.02) | 0.52*** | (0.02) |
| Degree | | | | | 0.81*** | (0.05) | 0.81*** | (0.05) |
| *Father's education (none)* | | | | | | | | |
| A Level | | | | | 0.21*** | (0.02) | 0.21*** | (0.02) |
| Above A Level | | | | | 0.46*** | (0.02) | 0.46*** | (0.02) |
| Degree | | | | | 0.67*** | (0.03) | 0.67*** | (0.03) |
| *Parent's age* | | | | | | | | |
| Mother's age | | | | | 0.08*** | (0.01) | 0.08*** | (0.01) |
| Father's age | | | | | 0.06*** | (0.01) | 0.06*** | (0.01) |
| *Family Structure (1971)* | | | | | | | | |
| Lone mother | | | | | -0.40*** | (0.06) | -0.40*** | (0.06) |
| *Family structure in 1981 (Married)* | | | | | | | | |
| Remarried | | | | | -0.12*** | (0.02) | -0.12*** | (0.02) |
| Single | | | | | -0.11*** | (0.02) | -0.11*** | (0.02) |
| Not living with parents | | | | | -0.08*** | (0.01) | -0.08*** | (0.01) |
| *Birth type (Non twin)* | | | | | | | | |
| Twin | | | | | | | -0.03 | (0.03) |
| Cut 1 | -3.23*** | (0.04) | -3.32*** | (0.04) | -3.69*** | (0.06) | -3.69*** | (0.06) |
| Cut 2 | -1.16*** | (0.02) | -1.25*** | (0.02) | -1.59*** | (0.04) | -1.59*** | (0.04) |
| Cut 3 | -0.32*** | (0.02) | -0.41*** | (0.02) | -0.69*** | (0.04) | -0.69*** | (0.04) |
| Cut 4 | 0.28*** | (0.02) | 0.20*** | (0.02) | -0.04 | (0.04) | -0.04 | (0.04) |
| Cut 5 | 0.48*** | (0.02) | 0.40*** | (0.02) | 0.18*** | (0.04) | 0.18*** | (0.04) |
| N | 61031 | | 61031 | | 61031 | | 61031 | |
| ll | -92534.48 | | -92506.29 | | -88735.79 | | -88735.43 | |
| P-value | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Pseudo R-squared | 0.01 | | 0.01 | | 0.05 | | 0.05 | |

Standard errors in parentheses
Legend: * p<0.05; ** p<0.01; *** p<0.001

are included, as shown in Model 2, the family size effect reduces slightly which suggests that birth order drives part of the family size differences. A negative birth order index is recorded which suggests that early born children achieve higher levels of education than later born children. These findings are consistent with the findings from chapter two, chapter three and chapter four. Once family background controls and individual characteristics are included in the model (Model 3), the family size coefficients reduce in size but maintain their significance while the negative birth order coefficient increases substantially. All other predictor variables behave as we have come to expect, class and parent's education are significant predictors for educational outcomes, so too is parents' age and family structure. If either of the LS member's parents remarried in 1981, there is a negative effect on educational outcomes relative to those whose parents remain married. There is also a negative effect for parents who have separated and respondents who live away from the parental home in 1981. The results from Model 4 indicate that in the full sample, net of background controls and family size, twins are not significantly different to non twin children. This finding is important as it shows that it is reasonable to compare non twin children with twin children (net of family background controls) in the second part of the analysis in this chapter.

Average marginal effects are calculated and are presented in Figure 5.3 for each of the highest education level achieved response categories. The graphs highlight that family size is associated with an increase in probability of achieving no qualification or low GCSE grades increase; and a decrease in the probability of achieving a degree or higher. However GCSE grades A-C and A Level or equivalent qualifications do not vary by family size.

**Figure 5.3 Average marginal effects predicting highest qualification achieved**




Due to software restrictions at the ONS, the test to check whether the parallel assumptions have been violated for the ordered probit models cannot be completed. As a result of this uncertainty and to follow practices in chapter two, analysis using logistic regression is shown to predict degree or higher level qualifications.

Table 5.19 predicts the achievement of a degree or higher using logistic regression by family size and family background controls. The results in Model 2 confirm those seen in Table 5.18. As family size increases the log odds of achieving a degree or higher reduce significantly relative to a lone child. As birth order increases the log odds of achieving a degree or higher reduce significantly. In addition, the extra sibling variable, which indicates that a respondent has a step sibling, an adopted sibling or a sibling born out of wedlock in the household, yields significantly lower log odds of achieving a degree or higher. All other variables behave as we have come to expect and twin children do not have significantly different log odds of achieving a degree or higher compared with non twin children.

***Table 5.19 Logistic Regression Predicting Degree or Higher***

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| *Twin (Non twin)* | | | | | | | | |
| LS member is a twin | -0.02 | 0.07 | -0.02 | (0.07) | -0.02 | (0.07) | -0.05 | (0.09) |
| *Family size (Lone child)* | | | | | | | | |
| One sibling | | | -0.08* | (0.04) | | | -0.07 | (0.05) |
| Two siblings | | | -0.23*** | (0.04) | | | -0.20** | (0.08) |
| Three siblings | | | -0.30*** | (0.04) | | | -0.26* | (0.11) |
| Four siblings | | | -0.33*** | (0.05) | | | -0.29* | (0.14) |
| Five or more siblings | | | -0.43*** | (0.05) | | | -0.38* | (0.18) |
| Extra sibling | | | -0.37*** | (0.03) | | | -0.34*** | (0.07) |
| Birth order index | | | -0.34*** | (0.07) | | | -0.43*** | (0.10) |
| *Age Spacing* | | | | | | | | |
| No of sibs 3 years older | | | | | -0.15*** | (0.02) | -0.01 | (0.03) |
| No of sibs 1 or 2 years older | | | | | -0.14*** | (0.02) | 0.03 | (0.03) |
| No of sibs 1 or 2 years younger | | | | | -0.01 | (0.01) | -0.04 | (0.06) |
| No of sibs 3 years younger | | | | | 0.01 | (0.01) | -0.02 | (0.05) |
| Constant | -0.47*** | 0.09 | -0.19* | (0.09) | -0.63*** | (0.08) | -0.15 | (0.13) |
| N | 61031 | | 61031 | | 61031 | | 61031 | |
| ll | -32815.78 | | -32643.41 | | -32692.93 | | -32642.32 | |
| P-value | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Pseudo R-squared | 0.07 | | 0.08 | | 0.08 | | 0.08 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, class, mother's education, father's education, parent's age, family structure in 1971 and family stricture in 1981.

When age spacing controls are included in Table 5.19, Model 3 there is evidence that having older siblings is more detrimental on education than having younger siblings and the negative log odds are greater if siblings are over three years older rather than one to two years older. However when family size and birth order are reintroduced in Model 4, the age spacing coefficients lose their significance. The family size, extra sibling and birth order index coefficients remain significant, except for a respondent with one sibling who is no longer significantly different to a lone child. The family size log odds reduce when age spacing controls are included in the model, which suggests that age spacing ameliorates the

**Figure 5.4 Average marginal effects predicting degree or higher by family size from Model 4**

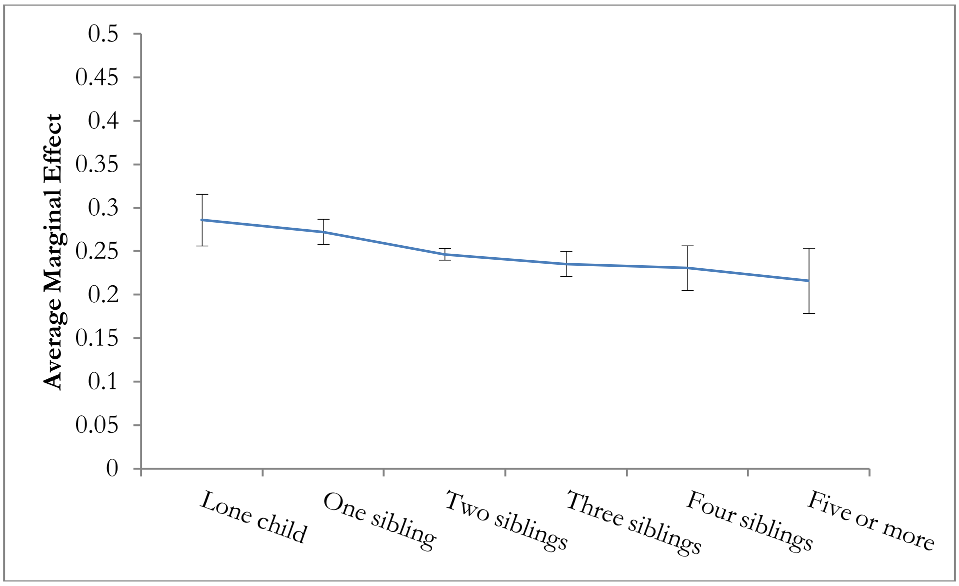
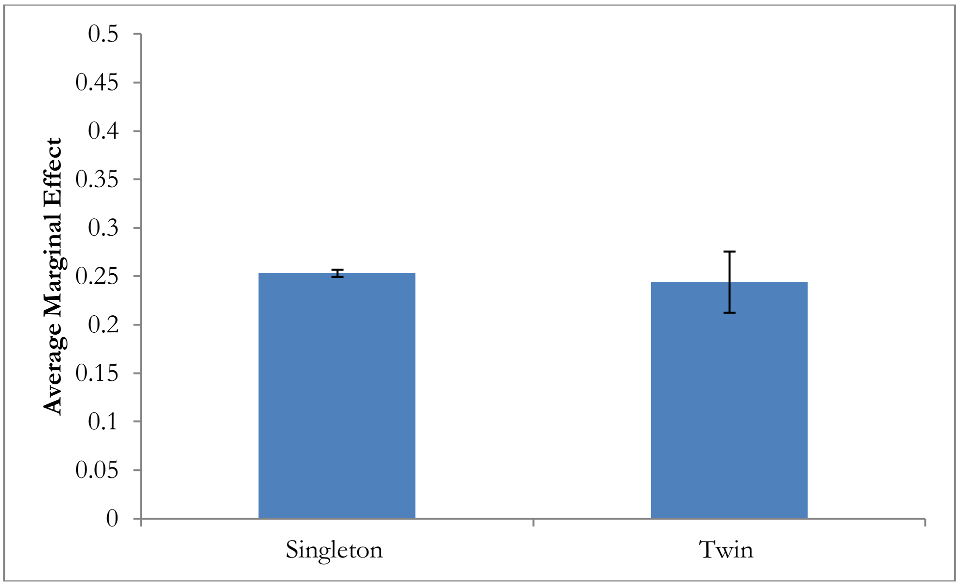



**Figure 5.5 Average marginal effects predicting degree or higher, comparing twins with non twins**



effects of resource dilution. The results of this analysis using the binary variable denoting whether the young person has siblings widely spaced or not is shown in Appendix 5.1[52].

Average marginal effects for family size are calculated from Table 5.19, Model 4 and are shown in Figure 5.4. The contrasts which are significantly different are between a lone child versus two siblings; three siblings; four siblings; or five or more siblings, and contrasts between a child with one sibling versus a child with two; three; four; or five or more siblings. Therefore the only contrasts which are sensitive to resource dilution as family size increases by one are children with one sibling versus children with two siblings. The results show that a lone child has a 29% probability of achieving a degree or higher and an otherwise comparable child with five or more siblings has a 22% chance. The average marginal effects for twins and non twins are shown in Figure 5.5. The contrasts are not statistically different but show that non twins have a 25% probability of achieving a degree or higher, while twins have a 24% probability in the general population, net of family background controls.

