

Only children and cognitive ability in childhood: a cross-cohort analysis over 50 years in the U.K.

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Abstract

With declining family size and a gradual shift in family size ideals, only child families are expected to become more common in many advanced societies. Although previous research shows that in terms of cognitive outcomes only children tend to do as well as children with few siblings and better than children from large families, other studies show that they experience a disadvantage. One potential explanation for the mixed results across studies is that they cover different time periods: if the selection mechanisms into the formation of only child families change over time, the development of only children compared to children growing up with siblings could, as a consequence, also vary over time. This possibility remains largely untested in the literature. In this study, using data from four UK birth cohorts (born in 1946, 1958, 1970, 2000-2002), we test whether the association between cognitive ability at age 10/11 and being an only child has changed over time and, if so, whether it is explained by cross-cohort differences in the characteristics of only child families. The results show that only children have higher cognitive scores than children who grow up with siblings but also that the advantage has weakened over time – which is consistent with the evidence that across the cohorts analysed only children have become a more heterogeneous and thus disadvantaged group. Adjustment by family socio-demographic characteristics attenuates within and cross cohort differences. Moreover, the results show that the cognitive advantages associated with being an only child vary considerably by whether the cohort member has been exposed to parental separation. Taken together, the findings underscore that the selection process into being an only child is important in explaining the link between only childness and cognitive ability in childhood and how it varies over time and across studies.

Introduction

Only children's – namely children who grow up without siblings – unusualness and uniqueness have intrigued and fascinated researchers, clinicians and society for decades. Because of the lack of siblings, only children have often been described as spoiled, overprotected and lonely (Falbo & Polit, 1986). The emergence of the negative views around only children dates back to the late 1800s when G. Stanley Hall, an eminent psychologist, defined the only child as a 'disease in itself' (Mancillas, 2006). Although these views were developed on the basis of questionable scientific methods and on extremely small samples of children suffering from psychological problems, they permeated the general views and contributed to develop negative stereotypes about only children (Mancillas, 2006). Despite the fact that the scientific evidence has either disproved or at least presented enough evidence to question these views, even in contemporary low-fertility societies, negative stereotypes about only children are still present and might contribute to explain the persistence of the two-child family ideal (Sobotka & Beaujouan, 2014). Figure 1, for example, shows an image circulated during the 2016 Italian Fertility Day¹ which conveyed the message that one of the unintended and negative consequences of childbearing postponement is to have an 'only' child.

Figure 1 Image circulated during the 2016 Fertility Day in Italy



Note: Translation from Italian: “*Delaying motherhood leads to an only child. If any child at all*”. The image was advertised as part of the 2016 Italian Fertility day, with the intention of warning women that one of the “dangers” of postponing childbearing is to have an only child.

But is being an only child really a disadvantage? Although previous research shows that in terms of cognitive and educational outcomes, on average, only children do as well as children with few siblings and better than children from large families (Falbo & Polit, 1986), other studies report a disadvantage (Belmont & Marolla, 1973; Black, Devereux, & Salvanes, 2010). The context under study and, in particular, the characteristics of only child families which vary across geographical contexts have been identified as one of the explanations behind the mixed results across different studies (Choi & Monden, 2017). In countries where small families are more prevalent, only child families tend to be socio-economically advantaged (e.g. Spain, Italy and Greece). On the contrary, in countries where small families are less prevalent, only child families tend to be, on average, less advantaged than other families (e.g. Norway, Sweden and Ireland). The variation in the characteristics of only child families, in turn, explains why in

¹ The Italian fertility day was launched with the intention to attract attention to the topic of fertility and its protection, and to underline the danger of falling birth rates in the country. It was also meant to put focus on the beauty of maternity and paternity and medical help for those people who are having problems conceiving. The campaign was condemned by many for being sexist, ageist, anachronistic.

some countries only children perform better than children from other sibship groups whilst in others they perform worse. This finding empirically supports the argument that the selection into being an only child family has at least as strong an influence on only children's outcomes as does their sibling position (Falbo & Poston, 1993). Yet, in the existing body of work on only children, the selection mechanisms have received far less attention than the development of the only children themselves.

Another potential source of variation across studies - many of which were conducted during the 1980s (Blake, 1981b) - which has not received enough attention or scrutiny so far is whether and how the development of only children has changed over time. The social and economic factors that lead to the formation of one child families might vary substantially not only across place but also time. One could hypothesize that the composition of the only child group has changed over time because, for example, couples marry later and divorce more frequently (Breton & Prioux, 2009; Gee, 1992). Alternatively, the link between the characteristics of only children and cognitive ability might change over time (REF). For example, the association between divorce and cognitive ability might change as it becomes more widespread. Changes over time in the association between being an only child and cognitive ability could thus be the result of secular changes in the composition of the only child group and/or changes over time in how that composition is linked to cognitive ability. A thorough understanding of whether the selection into being an only child family has changed over time is critical in understanding the development of this group and to contextualise the findings emerging from different studies.

With declining family size and a gradual shift in family size ideals that we have started to observe in many countries, one child families are becoming or are expected to become more common in many advanced societies (Präg, Choi, & Monden, 2020; Sobotka & Beaujouan, 2014). We need more systematic evidence on only children and their development over the life course to strengthen our understanding not only on *whether* but also *why* only children perform differently or similarly to children who grow up with siblings. In this study, we contribute to this aim by using data from four UK birth cohorts which cover children born during a 50 years period: in 1946, 1958, 1970, 2000-2002. We test whether the cognitive ability of only children with respect to that of children who grow up with siblings has changed over time and, if so, why. Moreover, we test whether, within each birth cohort, the association between being an only child and cognitive ability varies according to family structure.

Background

Three main theories have been used in social science research focussing on the consequences of being an only child. The first, the *resource dilution* theory, argues that siblings are competitors for parental resources such as time, money and energy. Because these resources are limited, each sibling reduces the amount of time and financial investment any one child can receive (Blake 1989; Downey 1995). This theory predicts that only children perform, particularly in terms of educational outcomes, better than children from large families and similarly to children from small families because they do not have to share parental resources with any or many siblings. Although for different reasons, the *confluence* theory also predicts only children perform better than children with siblings. First introduced by Zajonc and Markus (1975), the theory predicts that a child's cognitive ability depends on the intellectual environment in the family, which declines as the number of siblings increases. The only child benefits from not having siblings as s/he is exposed to a higher quality intellectual environment. In contrast, the *socialization* theory argues that siblings constitute a resource (Goetting 1986)

since they provide children with opportunities to share, to learn how to negotiate and resolve conflict. Having younger siblings can also promote the development of tutoring skills, thus giving children the opportunity to refine their own cognitive skills whilst they teach to their younger siblings. The socialization theory argues that, although only children might benefit in terms of educational outcomes from growing up without siblings, they will experience other kinds of disadvantages because they lack siblings with whom to interact resulting in worse personal adjustment, cooperativeness and ability to get along with peers (Falbo and Polit 1986).

On the one hand, existing research, on average, supports the arguments of the dilution and confluence theories (Blake, 1981a, 1981b; Falbo & Polit, 1986; Mancillas, 2006). When looking at educational outcomes in childhood and adulthood, most studies find only children to be either advantaged or no different from children in two-child families and to perform better compared to children from larger families (Blake 1981a, 1981b; Gee 1992). Similarly, existing evidence generally does not support the socialization theory as it finds that only children are comparable to children with siblings (especially the ones with few siblings) in terms of personality, parent-child relationships, achievement, motivation and personal adjustment (Falbo and Polit 1986). Although the work by Downey and Condron (2004) finds evidence of a social skills deficit amongst only children at kindergarten, more recent work by Bobbitt-Zeher and Downey (2016) show that these deficits appear to be overcome by adolescence.

On the other hand, some studies present a picture on only children that does not fully conform with the resource dilution and confluence theories. In particular, whilst only children tend to always outperform children with many siblings (four or more), the evidence on how only children perform compared to children from small families is not consistent across studies (Belmont & Marolla, 1973; Choi & Monden, 2017). Work by Black et al. (2010), for example, shows that in Norway only children perform worse in intelligence scores than children with two or three siblings before as well as after accounting for control variables capturing the socio-economic status of the family. Belmont and Marolla (1973) found that only children performed worse in intelligence scores than first and second-borns from two and three-child families and worse than first-borns from four-child families (Belmont and Marolla 1973). Monden and Choi (2017) show important variations in the cognitive ability of only children across Europe. Only children perform worse than other sibship groups in contexts (such as Sweden, Ireland and Belgium) where they constitute a smaller proportion of children and where their parents are more disadvantaged.