In summary there is enough evidence to accept H1: using observational data a negative relationship between family size and highest qualification achieved is identified, net of family background controls. There is also evidence of a strong and significant negative birth order association with educational attainment which is consistent with the findings from the previous chapters. H2 can also be supported; the inclusion of age spacing between siblings ameliorates the negative effects of resource dilution net of family background controls; however there is no evidence to suggest that age spacing is more important than family size as suggested by Guo & Vanwey (1999a).

[52] The results from Model 3 in Appendix 5.1 suggest that the family size and birth order coefficients do not change significantly between models and that having siblings spaced three years or more older or younger is detrimental to educational outcomes.

*Part II*

*H3 There is evidence of resource dilution for twin children net of family background, birth order and age spacing.*

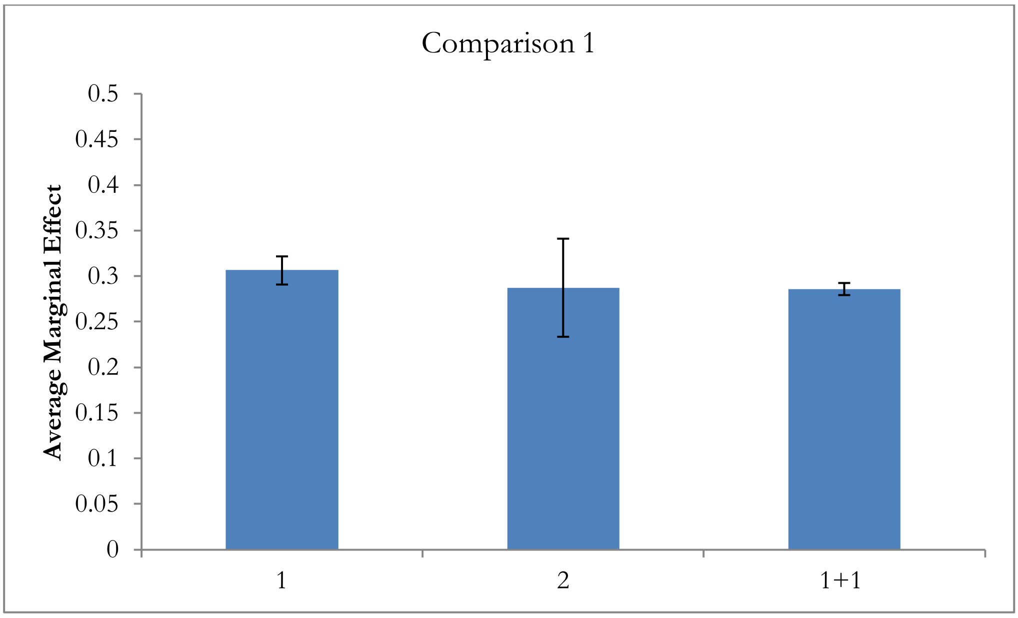
This analysis compares the educational outcomes of lone children with twin children (at first birth) and children with one [non twin] sibling, as outlined in Figure 5.1. The results in Table 5.20 show that resource dilution is evident for children with one [non twin] sibling relative to lone children. However there are no significant educational differences between twin children and lone children which suggest that influence of family size are negligible.

***Table 5.20 Logistic Regression Predicting Degree or Higher***

| | Model 1 | |
|---|---|---|
| *Comparison 1 (ref: Lone Child)* | | |
| Twins | -0.09 | (0.14) |
| Two non twin children | -0.10* | (0.04) |
| Constant | -0.58** | (0.18) |
| N | 25140 | |
| ll | -14284.62 | |
| P-value | 0.00 | |
| Pseudo R-squared | 0.07 | |

Average marginal effects are calculated and are shown in Figure 5.6. The graph shows that the probability of lone children achieving a degree or higher is 31% while an otherwise comparable child with one sibling has 29% probability; this finding is statistically significant. A twin also has a 29% probability of achieving a degree or higher, however this does not yield significant contrasts with either a lone child or a child with one sibling. Therefore while there is some evidence of resource dilution effects for twins relative to a lone child, this finding is not significant. This indicates that family size may be endogenous.

**Figure 5.6 Marginal Effects Predicting Degree or Higher: A Twins versus Non Twin Comparison**




In summary, there is no strong evidence of resource dilution for twin children relative to lone children. Neither is there a significant difference between twin children and children with one sibling. This finding indicates that H3 can be rejected.

*H4* *There is evidence of resource dilution for non twin children who experience an exogenous increase in family size net of family background, birth order and age spacing.*

The analysis now turns to a comparison of a non twin child who experiences an exogenous increase in family size with those who do not. This differs from the previous hypothesis test as it doesn't directly examine the educational outcomes of twin children, instead it examines the educational outcomes of siblings of twins as outlined in the estimation strategy in Figure 5.2. The results are presented in Table 5.21. Comparison 1 shows that there is a reduction in the log odds of achieving a degree or higher for a first born who experiences an exogenous increase in family size relative to a first born who doesn't, however the results are not statistically significant. Both Comparison 2 and Comparison 3 indicate that there is a slight increase in log odds if there is an exogenous increase in family size, however the coefficients are not statistically significant. Comparison 4 indicates that there is a reduction in log odds if the LS member has siblings who are twins, but again the result is not statistically significant.

Birth order coefficients are negative and significant in these models which indicates that while family size has a negligible impact on educational outcomes inequalities within the family remain in the form of birth order. Results are shown in Appendix 5.2.

Average Marginal Effects are calculated and the graphs are shown in Figure 5.7. Only Comparison 4 has significant contrasts ($p<0.01$) which suggests that resource dilution is evidence for a non twin who has twin siblings at fifth birth. This finding indicates that only in large families do we see evidence of resource dilution effects on siblings if there is an exogenous increase in family size. It may be the case that in larger families, the additional child is more difficult to accommodate or that resources are difficult to reallocate (Caceres-Delpiano, 2006). Comparisons 1-3 indicate that there is no difference in probabilities of achieving a degree or higher whether there is an exogenous increase in family size or not.

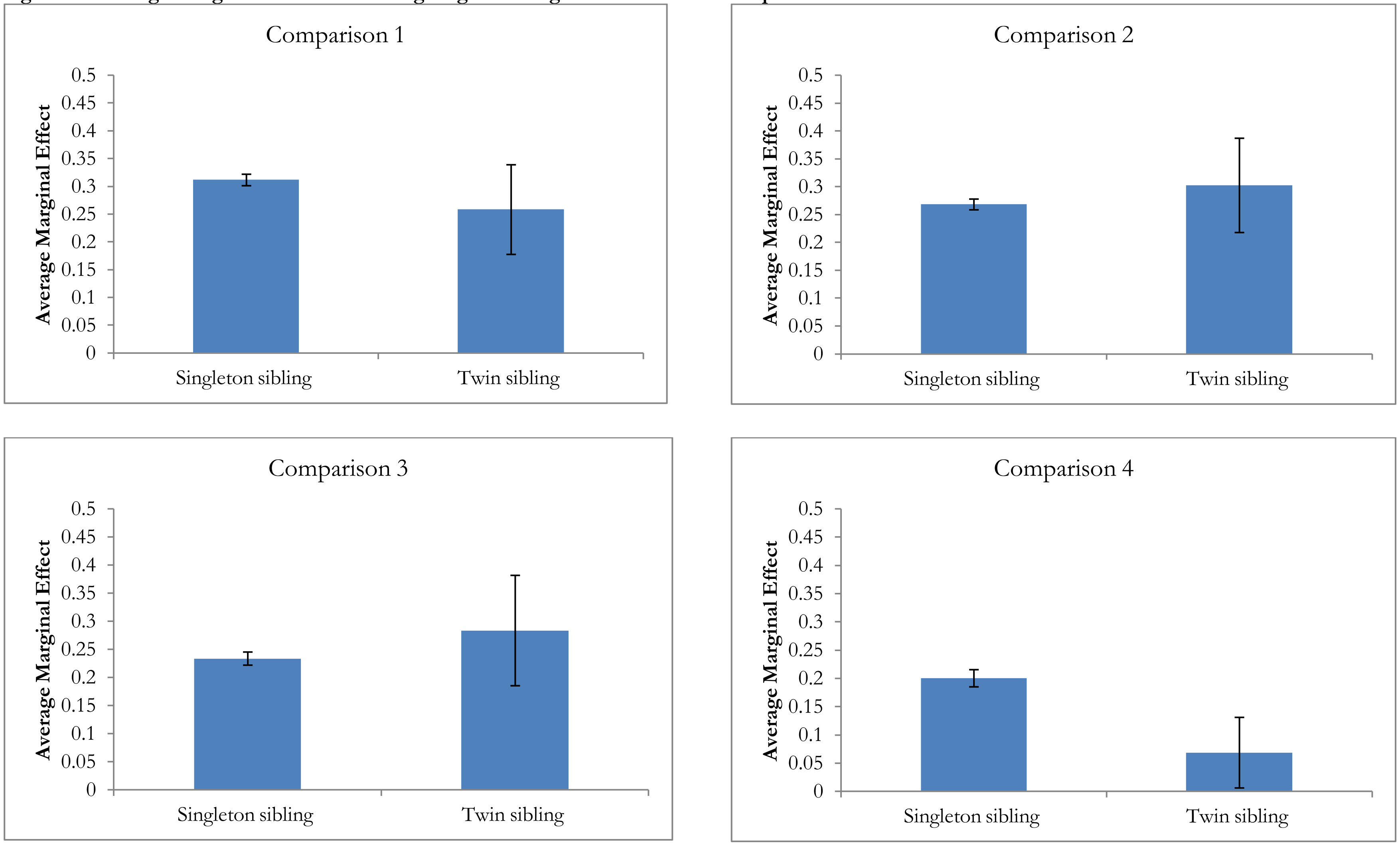
As a sensitivity analysis, instrumental variable models were used following the methods of Black et al. (2004). The findings are shown in Appendix 5.3. The two-stage least squares (2SLS) use the birth of twins as a source of exogenous variation in family size, predicting completed years of education, indicate that there is no evidence of resource dilution. Taken together the implication of these findings is that family size has a negligible effect on completed years of education and highest education level attained.

***Table 5.21 Logistic Regression Predicting Degree or Higher by Comparison Groups (non twins with non twin siblings versus non twins with twin siblings)***

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| *Comparison 1 (ref: no twin siblings)* | | | | | | | | |
| LS member has twin siblings at second birth | -0.26 | (0.22) | | | | | | |
| *Comparison 2 (ref: no twin siblings)* | | | | | | | | |
| LS member has twin sibling at third birth | | | 0.17 | (0.21) | | | | |
| *Comparison 3 (ref: no twin siblings)* | | | | | | | | |
| LS member has twin sibling at fourth birth | | | | | 0.26 | (0.25) | | |
| *Comparison 4 (ref: no twin siblings)* | | | | | | | | |
| LS member has twin sibling at fifth birth | | | | | | | -1.23 | (0.50) |
| Constant | -0.63 | (0.28) | -0.56 | (0.21) | -0.60 | (0.23) | -0.30 | (0.31) |
| N | 8672 | | 9299 | | 5752 | | 2955 | |
| ll | -5018.78 | | -5024.08 | | -2946.4 | | -1426.45 | |
| P | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| r2_p | 0.08 | | 0.09 | | 0.09 | | 0.06 | |

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for ethnicity, gender, class, parents' education, parents' age, family structure in 1971 & 1981, absolute birth order and age spacing (near versus far siblings)

**Figure 5.7 Average Marginal Effects Predicting Degree or Higher: A Non Twin Comparison**



In summary, there is no strong evidence of resource dilution for non twin children who experience an exogenous increase in family size. As a result, H4 must be rejected. There are two possible explanations for these findings. One is that endogenous factors, such as values towards education or degree of child centeredness, may be at work in families where twins are born at second, third and fourth birth. The second plausible explanation is that parents who experience an exogenous increase in family size as a result of a twin birth may be able to reallocate resources, but this is more difficult in very large families.