The association between being an only child and development might be more complex than previously supposed and nuanced than what theories such as the resource dilution predict. Because there is a link between sibship size and socio-economic status in the family (Ref), the association between being an only-child and development gets confounded by the average level of wealth in the family. Since in many contexts a small family size is a marker of higher SES and a large family size of lower SES, at least on average, only children tend to perform similarly to children from small families and better than children from large families. When it is not the case that they belong to advantaged families, they perform worse, at least compared to children from smaller families. Taken together, the evidence points to the need of contextualizing the position of only children relative to other sibship groups based on selection on family resources which might be more important in determining children's development and life chances than being an only child per se – an argument that is well supported by the study of Monden and Choi (2017).

In this study we aim to build and expand on this argument in two ways. First, we argue that the composition (i.e. the characteristics) of the only child group can vary not only across contexts but also across time (Gee 1992). Earlier in the 20th century, it was believed that only children were more likely to be born and grow up during times of economic hardships and wars (Falbo & Polit, 1986). For example, in the study by Belmont and Marolla (1973) only children's worse performance in intelligence scores is likely to be explained by the fact that only child families were strongly negatively selected as they disproportionately represented families that were worst hit by the 1944-45 Dutch famine. The more recent increase in only children has been attributed to other demographic trends such as the rising divorce rates, teenage pregnancy, increased postponement of childbearing and changing social norms (Blake 1981b). Yet, even if the composition of the only child group does not vary over time, the link between the characteristics of only children and cognitive ability might change over time (REF). For example, the association between divorce and cognitive ability might change as it becomes more widespread. This is illustrated in Figure 2. Changes over time in the association between being an only child and cognitive ability could be the result of secular changes in the composition of the only child group (A- *Composition*) and/or changes over time in how that composition is linked to cognitive ability (B-*Confounding*). *The primary aim of this study is to explore the characteristics of only child families and the development of only children in a cross-cohort perspective.*

Figure 1

Second, we argue that the existing literature has viewed and analysed only children as a homogenous group. However, even within the same period, there can be different selection processes which lead a child to be an only child. For example, a child might be without siblings as a result of single parenthood, parental separation, a deliberate or constrained choice, or because the parents suffered from secondary infertility and were unable to have a second child. Because the selection into being an only child might matter more than the only child status per se, looking at the “average” only child might mask important heterogeneity in the development of this group and contribute to the persistence of stereotypes. For this reason, *our secondary aim is to explore whether, and if so how, the association between being an only child and cognitive ability varies when we stratify the analyses by family structure* i.e. whether the cohort member is living with both parents at age 10/11 which we used as a proxy for having been exposed to single parenthood or having experienced parental separation.

Data and Methods

We used data from four UK birth cohort studies. The 1946 National Survey for Health and Development (NSHD) is a longitudinal cohort study whose origins lie in a maternity survey of all 13,687 children born in England, Scotland or Wales during one week of March 1946. A socially stratified subsample of 5,362 singleton children born to married parents was selected for follow up. We use data from the birth survey (response rate for age 0-4 interviews was 95%) and from the age 11 survey (response rate for age 5-15 interviews was 89%).

The 1958 National Child Development Study (NCDS) is a longitudinal cohort study that followed 17,416 children born in England, Scotland, or Wales during a week of March 1958. We use data from the birth survey (response rate 99%) and from the age 11 survey (response rate 88%).

The 1970 British Cohort Study (BCS) is a longitudinal cohort study that followed 16,571 children born in England, Scotland, or Wales during one week of April 1970. We use data from the birth survey (response rate 96%) and the age 10 survey (response rate 87%).

The Millennium Cohort Study (MCS) is a longitudinal cohort study that followed 19,244 children born between September 2000 and January 2002 in the England, Scotland, Wales, or Northern Ireland. The sample was selected from a random sample of electoral wards using a stratified sampling strategy to ensure the representation of all four of the UK countries, with an oversampling of disadvantaged and ethnically diverse areas. We used weights to account for the complex sampling design and non-response and overrepresentation of disadvantaged and ethnically diverse areas and the survey command to account for the clustering of samples within strata. In the analyses, we used data from Sweep 1 (response rate 82%), which was collected when the children were around nine months old; and from Sweep 5, which was collected when the children were around 11 years old (response rate 72%) (Plewis, Calderwood, Hawkes, Hughes, & Joshi, 2007) We refer to the MCS as the 2001 cohort study, since the majority of births in the sample occurred in 2001.