## Summary

This chapter set out to explore the extent of resource dilution effects on a sample aged 0-15 in 1971 using the LS Census data. Using twins as an instrument, this chapter addresses some of the criticisms of the resource dilution model by trying to identify whether resource dilution effects were evident for children who experienced an exogenous increase in family size, either as a result of having a sibling who is a twin or being a twin themselves which increases the desired family size by one.

The first substantive finding from this chapter is that although family size associations with educational outcomes are evident using observational data for those born 1956-1971 by modelling twins as an exogenous increase in family size reveals that these effects are no longer significant. There is no evidence of resource dilution for twins and siblings of twins for people born between 1956-1971 in England and Wales. There are a number of ways to interpret this finding. This may be taken as evidence of family size effects masking unobserved parental characteristics (Downey, 2001); or that resources are sufficiently reallocated in the home to mitigate the negative effects of family size on educational outcomes (Caceres-Delpiano, 2006); or that resource dilution measures are not sufficiently sensitive to identify the effects of an exogenous increase in family size by one child.

The first explanation is that endogenous factors lie behind the family size effect. Family size may be selected by parents based on an unobserved shared characteristics, such as values towards the family or education. These unobserved characteristics may be masked by the family size effect. Evidence from this chapter suggests that there may be endogenous factors at play; but the actual nature of these characteristics cannot be identified using these methods with this data. This provides an avenue for future research to investigate the characteristics of couples; their intentions and attitudes about family size prior to childbearing; influence of religious practices and expectations; fertility decisions; and child-skill development.

Black et al.(2004) find no difference in the completed years of educational for non twin children with twin siblings. This finding is replicated here. However Black et al.'s interpretation of the findings underestimates the adaptability and resourcefulness of parents. It remains possible that the negative family size association could be mitigated in another way that is not controlled for in the instrumental variable model. For example it may be that resources are reallocated as a result of parents adapting to their unexpected arrival (Caceres, 2004; Caceres-Delpiano, 2006) or as a result of the increase of familial resources and parenting skill as parents age (Belsky, 1984; Powell et al. 2006).

Furthermore there is evidence, when testing the resource dilution model in the full sample using the LS Census data, that an increase by one child does not yield significantly different contrasts except for a child with one sibling versus a child with two siblings. This suggests that while resource dilution effects are evident, as there is a clear decline as family size increases, they are not sensitive enough to capture educational differences as family size increases by one. Therefore a stronger test would see an increase in the number of children by more than one child, captured by the incidence of triplets rather than twins, as the resource dilution model is not sensitive to a one child increase.

The second substantive finding from the analysis in this chapter is that birth order associations remain significant and negative in the full sample and the restricted samples. This finding implies that even if family size reduced continues to decline or is reduced; inequalities would remain because of the differential outcomes by birth order.

The third substantive finding relates to age spacing. Although age spacing is important to take into account, it is not stronger than family size effects as Guo and Vanwey suggest (Guo and Vanwey, 1999).

To conclude, there is no evidence of resource dilution on educational outcomes when twins are taken to symbolise an exogenous increase in family size. This finding is robust when predicting a degree or higher and completed years in education. Taken together, these findings suggest that endogenous effects may drive the differences in educational outcomes by family size; or resources may be reallocated by parents effectively when they experience an exogenous increase in family size; or it may be that resource dilution is sensitive to family size changes greater than one sibling. A sensitive evaluation of the results leads to the conclusion that resource dilution effects operate under certain family conditions but endogenous factors may drive some of the family size effects.

Future research should test whether there are resource dilution effects for IQ, as Black et al.(2007a) found that IQ is more sensitive differences in resource availability as a result of an exogenous shock. In addition, this body of literature would benefit from more research into the resource reallocation in the family which may mitigate the negative effects of family size. A more detailed examination of the manner in which the familial resources change over the life course may shed more light on the evidence presented in this chapter. Lastly, there is an opportunity to carry out tests using triplets to identify whether an exogenous increase in family size by two children yields similar results.

The concluding chapter, that follows, draws together the evidence presented in this thesis and discusses the implications of the findings along with the theoretical and methodological contribution.

# Chapter 6: Conclusion

## Introduction

This concluding chapter restates the main empirical findings of the research reported in this thesis and discusses how these findings contribute to the body of empirical evidence. Furthermore it reviews the theoretical and methodological approaches adopted in this thesis and the impact of this empirical work on future research. The main aim of this thesis is to identify in what ways the family matters for a child's educational outcomes. In addressing this aim, six research questions were answered. The main findings are outlined below in relation to these research questions.

## Empirical findings

### *Is family size associated with familial resources?*

In chapter two it was identified that family size is negatively associated with class background, parental education, mother's employment status, number of books in the home and family structure. These findings are supported by the results in chapter three which identifies a similar pattern using LSYPE data for those born in 1990 or 1991: the proportion of young people who have access to resources varies by family size. In particular this includes intellectual, cultural and financial resources (measured by parental education and parents' class, income levels and access to a computer and the internet). The evidence presented in chapter five for those born 1956-1971 in the LS Census data also shows that class and parental education varies by family size. These findings support the underlying predictions of the resource dilution model that as family size increases access to resources decrease.

Overall, the findings reported provide substantial evidence that familial resources do differ by family size. This implies that as well as parental fertility decisions varying by resources, children's experiences vary considerably by family size. There is evidence that there a reduction in absolute resources as family size increases, but there is also evidence, particularly with respect to parenting skill that the greater number of siblings a young person has the greater the competition for these resources. This means that children from larger families experience a double disadvantage, first as their absolute resource is smaller than families with fewer children and second because the competition for that resource is greater within the family.

*Is having a large family associated with lower levels of objective and subjective educational outcomes and has this changed over the 20$^{th}$ century?*

The resource dilution model posits that as a result of a reduction in resources, as family size increases there is a negative association with educational outcomes. This thesis examines a number of forms of educational outcome including highest qualification achieved (chapter two, chapter five); GCSE achievement (chapters three and four); subjective measures which include whether the young person feels like they are making progress at school, whether they like school and aspirations for university (chapters three and four); in addition to social-emotional outcomes such as their feelings of control in their life, the manner in which they spend their time and the degree of social acceptance among peers (chapter three).

With regards to the objective educational outcomes, the evidence presented in chapter two indicates that the probability of children with one sibling achieving a degree or higher is 22% compared with equivalent children with five or more siblings at 11% net of family background controls. The resource dilution test using LSYPE data in chapter three identifies that for achieving five A*-C GCSEs there is also evidence for resource dilution. The magnitude of the difference is that a lone child has a 65% probability of achieving five good GCSE grades, while an otherwise comparable child with five or more siblings has a 50% chance of achieving five A*-C GCSEs, a 15 percentage point difference in probability. The difference in probability between lone children and children with five or more siblings is larger when predicting A*-C GCSE grade in English (19%) and smaller when predicting A*-C GCSE grade in Maths (10%), net of family background controls. The results from the LS Census data in chapter five show that a lone child has a 29% probability of achieving a degree or higher and an otherwise comparable child with five or more siblings has a 22% probability.

The sensitivity of these findings varies, meaning that some show significant differences in probability when the family size increases by one and others do not[53]. Despite the issue of sensitivity of the resource dilution model findings, there is evidence to accept that resource dilution is associated with educational outcomes using observational data. It is particularly interesting to note that there are consistent effects of resource dilution when examining both the highest level of education attained and the quality of the GCSE grades achieved. Furthermore chapter two identified that there is no evidence that the resource dilution

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[53] In chapter two significant contrasts are found when the number of children increase by one for children with one sibling compared to children with two siblings as well as children with two siblings compared to children with three siblings in addition to the other significant contrasts outlined in chapter two. Similarity, in chapter three, significant contrasts are found comparing children with one sibling with children with two siblings; and comparing children with three siblings with children with four siblings in addition to the other significant contrasts as described in chapter three. For the LS data in chapter five significant contrasts were found between children with one sibling relative to children with two siblings in the full sample analysis.

model has changed much over time, despite educational expansion and policy changes which seek to increase access to higher education.

The strength of the family size association is found to be second only to parental class as a predictor of educational attainment, with the influence of birth order a close third. This finding contradicts Blake's argument that family size is more important than class as a predictor for educational outcomes (Blake, 1989).

There is some indication from the findings in chapter three that resource dilution is more critical before the young person is a teenager: the short term changes in access to resource when the young person is aged 13-16 are not significantly associated with GCSE results.

Returning to the findings which relate to subjective measures of educational outcomes in chapter two and chapter three, Blake (1989) highlighted that the young person's ability to participate in stimulating environments may also be influenced by resource dilution. More specifically, she noted that aspirations, personality, confidence and social skills may be dependent on sibship size composition. As with the objective measure of educational outcomes, birth order has a persistent negative association when predicting whether the young person likes school, makes progress at school, and will apply to university and are confident of being accepted if they apply. There is a less clear picture when predicting subjective educational success by family size: there are negative associations with applying to university and belief that they will be accepted if they apply; however they are not large enough to accept that resource dilution is evident for these outcomes, net of family background controls.

Family size is significantly and negatively associated with a number of educational outcomes. While family size remains an important predictor of educational outcomes and offer some descriptive analysis of the processes within the family, caution should be exercised when interpreting the results. The negative association between family size and educational outcomes do not represent a causal relationship evident from the results presented in chapter five.

*Is there any evidence that family size is associated with the emotional health and life perspectives of young people?*

A weak family size association was found when testing emotional health concerns. Lone children are significantly less likely to report emotional health concerns than children with one sibling, and while there is a slight increase in the likelihood of having poor emotional health as family size increases, the size of the effect is small. Furthermore perspectives on life vary by family size: there is evidence that young people are more likely to express external locus of control as family size increases.

Family size is associated with aspects of a young person's identity, including their coping systems and perspectives on life. This may have consequences for the young person's educational experience on the whole.

*Is there any evidence that family size is associated with the degree of confidence and sociability outside of the home?*

The sociability of a young person does vary by family size. There is a positive relationship between family size and the frequency of socialising with others at home. In addition there is evidence that spending time with siblings is associated with an increase in the probability of achieving five good GCSE grades if the young person comes from a small family.

However there is evidence that spending time alone is associated with an increase in the probability of achieving five good GCSE grades if the young person comes from a larger family. Furthermore there is a weak positive relationship between family size and being bullied.

These findings highlight that siblings can act as a resource under certain conditions: having siblings and spending time with them can provide an advantage to the young person if the family size is small. However there are diminishing returns on GSCE achievement of spending time with siblings if the young person comes from a larger family.

### *Do parenting strategies vary by family size?*

In line with the expectations of the resource dilution model, chapter four found a negative association between family size and parenting strategies, including the nature of interactions and involvement in the child's life. This chapter makes use of Lareau's concerted cultivation theory, which states that communication with the child, involvement in the child's schooling, and organisation of daily life influence the educational outcomes of children. These strategies require financial resources, an understanding of the schooling system, time investments and a degree of warmth and attention. There is evidence that the ability to talk to parents about schooling varies significantly, albeit weakly by family size: as family size increases the probability of talking to parents decreases. With regards to parental involvement in the young person's schooling there is some evidence of resource dilution. In addition, there is evidence of a negative family size association with attending extracurricular lessons and private lessons.

The results in chapter four identified that parenting strategies can ameliorate the effects of family size by around 25 GCSE points. Furthermore parents who adopt these concerted cultivation strategies see significant positive associations between these strategies and their child's GCSE grades by two A grades, net of family background controls.

According to these findings, some parenting strategies are associated with an improvement of children's educational outcomes. These strategies involve parents talking to their children, being involved in schooling and being willing to pay for private tuition or extracurricular lessons. Differential experiences in the family are associated with educational inequalities.

*Is there any evidence of a causal relationship between family size and educational outcomes?*

Chapter five addressed the main criticism of the family size literature that there may be omitted variable bias or that family size is endogenous. This thesis includes a test of whether an exogenous increase in family size yields a negative association with degree attainment and completed years in education. The results indicate that when an exogenous increase in family size is taken into account, there is no evidence of a significant negative association between family size and educational attainment for twins or siblings of twins.

This may be interpreted in two ways: that endogenous factors drive the family size effect; or that parents are able to reallocate resources when there is an unexpected child. The consequence of this finding is that while family size remains an important predictor for educational outcomes, the results should be interpreted cautiously. Additionally, further research is required to establish the nature of the omitted variable and the adaptability strategy that parents may adopt as a result of an exogenous increase in family size. The implication of this finding is that a reduction in family size would not ameliorate inequalities in education. This conclusion contradicts that of Blake's in which she suggests that smaller families will result in more equality (Blake, 1989).

### *Birth Order*

The explanations for the variation in educational outcomes by birth order range from parental time-depletion to psychological differences. Nisbet and Entwistle (1967) argue that as family size increases, parents make necessary adjustments to the amount of time they can allocate to the younger children and as a result, spend less time with them. Alternatively the resulting educational differences by birth order may be due to parental expectations - the first born children satisfy the expectations of the parents and as the birth order increases, the parents become more relaxed about the educational achievements of the later born children (Sampson, 1965). Steelman and Mercy (1980) found evidence to confirm the confluence model which argues that the educational outcomes of children are reduced as birth order increases due to a reduction in the overall intellectual climate of the home. More recently Powell and Steelman found evidence to support this view (Powell and Steelman,1990; 1993). Belmont and Marolla (1973) argued that children with elder siblings develop physiological differences as a result of the mother having a tired uterus which reduces access to essential nutrients in the womb, leading to psychological differences.

Birth order yields mixed results in the existing literature. Some find little evidence of associations between birth order and education (Beer and Horn, 2000; and Rodgers, 2001) or modest results (Salmon and Daly, 1998). However in the UK there are some consistent findings with Booth and Kee (2009) and Iacovou (2001, 2008) both identifying strong and significant negative birth order associations. The findings in this thesis support the previous research in the UK; there is a strong and consistent negative birth order association for highest educational qualification achieved; GCSE results; and subjective measures including liking school, making progress at school, the likelihood of applying to university and the belief that they will be accepted to university if they apply. However there were no significant birth order associations predicting emotional health concerns (measured by the General Health Questionnaire) or predicting external locus of control.

Higher birth order children are less likely to spend time with their siblings compared with lower birth order children but they are more likely to spend time with friends. There is no evidence to suggest that being bullied varies by birth order.

Questions remain about why some parents choose to make greater investments into their children than others, and why some parents invest more in early born rather than late born children. There are a number of possible reasons for this finding. It may relate to the utility of children as discussed by Townes, Beach and Wood (1980) who focus on the importance of the sequential manner that fertility decisions are made. They argue that the benefits from child one and child two are unique. For example the first child satisfies the desire for children, the second child is desired in order to provide the first with a companion, while more than two children do not add any more unique benefits to the family and in fact symbolise a growing cost[54].

To further illustrate this point, parenting strategies are shown to vary by birth order. Chapter four identified that as birth order increases all parental strategy measures decrease significantly, except for the likelihood of parents reporting that they can help with their child's education and parents talking to their child about school. This means that higher birth order children are significantly less likely to talk to their mother and father about things that are important to them and less likely to attend private and extracurricular lessons.

[54] Although a third child (or more) may fulfil the desire for gender balance, e.g. if the first two children are boys then parents may have a third in the hope that it is a girl (Conley, 2000; Kidwell, 1981; Powell and Steelman, 1990).

In chapter five, the test to identify whether an exogenous increase in family size reduces educational outcomes yielded significant and negative birth order associations, in line with the findings of Black et al.(2004). The implication for this finding is that inequalities are likely to persist even if family size reduces because of the variation in outcomes by birth order.

*Lone children: a special case*

The empirical findings also show that parents with a lone child differ significantly from parents with more than one child. Lone children are significantly more likely to have parents with lower levels of education; be born to younger fathers; and have more complex family structures than children with siblings. From the analysis in chapter three, there is evidence that lone children born in 1990-1991 are more likely to come from a household where parents are not married, have lower levels of education and with younger fathers.

In terms of achievement, lone children excelled beyond their peers with siblings, especially those with older siblings, however often these differences were not statistically significantly different to children with one sibling. Furthermore the results in chapter two identified that for earlier cohorts, there was a lone child disadvantage relative to children with one sibling.

Lone children are no more likely to spend time alone than children with siblings, however they are slightly less likely to spend time with friends at home than children with siblings. This may be beneficial for lone children in terms of their educational outcomes as there is some evidence that spending the majority of free time with friends (either inside or outside of the home) is detrimental to GCSE results. Lone children are no more likely to be bullied than children with siblings nor are they more likely to report poor emotional health.

They are less likely to report feelings of lack of control in their life compared to children with siblings.

In summary, the empirical findings of this thesis systematically explain the processes within the family which are associated with children's educational outcomes. It identifies what components perform, or fail to perform in relation to the young person's educational experience. Furthermore the empirical findings challenge the convention that a reduction in family size will increase equality.

## Theoretical contribution

The statistical analysis of the quantitative data in this thesis lends itself to a description of empirical patterns as shown above. In addition to identifying these patterns, there are a number of theoretical contributions that this thesis sought to make.

The first theoretical contribution is to provide a more complete understanding of the nature and structure of differentiation with regards to family resources in the UK, England and Wales. The size of the family resource is measured, so too is the benefit of familial resources and the manner by which these benefits are conferred across generations. Previous work carried out using the resource dilution model tends to be concentrated on American contexts or in the developing world using objective measures of education. This thesis concentrated tested the family effects on the educational environment more generally in addition to temporal changes.

This research takes into account the objective measures of educational outcome related to grades or highest level of education achieved. The status attainment literature examines the influence of the size of the group in a number of contexts, for example Simmel (1902-3) discusses the impact of congestion[55] on the individual (Pietila, 2011) and Easterlin and examines the consequences cohort size (Easterlin,1980). The current research continues in this tradition by examining crowding in the home. Attention is paid to fertility outcomes and intentions; the transfers of capital; and status attainment through educational outcomes. In addition to this, this thesis adopts a more holistic approach to educational outcomes as it examines the impact of congestion in the home on sociability, emotional health, perspectives on life and subjective measures of education. Related to this, this thesis acknowledges that while there may be disadvantages of having siblings, in line with the resource dilution model, there are a number of advantages including offering learning and socialising opportunities, and support to the young person.

The second theoretical contribution that this thesis makes is with regard to the issue of causality. This is the first large scale analysis of resource dilution effects on families who experience an exogenous increase in family size in England and Wales. This research tested whether an exogenous increase in family size as a result of a twin birth would reduce the educational outcomes of twins or siblings of twins. The results suggest that it does not. This indicates that Downey may be right to say that smart parents may have small families but small families may not make smart children (Downey, 2001). However the discussion in chapter five highlighted that further research is required into examining the possibility that parents are able to reallocate their resources (Caceres, 2004; 2006). The findings do not support Blake's conclusion that a reduction in family size would increase educational equality (Blake, 1989). Furthermore this thesis presented evidence of significant and negative birth order associations which reduce the likelihood of educational equality being reached through changes in family size.

[55] Congestion relates to an overcrowded context which makes people act in a negative way, including antagonistic behaviour (Pietila, 2011).

The final theoretical contribution relates to the parenting strategies test. This aspect of the thesis links Blake's discussion of what constitutes the resources for parental attention with Lareau's parenting strategies (Blake, 1989; Lareau, 2003). Blake's notion of parenting strategies acknowledges time and attention, emotional and physical energy, and the ability to interact with children as individuals. While this offers a number of component parts to parenting practices, it doesn't form a coherent testable theory, which makes it somewhat difficult to operationalise. Therefore by turning to Lareau's theory of concerted cultivation, which offers clearer definitions and boundaries, and captures elements of Blake's components of interest, a more coherent understanding of the parenting practices can be gathered. Furthermore the concerted cultivation strategy captures aspects of parenting practices including degree of child-centeredness and willingness to invest in a stimulating educational environment which is a good marriage with Blake's resource dilution model. As a consequence, by linking these two theories together, the effects of parental resources on educational outcomes can be more clearly understood. Firstly, the results highlight how much these parenting strategies vary by family size therefore testing concerted cultivation strategies by family size. Secondly, the results show how much concerted cultivation ameliorates the negative family size relationship. Thirdly, the influence of concerted cultivation strategies is identified after controlling for the resource dilution model.

## Methodological Contribution

This thesis makes a number of methodological contributions. Firstly it uses three different datasets which satisfy the aims of this thesis. The British Household Panel Study (BHPS) was used in order to identify whether family sizes have changed over time and whether the strength of resource dilution has changed over time. The Longitudinal Study of Young

People in England (LSYPE) was used to take advantage of the detailed parent and child reports on the family environment, and made use of the additional educational outcomes such as the quality of grades achieved at school; subjective measures of education; personal outlook and emotional wellbeing; victimisation; and the effects of change in family size over time. The Longitudinal Study (LS) census data was used to take advantage of age spacing and ability to identify multiple births. Using multiple datasets offers the opportunity to examine different family conditions; different periods of time; and a number of dependent variables including subjective and objective measures of educational outcomes. The robustness of findings across datasets provides reassurance that effects are not unique to the data under investigation.

The use of marginal effects allows comparability within and across models and helps to identify the effects of interactions which offers a more potent understanding of the processes at play. In addition, this thesis makes a methodological contribution by unpacking some of the differences in parenting style by family size by testing the use of Lareau's concept of concerted cultivation versus natural growth. Lareau's theory was derived from a qualitative study and I use the LSYPE to operationalise her concepts using English data. Operationalising a qualitative study can be difficult, particularly if it is based on research from a different cultural field. Related to this, a Principal Component Analysis (PCA) was used to test whether the underlying assumptions about parenting strategies have shared characteristics to ensure that the variables were appropriate and robust to alternative specifications.