Variables

Cognitive ability: In each cohort, the dependent variable was a measure of verbal cognitive ability collected when the children were 10 or 11 years old (Moulton et al., 2020). In the 1946 and in the 1958 cohort studies, the verbal cognition was assessed based on the verbal score of the General ability test which was administered at age 11 (National Foundation for Educational Research) (Douglas, 1964). Children were tested individually by teachers. In the 1970 cohort study, the verbal cognition was assessed by a teacher using the Word Similarity subscale of the British Ability Scales (Elliott, Murray, & Pearson, 1978). In the 2001 cohort study, the verbal cognition was assessed by the interviewer using the Verbal Similarity subscale from the British Ability Scale (Second Edition) (Hansen, 2014). For the 1970 and the 2001 cohort studies we used scores that were standardised based on a normed pool of scores within three-month age ranges. For the 1946, 1958 and 1970 cohort studies, we adjusted for the children's age at interview. One of the strengths of this study lies in the fact that we relied on tests of cognitive ability that are comparable across the four birth cohorts, as they all measure verbal ability and were collected at similar ages. However, since different tests were administered in each cohort, we have standardised them to a mean of zero and a standard deviation of one.

Sibling status: Only children – defined here as cohort members who do not grow up **living** with siblings - were identified in each of the studies mainly based on information available at the age 10/11 interview. We focused on age 10/11 because it was considered to be late enough in the cohort members' life to capture the existence of younger siblings - as in the vast majority of cases siblings are not born more than 10 years apart - and also early enough that older siblings of cohort members would likely still be co-resident.

To identify the presence of siblings in the 1946 cohort study, we relied on fertility/childbirth history questions asked to the cohort members' mothers about live-born children born before or after the cohort child. In the 1958 cohort study, sibling status was defined based on whether the cohort member was reported as the mother's first birth at the time of the cohort member's birth, adjusted for cohort members who were twins or triplets, and whether at the age 11 survey the mother reported having had any subsequent births. If the information on subsequent births was missing from the age 11 interview, we categorized the cohort member as having siblings if the age 16 interview revealed the presence of siblings. In the 1970 cohort study, sibling status was defined based on whether the cohort members had any younger or older brothers or sisters

at age 11 interview (or twin/triplet siblings). The data in these three cohorts does not enable us to distinguish full and half-siblings. In the 2001 cohort study, sibling status was defined based on whether the cohort member had any full, half, step or adoptive siblings reported as living in the household at any sweep.

When looking at all those interviewed at age 10/11 (i.e. not focussing exclusively on this study's analytical sub-sample) 13.6% of those born in 1946 were only children, 6.8% of those born in 1958, 7.8% of those born in 1970 and 9.2% of those born in 2001. The general trend is similar to that of the proportion of women with one child only, as reported in official UK cohort fertility estimates (ONS, 2011). Estimates from other sources suggest the prevalence of one-child families has been relatively stable, fluctuating between 10 and 15% of women born between 1940 and the mid-1960s following a decline from over a fifth of women born in the early to mid-1920s (Breton & Prioux, 2009; Frejka & Sobotka, 2008).

In the analyses, we used the only-child variable as a binary indicator (only child vs. with siblings) and as a categorical variable (only child; one sibling; two siblings; three or more siblings).

Other variables: The other independent variables were a set of child and family characteristics collected during the first or age 10/11 survey of each cohort study. We used these variables to describe the socio-demographic selection into growing up as an only child and test whether it has changed over time, as well as to unpack the association between being an only child and cognitive ability. In terms of child characteristics, we considered the sex of the cohort child and his/her birth order i.e. the numerical order of the live birth (categories: first, second, third or higher) which is associated with cognitive ability (Barclay, 2015; Bjerkedal, Kristensen, Skjeret, & Brevik, 2007; Mare & Chen, 1986). In terms of family characteristics we considered the mother's education (binary indicator; 1946/1958/1970 cohort studies: whether the mother stayed in education until the minimum age; 2001 cohort study: whether the mother had degree-level education), the father's (1946/1958/1970 cohorts), or the family's social class (2001 cohort, the highest in the household) based on the Registrar General Social Class (categories in all cohorts: professional occupation, managerial and technical occupations, skilled non-manual occupations, skilled manual occupations, partly skilled occupations, unskilled occupations). We also considered maternal age at the cohort member's birth (categorical: <20, 20-24, 25-29, 30-34, 35-39, 40+) and the mother's marital status at birth (categories 1970/1958 cohort: married or single; categories 2001 cohort: married, cohabiting or single). To capture family instability, we considered whether the cohort members parents were living together (1946/1958/1970 cohort studies which did not collect direct information on marital status) or were married/cohabiting in the 2001 cohort study at age 10/11 interview. We use this variable as a proxy for parental separation. Finally, we considered whether the mother breastfed the cohort member for at least one month (binary indicator) and whether the mother smoked during pregnancy (binary indicator). We did not adjust for marital status at birth in the 1946 cohort study (since all cohort members were born to married mothers) and for smoking during pregnancy (since the variable was not collected).

Inclusion criteria and exclusions

We excluded from the analyses observations with missing values on any of the variables used in the analyses. In families with multiple births, we randomly selected one cohort child. These exclusions reduced the 1946 cohort sample to 3,288 observations (out of XX cases in the age 11 survey), 1958 cohort sample to 10,948 (out of 13,951 cases in the age 11 survey), the 1970

cohort sample to 8,799 (out of 14,350 cases in the age 10 survey), and the 2001 cohort sample to 11,805 observations (out of 13,287 cases in the age 11 survey).

Methods

In the first step of the analyses, we compared the family socio-demographic characteristics and the maternal health behaviours based on sibship status. The aim of this step is to show whether and, if so, how the selection into only child families has changed over time.

In the second step of the analyses, in order to analyse the association between being an only child and cognitive ability in childhood, we estimate a series of linear regression models. The analyses for the MCS are conducted using sample weighting and accounting for the complex survey design. All analyses are conducted in Stata 15.

We explore the association between sibship status and cognitive ability by estimating the following five models across the four birth cohorts:

- (0) $COGNITIVE\ ABILITY = \alpha + \beta_1 ONLY\ CHILD$
- (1) $COGNITIVE\ ABILITY = \alpha + \beta_1 SIBSHIP\ STATUS$
- (2) $COGNITIVE\ ABILITY = \alpha + \beta_1 SIBSHIP\ STATUS + \beta_2 BIRTHORD$
- (3) $COGNITIVE\ ABILITY = \alpha + \beta_1 SIBSHIP\ STATUS + \beta_3 SOCIODEM - HEALTH$
- (4) $COGNITIVE\ ABILITY = \alpha + \beta_1 SIBSHIP\ STATUS + \beta_2 BIRTHORD + \beta_3 SOCIODEM - HEALTH$

where *COGNITIVE ABILITY*, the dependent variable, is the z-transformation of the verbal ability score measured at age 10/11. In Model (0), the baseline model, we adjust for *ONLY CHILD* which is a binary indicator measuring if the cohort child is an only child or has siblings living in the household. In this model, we compare cohort members who are only children to all the cohort members with siblings combined into a single category. In subsequent models 1-4, we expand on this variable and categorize children with siblings based on the number of brothers/sisters they have. *SIBSHIP STATUS* is a categorical variable for the number of siblings the cohort member has (0,1,2,3+). In model 2, we adjust for *BIRTHORD*, namely the birth order of the cohort members in the family. In model 3 we adjust for *SOCIODEM-HEALTH* i.e. family socio-demographic characteristics (e.g., maternal age at the time of birth, level of education, marital status at the time of birth) and maternal health behaviours (smoking during pregnancy and breastfeeding). Finally, Model 4 is a fully adjusted model. The models that include adjustments for covariates are only partially comparable across cohorts, as in the 1946 cohort study we cannot adjust for all the variables we adjust for in the other cohort studies and there might be differences in the meaning of these variables across the different cohorts.

To explore whether the association between being an only child and cognitive ability varies by family instability, we run Model (1) interacting the sibship status variable by a binary indicator capturing whether the cohort members are living with both parents or only one parent at the age 10/11 interview (which we use as a proxy for parental separation). To explore heterogeneity in the association between being an only child and cognitive ability, we choose parental

separation/marital instability for two reasons. First, we chose separation because we know that parental separation is a proxy for social disadvantage and reduced resources available in the family and thus it enables us to compare only children who grow up in less resourceful environments from those who grow up in more resourceful environments. Second, because it enables us to distinguish at least part of the cases where the only childness is more likely to be the result of a choice (i.e. if the parents are together) from the cases where the only childness is less likely to be the result of a deliberate choice. Clearly, we do not argue that the distinction is perfect since the association between having an only child and parental separation could go in different directions and be explained by multiple mechanisms.