Another methodological contribution relates to the research presented in chapter five where an instrument is used to approximate a social experiment. Advantage is taken of longitudinal data by identifying twins as an exogenous increase in family size in order to compare those families who experience an increase with those who do not. Using an instrumental variable approximates a social experiment which is a useful tool to try to estimate causal effects in the social sciences. However it is acknowledged in this thesis that there are a number of caveats relating to the conclusions drawn from this part of the research due to the strength of the instrument. This finding challenges the conclusions drawn by Black et al. (2004) and opens avenues for future research.

## Future Research

In this thesis I have examined the descriptive picture of families in the UK, and tried to address the difficult issue of causality. However there remain a number of avenues for future research.

There is an opportunity to identify whether the resource dilution model is sensitive to an exogenous increase by two rather than by one child through the incidence of triplets in the family. This would shed more light on whether resource dilution effects are evident in the family and under what conditions they are present. Related to this, speculative work could identify what parental values may predict the family size and if these values reduce the family size effects to test whether endogenous factors may be masked by the apparent family size effect. In addition, the ability for the family to be able to adapt to an exogenous increase in family size should be further investigated. Resource reallocation as described by Caceres (2004; 2006) could be a powerful explanation for why these resource dilution effects are not found with an unexpected increase of family size.

The evidence and explanations offered in this thesis relate to a specific national context. Cross national comparisons would provide insight into whether other contexts which have different family size norms, welfare systems and education systems yield similar results as those found in this thesis. In addition cross-national comparisons can explore the contextual effects of different family practices relating to extended kinships and community characteristics which may ameliorate the family size associations.

It is evident that the avenues for future research outlined are important lines of inquiry as they contribute greatly to the understanding of family processes and inequalities in society.

## Summary

This research highlights the importance of the family for educational outcomes. There is evidence that family size is negatively associated with highest qualification achieved and GCSE grades conditional on family background characteristics. The findings also show that birth order has a consistent negative association with educational attainment, which indicates that future research should focus on the inequalities of resource availability within families. Resources are diluted as family size increases, and parenting styles vary by family size which has a direct influence on educational outcomes. However when the educational outcomes of children who have experienced an exogenous increase in family size are compared to those who do not, there is no evidence of significant family size associations. This indicates that family size effects may operate through unobserved family characteristics. However there are a number of explanations offered for this finding, and further research is required to be able to establish whether we can be confident in this result.

If we are to accept that there are endogenous factors at play, it is unlikely that the reduction in family size will lead to equal educational opportunities because family size is an outcome of a number of parental preferences. In addition to this, there is a significant and negative birth order associations. Consequently, a change in family size will not lead to greater educational equality. This conclusion contradicts that of Blake (1989) in her seminal book in which she argues that a reduction in family size will improve the educational outcomes for all, thus benefiting the whole of society. Therefore it remains an opportunity for and the responsibility of education policy makers to implement school based practices which seek to equalise educational opportunities.

# Appendices

## Appendix 2.1: Cut points for Ordered Probit (Table 2.10)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| Cut 1 | -1.21*** | (0.05) | -1.44*** | (0.07) | -1.46*** | (0.08) | -1.38*** | (0.08) |
| Cut 2 | -1.06*** | (0.05) | -1.28*** | (0.06) | -1.29*** | (0.08) | -1.21*** | (0.08) |
| Cut 3 | -0.36*** | (0.04) | -0.58*** | (0.06) | -0.53*** | (0.08) | -0.45*** | (0.08) |
| Cut 4 | -0.05 | (0.04) | -0.27*** | (0.06) | -0.20* | (0.08) | -0.12 | (0.08) |
| Cut 5 | 0.88*** | (0.04) | 0.66*** | (0.06) | 0.83*** | (0.08) | 0.91*** | (0.08) |

## Appendix 3.1 Multiple Imputation Strategy

Multiple Imputation (MI) is a simulation based approach for analysing incomplete data in which missing data are imputed several times and the results of each imputation are combined. What this means in practice is that MI replaces missing values with multiple sets of simulated values derived from 'repeated imputation' inference (Rubin, 1987). Each of the simulated complete datasets is analysed by standard methods, the results are then combined to produce estimates and confidence intervals that incorporate missing-data uncertainty. Therefore it is not the objective of MI to predict missing values as close to the true value, but to handle missing data in a way which doesn't interfere with valid statistical inference (Rubin, 1996).

Imputation was carried out using chained equations (ICE) as it accommodates multivariate imputation where the missing value pattern is arbitrary. The benefits of this approach are that it allows conditional specifications and it imputes the values sequentially, offering some flexibility. The values were imputed using the predictive mean matching method take from the posterior predictive distribution where the value is chosen based on the observed value corresponding to the closest predicted value[56].

Following Rubin's recommendation, ten imputations were created and analysed. Rubin notes that unless the rate of missing information is very high there is little advantage to producing and analyzing more than a few imputed datasets, he argues between three and ten imputations are appropriate (Rubin, 1987). As mentioned, a completed case analysis is used for the dependent variable, but all of the dependent variables are included in the multiple imputation models to avoid biasing

[56] More information on these techniques can be found in the Stata manual and the worksheets written by Lunt (2011).

of results. An indicator was created which shows whether the dependent variable was missing in the observed data, and the analysis was conducted only if the dependent variable was observed. Although including imputed dependent variables in the analysis is acceptable under certain conditions, it can increase the risk of biases in the results (Young and Johnson, 2010).

***Table 3.1.1: Logistic Regression Predicting Five GCSEs A*-C (Including English and Maths), presenting Log Odds***

| | Model 1 Complete | Model 2 Single Imputation | Model 3 Multiple Imputation |
|---|---|---|---|
| Family size | -0.05 | -0.11*** | -0.13*** |
| | (0.04) | (0.03) | (0.03) |
| Birth order | -0.40*** | -0.40*** | -0.36*** |
| | (0.06) | (0.04) | (0.03) |
| Family type | -0.25* | -0.08* | -0.11*** |
| | (0.13) | (0.04) | (0.03) |
| Female | 0.45*** | 0.42*** | 0.42*** |
| | (0.08) | (0.06) | (0.04) |
| Ethnic min | 0.46*** | 0.36*** | 0.40*** |
| | (0.11) | (0.08) | (0.05) |
| Family class | -0.15*** | -0.14*** | -0.12*** |
| | (0.02) | (0.01) | (0.01) |
| Income | 0.21** | 0.23*** | 0.15*** |
| | (0.07) | (0.05) | (0.02) |
| Log income | -0.36 | -0.58 | -0.15 |
| | (0.51) | (0.38) | (0.17) |
| Step | -0.24* | -0.37*** | -0.36*** |
| | (0.11) | (0.09) | (0.07) |
| Computer | 0.43* | 0.99*** | 0.94*** |
| | (0.22) | (0.17) | (0.13) |
| Internet | 0.38** | 0.37*** | 0.31*** |
| | (0.14) | (0.10) | (0.07) |
| Mum age | 0.50*** | 0.51*** | 0.42*** |
| | (0.07) | (0.06) | (0.05) |
| Dad age | 0.22*** | 0.22*** | 0.27*** |
| | (0.07) | (0.06) | (0.05) |
| Constant | -3.75*** | -4.51*** | -4.46*** |
| | (0.79) | (0.57) | (0.38) |
| N | 5786 | 9095 | 11587 |

Legend: * p<0.05; ** p<0.01; *** p<0.001

Some post estimation commands are made tricky to use in conjunction with MI. In addition to this, R-squared results and other model statistics are not available using MI command unless user-written or wrapper commands are used which has a high computational cost.

In order to justify the imputation strategy adopted, three comparative models were run predicting the achievement of five good GCSEs (A*-C including English and Maths) using the different treatments of missing data. The results are shown in Table 3.1.1. The first model shows the results of a completed case analysis which leaves a sample size of 5786.

The second model shows the results of single imputing (by subgroup mean) which has 9,095 observations[57]. The third model shows the results from the multiple imputation strategy outlined above and has 11,587 observations. The substantive results do not differ between models; however the significance level and the standard errors do vary, showing the level of precision in the data.

[57] Piesse and Kalton (2009) recommend that with respect to item non-response, missing values should be imputed for household income, fathers' highest qualifications, family's class, attitudes and aspirations towards schooling measures using a subgroup mean and recommended weights. In the LSYPE sample, 25% of the values for father's education are missing, so the variable which captures family's highest recorded qualification was used instead. Family class has 6% of values unknown; so I assigned a subgroup mean by family's highest education. 18% of the income data was missing so a subgroup mean by class was assigned. 22% of father's age data is missing, so a subgroup mean was generated by mother's age. There is a cost to this approach, including a reduced variability, increase the $R^2$ and a decrease of standard errors.

# Appendix 3.2 Full Logistic Regression Models Predicting GCSE results

Logistic Regression Predicting A*-C GCSE in English

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | |
| One sibling | 0.06 | (0.08) | -0.12 | (0.09) | -0.20* | (0.09) |
| Two siblings | -0.08 | (0.08) | -0.26** | (0.09) | -0.35*** | (0.09) |
| Three siblings | -0.32*** | (0.09) | -0.38*** | (0.09) | -0.47*** | (0.10) |
| Four siblings | -0.74*** | (0.09) | -0.73*** | (0.10) | -0.84*** | (0.11) |
| Five siblings | -0.92*** | (0.10) | -0.68*** | (0.11) | -0.77*** | (0.11) |
| Birth order index | -0.16** | (0.06) | -0.07 | (0.07) | -0.63*** | (0.08) |
| *Gender and Ethnicity (White, Male)* | | | | | | |
| Ethnic minority | 0.13** | (0.04) | 0.54*** | (0.05) | 0.52*** | (0.05) |
| Female | 0.66*** | (0.04) | 0.78*** | (0.04) | 0.80*** | (0.04) |
| *Class (Salariat)* | | | | | | |
| Intermediate | | | -0.23* | (0.10) | -0.18+ | (0.10) |
| Working | | | -0.63*** | (0.10) | -0.54*** | (0.10) |
| *Parent's highest qualification (Degree)* | | | | | | |
| Other Higher Education | | | -0.59*** | (0.09) | -0.50*** | (0.09) |
| A Level of equivalent | | | -0.85*** | (0.09) | -0.73*** | (0.09) |
| GCSE or equivalent | | | -1.07*** | (0.09) | -0.92*** | (0.09) |
| Level 1 | | | -1.55*** | (0.12) | -1.36*** | (0.12) |
| Other | | | -1.49*** | (0.15) | -1.40*** | (0.16) |
| None | | | -1.36*** | (0.10) | -1.32*** | (0.10) |
| *Income (Up to £10,399)* | | | | | | |
| From £10,400 to £20,799 | | | 0.25** | (0.09) | 0.24** | (0.09) |
| From £20,800 to £31,199 | | | 0.44*** | (0.12) | 0.37** | (0.13) |
| From £31,200 to £41,599 | | | 0.60*** | (0.15) | 0.51** | (0.16) |
| From £41,600 to £51,999 | | | 0.83*** | (0.19) | 0.70*** | (0.19) |
| Over £52,000 | | | 1.15*** | (0.20) | 0.97*** | (0.21) |
| Log income | | | 0.22 | (0.15) | 0.22 | (0.16) |
| *Family type (Not step family)* | | | | | | |
| Step | | | | | -0.22** | (0.08) |
| *Marital status (Married)* | | | | | | |
| Cohabit | | | | | -0.23* | (0.09) |
| Single Parent | | | | | -0.17** | (0.06) |
| No parents | | | | | -1.05*** | (0.24) |
| *Parent's age (20s)* | | | | | | |
| Mother 30s | | | | | 0.51 | (0.38) |
| Mother 40s | | | | | 0.97* | (0.38) |
| Mother 50s and over | | | | | 1.21** | (0.39) |
| Father 30s | | | | | 0.03 | (0.26) |
| Father 40s | | | | | 0.40 | (0.24) |
| Father 50s and over | | | | | 0.60* | (0.24) |
| Constant | 0.43*** | (0.11) | 0.30 | (0.29) | -0.24 | (0.55) |
| Observations | 11,587 | | 11,587 | | 11,587 | |
| Standard errors in parentheses | | | | | 0.1737 | |