Results

The characteristics of only child families: have they changed over time?

Tables 1-4 show descriptive characteristics of the analytical samples by sibship size (0,1,2,3+ siblings) for each birth cohort. The aim is to describe the characteristics of only child families based on a number of socio-demographic characteristics and to investigate whether they have changed across the cohorts analysed.

Table 1 shows the results for the 1946 cohort study, where 13.3% of cohort members are only children. In terms of family socio-economic status, only children appear to fall in between cohort members with one or two siblings and cohort members with three or more siblings – the latter being the most disadvantaged. For example, the percentage of children with a father in the top social class category is 4.1% among only children, 7-8% for children with one or two siblings and 3.3% for cohort members with 3+ siblings. 4.8% of only children belong to the category where the father belongs to the lowest social class category, 3.1% amongst cohort members with one sibling, 5% amongst cohort members with two siblings and 11% amongst cohort members with 3+ siblings. The patterns by maternal education are similar. In terms of maternal age at the birth of the cohort member, only children are less likely than all the other groups to have a younger mother (<20 years). Differences in the other maternal age categories are not marked up until the mid-late thirties where only children are more likely to have a mother in the age category 35-39 compared to cohort members with one sibling and more likely to belong to the age category 40+ compared to the cohort members with one or two siblings. However, despite the differences in relative terms, the proportion of only children who have an older mother is small in absolute terms (4%). The results do not show substantial differences in the prevalence of the proportion of cohort members living with both parents at age 11 by sibship status and small differences in the percentage of mothers who breastfed their children by sibship size.

Table 2 shows the results for the 1958 cohort study, where 7% of cohort members are only children. In terms of socio-economic status only children – similarly to what we observe in the 1946 cohort study – fall in between cohort members with one or two siblings and cohort members with 3+ siblings. Only children show the lowest percentage in terms of parents being married at the time of the birth but in absolute terms the great majority (93%) of only children are born to married parents. In terms of maternal age at birth the results are in line with the 1946 cohort ones. Only children are the group whose mothers are the most likely to have smoked during pregnancy (although differences by sibship size are small) and the least likely to have been breastfed. In contrast to what we observe in the 1946 cohort study, only children show the highest percentage (10.1%) of cohort members who are not living with both parents at age 11 (either because they have not lived with both parents from birth or because they have

experience parental separation by age 11²) followed by children with 3+ siblings (9%) and cohort members with 1 or 2 siblings (5.7% and 5.9% respectively).

Table 3 shows the results for the 1970 cohort study, where 7% of cohort members are only children. In terms of social class, the results mirror those of the 1946 and 1958 cohort studies. In contrast, there are some visible differences when we look at other indicators. On one side, only children have mothers who are nearly as likely as mothers of cohort members' with one sibling to have stayed in school beyond the minimum age and well more likely than cohort members with three or more siblings. On the other side, differences by marital status at birth and at age 11 are considerably more pronounced compared to the 1946 and 1958 cohort studies. 83.5% of only children are born to mothers who were married at the time of birth versus over 90% in the other sibling groups. 24.4% of only children are not living with both parents at age 11, compared to 10-12% of cohort members in the other sibship groups. Only children also show considerably higher rates of having a mother younger than 20 at the time of birth (16.5% vs. 7-9% in the other sibship groups).

Table 4 shows the results for the 2001 cohort study, where 9.3% of cohort members are only children. The characteristics of only children in this cohort are similar to those of only children born in 1970. In terms of maternal education, they tend to be in between cohort members with one or two siblings and cohort member with three or more siblings. In terms of relationship at the time of birth and at age 11, they tend to be more disadvantaged – even more so than amongst children born in 1970. For example, 44% of only children are born to mothers who are married at the time of birth in contrast to over 60% in the other sibship groups. 24.6% of only children parents' are not cohabiting at the time of birth, in contrast to 13-14% of cohort members with one or two siblings. We observed similar disparities at age 11, where 37.9% of only children live with both parents who are married in contrast to 58-59% in the other sibling groups; 43% of only children live with a single parent, in contrast to 21-23% of the other sibship groups. In this cohort, only children are more likely to have young and well as older mothers.