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Continued overleaf

Logistic Regression Predicting A*-C GCSE in Maths

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | |
| One sibling | 0.16* | (0.08) | 0.02 | (0.09) | -0.07 | (0.09) |
| Two siblings | -0.03 | (0.08) | -0.17* | (0.08) | -0.28** | (0.09) |
| Three siblings | -0.18* | (0.08) | -0.19* | (0.09) | -0.30** | (0.09) |
| Four siblings | -0.47*** | (0.09) | -0.39*** | (0.10) | -0.51*** | (0.10) |
| Five siblings | -0.73*** | (0.09) | -0.47*** | (0.10) | -0.58*** | (0.11) |
| Birth order index | -0.21*** | (0.06) | -0.14* | (0.06) | -0.62*** | (0.07) |
| *Gender and Ethnicity (White, Male)* | | | | | | |
| Ethnic minority | 0.08+ | (0.04) | 0.43*** | (0.05) | 0.40*** | (0.05) |
| Female | 0.08* | (0.04) | 0.10* | (0.04) | 0.11* | (0.04) |
| *Class (Salariat)* | | | | | | |
| Intermediate | | | -0.24** | (0.09) | -0.18* | (0.09) |
| Working | | | -0.62*** | (0.09) | -0.54*** | (0.09) |
| *Parent's highest qualification (Degree)* | | | | | | |
| Other Higher Education | | | -0.70*** | (0.08) | -0.64*** | (0.08) |
| A Level of equivalent | | | -0.83*** | (0.08) | -0.75*** | (0.08) |
| GCSE or equivalent | | | -1.01*** | (0.08) | -0.89*** | (0.08) |
| Level 1 | | | -1.40*** | (0.11) | -1.23*** | (0.11) |
| Other | | | -1.24*** | (0.15) | -1.15*** | (0.15) |
| None | | | -1.29*** | (0.09) | -1.27*** | (0.10) |
| *Income (Up to £10,399)* | | | | | | |
| From £10,400 to £20,799 | | | 0.23* | (0.10) | 0.20* | (0.10) |
| From £20,800 to £31,199 | | | 0.43** | (0.15) | 0.33* | (0.16) |
| From £31,200 to £41,599 | | | 0.60*** | (0.18) | 0.47* | (0.18) |
| From £41,600 to £51,999 | | | 0.76*** | (0.21) | 0.59** | (0.22) |
| Over £52,000 | | | 1.12*** | (0.22) | 0.89*** | (0.23) |
| Log income | | | 0.16 | (0.17) | 0.12 | (0.18) |
| *Family type (Not step family)* | | | | | | |
| Step | | | | | -0.27*** | (0.08) |
| *Marital status (Married)* | | | | | | |
| Cohabit | | | | | -0.34*** | (0.09) |
| Single Parent | | | | | -0.34*** | (0.06) |
| No parents | | | | | -0.90*** | (0.23) |
| *Parent's age (20s)* | | | | | | |
| Mother 30s | | | | | -0.17 | (0.35) |
| Mother 40s | | | | | 0.23 | (0.35) |
| Mother 50s and over | | | | | 0.51 | (0.37) |
| Father 30s | | | | | 0.21 | (0.34) |
| Father 40s | | | | | 0.56 | (0.34) |
| Father 50s and over | | | | | 0.65* | (0.33) |
| Constant | 0.49*** | (0.11) | 0.51+ | (0.29) | 0.68 | (0.58) |
| Observations | 11,587 | | 11,587 | | 11,587 | |
| Standard errors in parentheses | | | | | 0.1327 | |

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Continued overleaf

Linear Regression Predicting Capped Linear GCSE score

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | |
| One sibling | 6.89 | (5.64) | -4.11 | (5.24) | -11.41* | (5.19) |
| Two siblings | -3.01 | (5.58) | -12.33* | (5.19) | -20.52*** | (5.16) |
| Three siblings | -20.33*** | (5.93) | -20.67*** | (5.50) | -28.53*** | (5.47) |
| Four siblings | -50.43*** | (6.63) | -39.74*** | (6.18) | -48.39*** | (6.12) |
| Five siblings | -64.05*** | (6.78) | -37.44*** | (6.43) | -46.55*** | (6.37) |
| Birth order index | -26.62*** | (4.23) | -18.93*** | (3.94) | -49.12*** | (4.41) |
| *Gender and Ethnicity (White, Male)* | | | | | | |
| Ethnic minority | 18.00*** | (3.11) | 41.57*** | (3.04) | 39.06*** | (3.01) |
| Female | 36.23*** | (2.75) | 37.24*** | (2.55) | 37.57*** | (2.50) |
| *Class (Salariat)* | | | | | | |
| Intermediate | | | -16.52*** | (4.58) | -12.50** | (4.49) |
| Working | | | -42.31*** | (5.24) | -36.49*** | (5.12) |
| *Parent's highest qualification (Degree)* | | | | | | |
| Other Higher Education | | | -37.89*** | (4.62) | -32.80*** | (4.56) |
| A Level of equivalent | | | -50.34*** | (4.59) | -43.71*** | (4.53) |
| GCSE or equivalent | | | -63.47*** | (4.59) | -53.87*** | (4.55) |
| Level 1 | | | -95.76*** | (6.78) | -81.62*** | (6.77) |
| Other | | | -85.76*** | (9.21) | -77.63*** | (9.10) |
| None | | | -85.37*** | (5.62) | -81.81*** | (5.56) |
| *Income (Up to £10,399)* | | | | | | |
| From £10,400 to £20,799 | | | 19.80*** | (5.79) | 15.99** | (5.71) |
| From £20,800 to £31,199 | | | 36.34*** | (8.10) | 25.79** | (8.05) |
| From £31,200 to £41,599 | | | 48.99*** | (9.97) | 35.50*** | (9.95) |
| From £41,600 to £51,999 | | | 55.72*** | (12.06) | 39.34*** | (11.92) |
| Over £52,000 | | | 66.90*** | (12.70) | 47.00*** | (12.70) |
| Log income | | | 19.87* | (10.06) | 15.32 | (9.90) |
| *Family type (Not step family)* | | | | | | |
| Step | | | | | -22.49*** | (4.92) |
| *Marital status (Married)* | | | | | | |
| Cohabit | | | | | -16.42** | (5.53) |
| Single Parent | | | | | -31.55*** | (3.50) |
| No parents | | | | | -74.12*** | (13.71) |
| *Parent's age (20s)* | | | | | | |
| Mother 30s | | | | | 10.30 | (22.12) |
| Mother 40s | | | | | 36.01 | (22.48) |
| Mother 50s and over | | | | | 51.10* | (23.30) |
| Father 30s | | | | | 8.93 | (18.16) |
| Father 40s | | | | | 33.32+ | (17.35) |
| Father 50s and over | | | | | 41.84* | (17.20) |
| Constant | 386.33*** | (7.64) | 354.88*** | (17.48) | 356.22*** | (33.68) |
| Observations | 11,587 | | 11,587 | | 11,587 | |
| Standard errors in parentheses | | | | | 0.1985 | |

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

## Appendix 3.3 Logistic regression predicting external locus of control without ability controls

| | Even if I do well at school, I will have a hard time | | Success in Life is a matter of Luck | |
|---|---|---|---|---|
| *Family Size (Lone Child)* | | | | |
| One sibling | 0.06 | (0.07) | 0.26* | (0.11) |
| Two siblings | 0.19* | (0.08) | 0.28* | (0.11) |
| Three siblings | 0.20+ | (0.11) | 0.28* | (0.12) |
| Four siblings | -0.10 | (0.16) | 0.42** | (0.14) |
| Five or more siblings | 0.53* | (0.22) | 0.53*** | (0.14) |
| Birth order index | 0.10** | (0.03) | 0.19* | (0.09) |
| Constant | -1.49** | (0.57) | -1.14+ | (0.61) |
| Observations | 9,801 | | 10,240 | |

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age.

# Appendix 4.1 Principal Component Analysis with Concerted Cultivation Variables

*Principal components/correlation*

| | |
|---|---|
| Number of obs | 55723 |
| Number of comp. | 7 |
| Trace | 7 |
| Rho | 1 |

| Component | Eigenvalue | Difference | Proportion | Cumulative |
|---|---|---|---|---|
| Comp1 | 1.81 | 0.61 | 0.26 | 0.26 |
| Comp2 | 1.21 | 0.15 | 0.17 | 0.43 |
| Comp3 | 1.06 | 0.09 | 0.15 | 0.58 |
| Comp4 | 0.97 | 0.19 | 0.14 | 0.72 |
| Comp5 | 0.78 | 0.02 | 0.11 | 0.83 |
| Comp6 | 0.76 | 0.34 | 0.11 | 0.94 |
| Comp7 | 0.41 | | 0.06 | 1.00 |

*Principal components (eigenvectors)*

| Variable | Comp1 | Comp2 | Comp3 | Comp4 | Comp5 | Comp6 | Comp7 | Unexplained |
|---|---|---|---|---|---|---|---|---|
| Extracurricular activities | 0.05 | -0.05 | 0.72 | -0.62 | 0.32 | 0.03 | 0.00 | 0.00 |
| Private tuition | 0.05 | -0.03 | 0.60 | 0.78 | 0.15 | 0.08 | -0.01 | 0.00 |
| Confidence to help with YP's school work | 0.16 | 0.69 | 0.04 | -0.05 | -0.18 | 0.68 | -0.03 | 0.00 |
| Involvement in School | 0.18 | 0.67 | -0.03 | 0.05 | 0.31 | -0.64 | 0.03 | 0.00 |
| Talk about school | 0.44 | -0.03 | 0.28 | -0.06 | -0.79 | -0.31 | 0.03 | 0.00 |
| Talk to mum about important things | 0.61 | -0.18 | -0.15 | 0.01 | 0.23 | 0.08 | -0.71 | 0.00 |
| Talk to dad about important things | 0.61 | -0.18 | -0.16 | 0.02 | 0.26 | 0.15 | 0.70 | 0.00 |

## Appendix 4.2 Linear regression predicting capped linear GCSE scores with concerted cultivation measures

| | Base Model | | Communication | | Involved in School | | Organisation of daily life | | Concerted Cultivation (all) | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Family size (Lone Child)* | | | | | | | | | | |
| One sibling | -11.18* | (5.19) | -9.99+ | (5.17) | -10.81* | (5.17) | -9.26+ | (5.18) | -7.87 | (5.15) |
| Two siblings | -20.36*** | (5.14) | -18.79*** | (5.12) | -20.07*** | (5.12) | -17.92*** | (5.13) | -16.26** | (5.10) |
| Three siblings | -28.41*** | (5.46) | -25.90*** | (5.44) | -28.41*** | (5.44) | -25.85*** | (5.45) | -23.62*** | (5.42) |
| Four siblings | -48.27*** | (6.12) | -46.07*** | (6.10) | -47.50*** | (6.10) | -45.50*** | (6.11) | -42.79*** | (6.08) |
| Five or more siblings | -46.38*** | (6.38) | -44.63*** | (6.36) | -44.69*** | (6.36) | -43.03*** | (6.38) | -39.84*** | (6.34) |
| Birth order index | -48.98*** | (4.42) | -47.88*** | (4.41) | -49.50*** | (4.40) | -47.06*** | (4.41) | -46.58*** | (4.38) |
| *Communication (not talk)* | | | | | | | | | | |
| Talk to mum | | | 12.05** | (3.91) | | | | | 11.07** | (3.88) |
| Talk to dad | | | 8.75* | (3.48) | | | | | 8.07* | (3.47) |
| Talk about school | | | 32.28*** | (5.72) | | | | | 29.60*** | (5.66) |
| *Involvement in School (not involved)* | | | | | | | | | | |
| Confidence to help | | | | | 27.64*** | (3.01) | | | 26.90*** | (2.99) |
| Feel involved with schooling | | | | | 0.12 | (2.86) | | | -0.79 | (2.85) |
| *Organisation of daily life (did not attend)* | | | | | | | | | | |
| Private lesson | | | | | | | 8.25* | (3.80) | 8.60* | (3.77) |
| Extracurricular activities | | | | | | | 28.10*** | (3.44) | 27.72*** | (3.41) |
| Constant | 356.32*** | (32.17) | 307.75*** | (32.66) | 335.57*** | (32.24) | 345.99*** | (32.24) | 281.84*** | (32.78) |
| Observations | 11,361 | | 11,361 | | 11,361 | | 11,361 | | 11,361 | |

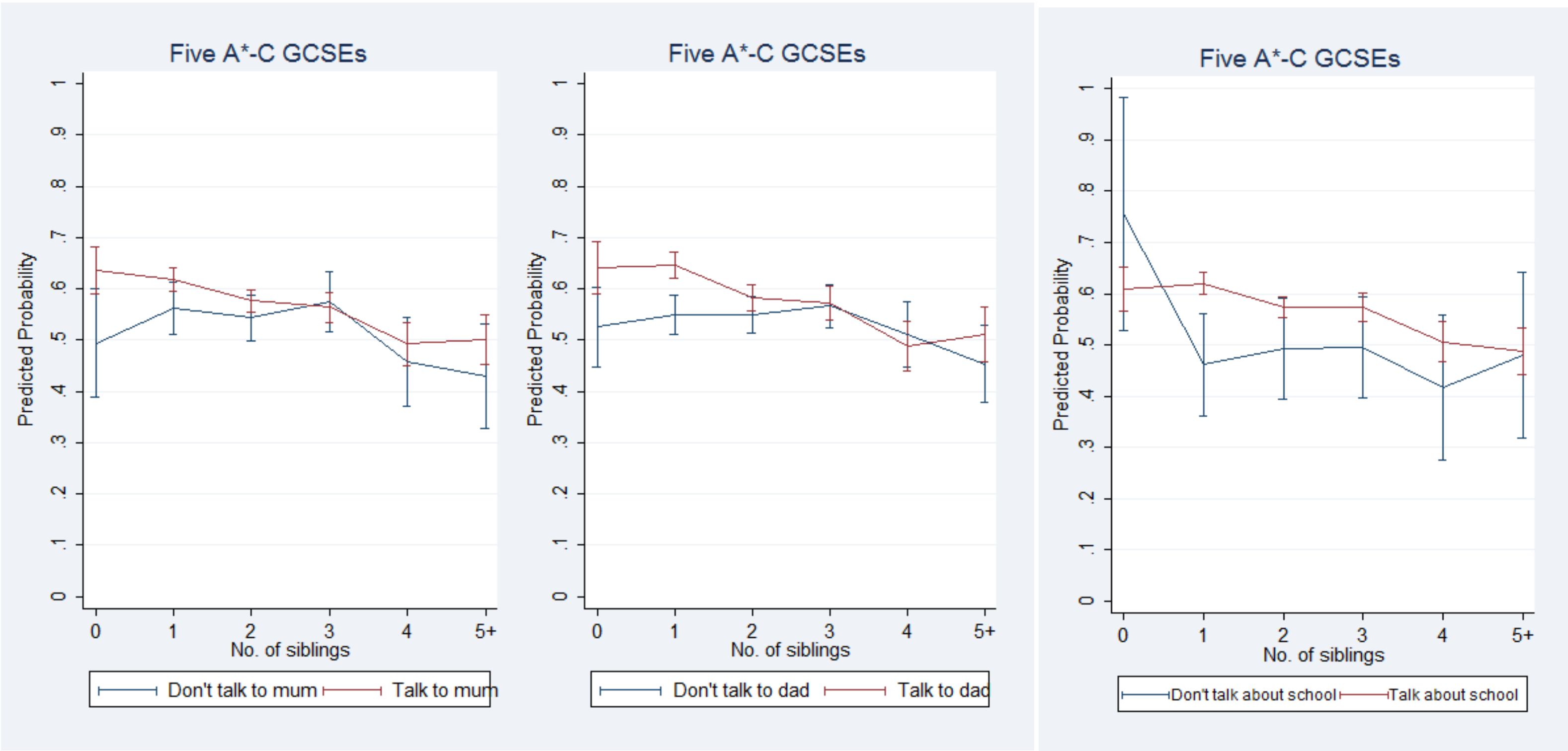
Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Controlling for gender, ethnicity, family class, parent's highest qualification, income, log income, family type, marital status and parent's age, family change.

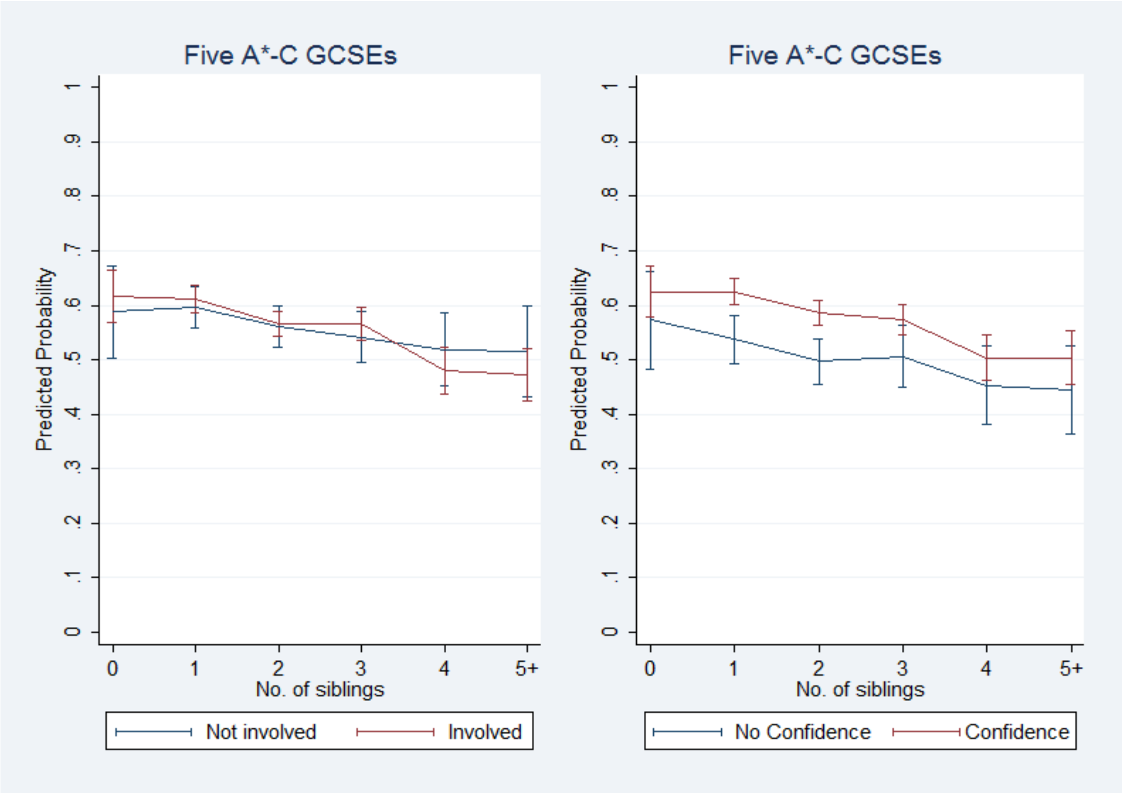
# Appendix 4.3 Marginal effects predicting five good GCSEs by family strategies X family size

**Marginal effects predicting five good GCSEs by communication strategies X family size**

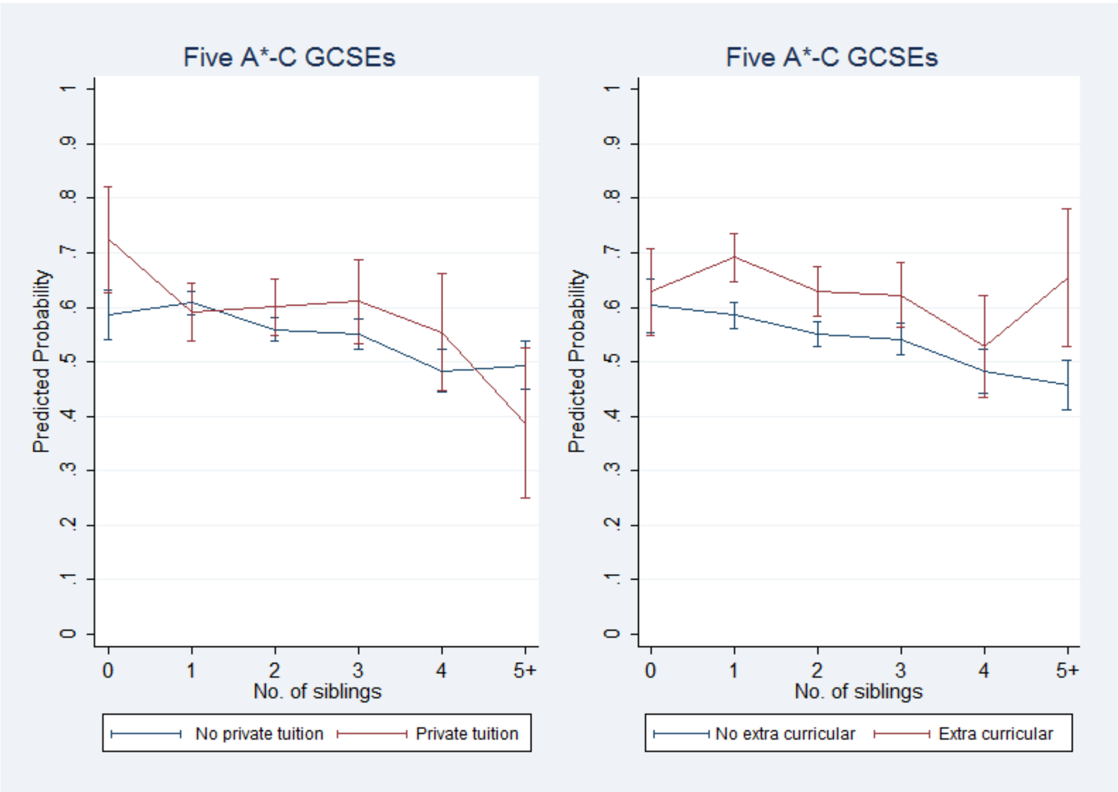



Continued overleaf

**Mariginal effects predicting five good GCSEs by invovlement in school X family size**




**Marignal effects predicging five good GCSEs by organisation of daily life X family size**



## Appendix 5.1 Logistic Regression Predicting Degree or Higher Comparing Age Spacing Results

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| *Family size (Lone child)* | | | | | | |
| One sibling | -0.08* | (0.04) | -0.07 | (0.05) | -0.05 | (0.04) |
| Two siblings | -0.23*** | (0.04) | -0.20** | (0.08) | -0.20*** | (0.04) |
| Three siblings | -0.30*** | (0.04) | -0.26* | (0.11) | -0.27*** | (0.04) |
| Four siblings | -0.33*** | (0.05) | -0.29* | (0.14) | -0.30*** | (0.05) |
| Five or more siblings | -0.43*** | (0.05) | -0.38* | (0.18) | -0.40*** | (0.06) |
| Extra sibling | -0.37*** | (0.03) | -0.34*** | (0.07) | -0.34*** | (0.07) |
| Birth order index | -0.34*** | (0.07) | -0.43*** | (0.10) | -0.36*** | (0.03) |
| *Twin (Non twin)* | | | | | | |
| LS member is a twin | -0.02 | (0.07) | -0.05 | (0.09) | -0.03 | (0.07) |
| *Age Spacing* | | | | | | |
| No of siblings 3 years older | | | -0.01 | (0.03) | | |
| No of siblings 1 or 2 years older | | | 0.03 | (0.03) | | |
| No of sibling 1 or 2 years younger | | | -0.04 | (0.06) | | |
| No of siblings 3 years younger | | | -0.02 | (0.05) | | |
| *Age Spacing (Siblings close in age)* | | | | | | |
| Far sib | | | | | -0.05* | (0.02) |
| Constant | -0.19* | (0.09) | -0.15 | (0.13) | -0.19 | (0.10) |
| N | 61031 | | 61031 | | 61031.00 | |
| ll | -32643.41 | | -32642.32 | | -32641.31 | |
| p | 0.00 | | 0.00 | | 0.00 | |
| r2_p | 0.08 | | 0.08 | | 0.08 | |

# Appendix 5.2 Logistic Regression Predicting Degree or Higher by Comparison Groups with Birth Order Effects

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| **Comparison 1 (ref: no twin siblings)** | | | | | | | | |
| LS member has twin siblings at second birth | -0.26 | (0.22) | | | | | | |
| **Comparison 2 (ref: no twin siblings)** | | | | | | | | |
| LS member has twin sibling at third birth | | | 0.17 | (0.21) | | | | |
| *Absolute Birth Order (Ref. First born)* | | | | | | | | |
| Second born | | | -0.22*** | (0.05) | | | | |
| **Comparison 3 (ref: no twin siblings)** | | | | | | | | |
| LS member has twin sibling at fourth birth | | | | | 0.26 | (0.25) | | |
| *Absolute Birth Order (Ref. First born)* | | | | | | | | |
| Second born | | | | | -0.23** | (0.09) | | |
| Third born | | | | | -0.40*** | (0.10) | | |
| **Comparison 4 (ref: no twin siblings)** | | | | | | | | |
| LS member has twin sibling at fifth birth | | | | | | | -1.23 | (0.50) |
| *Absolute Birth Order (Ref. First born)* | | | | | | | | |
| Second born | | | | | | | -0.38* | (0.16) |
| Third born | | | | | | | -0.33* | (0.17) |
| Fourth born | | | | | | | -0.48* | (0.20) |
| Constant | -0.63 | (0.28) | -0.56 | (0.21) | -0.60 | (0.23) | -0.30 | (0.31) |
| N | 8672 | | 9299 | | 5752 | | 2955 | |
| ll | -5018.78 | | -5024.08 | | -2946.4 | | -1426.45 | |
| P | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| r2_p | 0.08 | | 0.09 | | 0.09 | | 0.06 | |

Controlling for ethnicity, gender, class, parents' education, parents' age, family structure in 1971 & 1981 and age spacing (near versus far siblings

## Appendix 5.3 Instrumental Variable Model

Instrumental variable estimation provides a sensitivity test. This method replicates Black et al.'s (2004) analysis using instrumental regression on non twin children who either experience an exogenous increase in family size as a result of a twin birth or do not.

The instrument used is having twin siblings (TWINSIB). TWINSIB is a valid instrument if it is correlated with family size (the endogenous variable) and correlated with education only through family size. Furthermore TWINSIB is valid if it is an exogenous variable, and therefore uncorrelated with the errors (Kelejian, 1971).

The first stage of the two-stage least squares (2SLS) estimation identifies whether the instrument is correlated with the endogenous variable (family size). The second stage of the 2SLS estimates the effect of family size on education, using twin siblings as instruments. This identifies whether instrumenting for twin siblings changes the family size effect relative to the results in an OLS regression.

Following the methods adopted by Black et al. (2004), absolute birth order is controlled for in the instrumental regression. In addition controls for class, parental education, parents' age, family structure, age spacing, gender and ethnicity are included in the model. The analysis is conducted on families who have twins at their final birth are included in this part of the analysis as those who go on to have additional children have different preferences over family size. The frequency of LS members who have twin siblings whose parents stop having children after the birth of twins is shown in Table 5.3.1.

***Table 5.3.1 Frequency of families who stop having children after birth or twins when LS member is a sibling of twins***

| | Frequency of LS members who have twin siblings | Frequency of LS members who have twin siblings at final birth in family | Percentage of families who complete their family after the birth of twins |
|---|---|---|---|
| Twins at second birth | 273 | 132 | 48 |
| Twins at third birth | 220 | 134 | 61 |
| Twins at fourth birth | 138 | 93 | 67 |
| Twins at fifth birth | 78 | 53 | 68 |
| **Total** | **709** | **412** | **58** |

***Table 5.3.2 Cross tabulation of family size by completed years of education***

| % | Number of siblings ever had | | | | | | |
|---|---|---|---|---|---|---|---|
| Completed years of education | Lone child | One sibling | Two siblings | Three siblings | Four siblings | Five or more siblings | Total |
| <10 years | 12 | 10 | 14 | 21 | 27 | 35 | **16** |
| 11 years | 25 | 27 | 28 | 27 | 28 | 25 | **27** |
| 12 years | 24 | 25 | 24 | 22 | 19 | 17 | **23** |
| 13 years | 8 | 8 | 7 | 6 | 5 | 4 | **7** |
| 14 years | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| 15 years | 5 | 4 | 4 | 5 | 7 | 7 | **5** |
| 16 years | 26 | 26 | 22 | 19 | 14 | 12 | **22** |
| Total | **100** | **100** | **100** | **100** | **100** | **100** | **100** |
| N | 4,736 | 20,902 | 17,054 | 9,828 | 4,711 | 3,800 | 61,031 |

The highest educational attainment was converted into a linear scale which represents the completed years of education. The cross tabulation of family size by completed years of education is shown in Table 5.3.2. Those with no qualifications were coded to have 6 years of education which represents primary education which was compulsory for all respondents in the sample; those with secondary education would have 11 years for GCSE attainment or equivalent; those with AS Levels, apprenticeships or equivalent were coded to have 12 years of education. Those with A Level or equivalent qualifications were coded to have 13 years of education. If the respondent noted that they had other or 'professional' qualifications they were coded to have 15 years, while those with degree were coded to have 16 years of education. The analysis now turns to an approximated social experiment which examines the influence of twins as an exogenous increase in family size on educational outcomes. The results from the OLS regression and the 2SLS are shown in Table 5.3.3.

The preliminary results for the OLS regression indicate that as family size increases by one, there is a significant reduction in the completed years of education by between a third and half of a year (-0.30 and -0.47) net of family background, birth order and age spacing controls. Absolute birth order also yields statistically significant and negative coefficients indicating that as birth order increases, there is a reduction in the completed years of education by around half a year[58].

The first stage of the instrumental variable model shows that a twin birth significantly increases completed family size by between 0.22 and 0.69. The first stage regression F-statistic are 331, 28, 846 and 1,567, so in all four cases they exceed 10, indicating that instrument is not weak (Staiger and Stock, 1997). Furthermore this indicates that the standard methods for statistical inference (hypothesis tests, confidence intervals) using the estimated coefficients and standard errors can be relied upon (Stock and Watson, 2006).

The 2SLS estimate of the effect on the first child of changes in family size induced by the second birth being a twin is -0.01 which is less negative than the OLS estimate. The equivalent estimate for families that have at least three births is 2.43, this indicates there are no adverse effects of increased family size on completed years in education. The equivalent estimate for families with at least four births is -0.19 which is less negative than

[58] The birth order index also yields negative and significant coefficients, ranging from -0.55 to -1.23 (results not shown).

***Table 5.3.3 Regressing Family Size on Completed Years of Education Using the Presence of Twins as an Instrument***

| | OLS | | First Stage IV 2SLS | | Second Stage IV 2SLS | | N |
|---|---|---|---|---|---|---|---|
| **Instrument: Twin at Second Birth** | | | 0.52*** | (0.03) | | | 15,134 |
| (Sample: First child in families with 2 or more births) | | | | | | | |
| Number of children in Family | -0.30*** | 0.03 | | | -0.01 | (0.42) | |
| **Instrument: Twin at Third Birth** | | | 0.22*** | (0.04) | | | 10,617 |
| (Sample: First and second children in families with 3 or more births) | | | | | | | |
| Number of children in Family | -0.44*** | 0.05 | | | 2.43 | (1.30) | |
| Second Child | -0.52*** | (0.09) | | | 1.59 | (0.96) | |
| **Instrument: Twin at Fourth Birth** | | | 0.61*** | (0.02) | | | 9,240 |
| (Sample: First, second and third children in families with 4 or more births) | | | | | | | |
| Number of children in Family | -0.43*** | (0.06) | | | -0.19 | (0.63) | |
| Second Child | -0.49*** | (0.10) | | | -0.51*** | (0.11) | |
| Third Child | -0.56*** | (0.11) | | | -0.62** | (0.19) | |
| **Instrument: Twin at Fifth Birth** | | | 0.69*** | (0.02) | | | 4,840 |
| (Sample: First, second, third and fourth children in families with 5 or more births) | | | | | | | |
| Number of children in Family | -0.47*** | (0.11) | | | -1.19 | (0.67) | |
| Second Child | -0.75*** | (0.18) | | | -0.72*** | (0.18) | |
| Third Child | -0.63*** | (0.19) | | | -0.55** | (0.20) | |
| Fourth Child | -0.64** | (0.22) | | | -0.49 | (0.26) | |

Legend: * $p<0.05$; ** $p<0.01$; *** $p<0.001$.
Controlling for class, parental education, parents' age, family structure, age spacing, gender and ethnicity.

the OLS estimate and for families with at least five births the equivalent estimate is -1.19. For all models the family size estimates are not statistically significant which indicates that family size has a negligible effect on educational outcomes, once controlling for an exogenous increase on family size.

There is some evidence that absolute birth order remains a significant and negative predictor for most of the tests.

In summary there is evidence that family size is no longer a significant predictor for completed years in education when twins are used as an instrument. This implies that the association between family size and educational outcomes identified using observational studies are masking unobserved variables.

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