Taken together the results show similarities as well as differences in the characteristics of only children across the birth cohorts analysed. On one side, the results show continuity in the socio-economic characteristics of families with only children over time who tend to be in between smaller and larger families. On the other side, only children become more 'represented' in categories which are usually associated with disadvantage: teenage mothers, children born to single parents and children who do not live with both parents at age 10/11 (McLanahan, 2004). The results suggest that, over time, the characteristics of only children have changed in a way that this group has become more heterogenous and thus disadvantaged.

The cognitive ability of only children

Table 5 shows the main model results exploring the association between sibship size and cognitive ability at age 10/11. The full model results are presented in Web Tables 1-4. Model (0) – which is unadjusted and compares only children to children with siblings grouped into one category – shows that in all the four cohort studies only children have higher cognitive ability scores than children with siblings. However, the results also show that there is a gradient in the association over time. Only children born in 1946 have cognitive scores 0.32 standard deviations (95% CI: 0.20-0.44) above cohort members with siblings whilst only children born

² We see from the birth sweep that this is not much higher than the proportion born to unmarried parents – so in this cohort separation appears to make a relatively small contribution to the % not living with both parents at age 11.

in the most recent cohort 2001 perform 0.08 standard deviations (95% CI: 0.01-0.15) above cohort member who grow up with siblings. The confidence intervals around the 1946 and 2001 estimates do not overlap, leading us to conclude that the association between being an only child and cognitive ability at age 11 has weakened over time in the U.K. The results for 1958 and 1970 fall in between the 1946 and 2001 results and their confidence intervals also do not overlap with those of the 2001 cohort study, providing further evidence of the cross-cohort decline.

Model (1) is also unadjusted but this time cohort members with siblings are divided up based on their sibship size (1,2,3+), with only children as the reference category. These results, shown in Figure 1, help us to further understand how only children perform relative to children with siblings. In all the cohort studies, only children have cognitive scores that are at par with the scores of cohort members with one sibling (i.e. two child families). The differences are small or inexistent and not statistically significant. The differences between only children and children with siblings become larger as the number of siblings increases. In the 1946, 1958 and 1970 cohort studies only children perform significantly better than cohort members with two siblings. In 1946 cohort members with two siblings perform 0.25 standard deviations (95% CI: -0.39;-0.12) below only children; in 1958 they perform 0.11 standard deviations (95% CI: -0.19;-0.04) below and in 1970 they perform 0.3 standard deviations (95% CI: -0.38;-0.21) below only children. In contrast, differences between only children and children with two siblings in the 2001 cohort study are substantively small. Finally, only children outperform cohort members with three or more siblings in all the cohort studies. These are the largest differences in all the cohort studies but the pattern shows a gradient over time. In 1946, cohort members with three or more siblings perform 0.59 standard deviations (95% CI: -0.72;-0.45) below only children whilst in 2001 they perform 0.35 standard deviations (95% CI: -0.45;-0.24) below only children. Hence, differences between only children and the largest sibship size category have declined over time.

Adjusting for birth order in Model (2) partially attenuates the differences in cognitive outcomes between only children and cohort members with two or three siblings. This finding suggests that the differences in scores between only children and cohort members growing up with two or more siblings is at least partially explained by the fact that the latter are overrepresented in higher order births, which is associated with worse cognitive performance. As shown in Tables 1-4, the proportion of first-borns declines with increasing sibship size. Like in Model (1), in Model (2) differences between only children and cohort members with one sibling are not statistically significant.

In Model (3) we include adjustment for family socio-demographic characteristics. The results show that the differences in cognitive scores between only children and cohort members with three or more siblings are attenuated in all the cohort studies and that the attenuation is similar in magnitude to what we observe when we adjust for birth order in Model (2). In contrast, the difference in cognitive outcomes between only children and cohort members with two siblings is unchanged (if anything a bit larger) compared to Model (1). This finding is in line with the descriptive results showing that only children's socio-demographic characteristics are in stark contrast to those of cohort members with three or more siblings but tend to be (more) similar to those of cohort members with two siblings.

In the fully adjusted Model (4), compared to Model (1), differences between only children and cohort members with three or more siblings are attenuated by nearly 60% in the 1946 and 1958 cohort studies, by 35% in the 1970 cohort study and by 80% in the 2001 cohort study. Differences between only children and children with two siblings are also attenuated and no longer significant in all cohort studies except the 1970. Taken together, this first set of results show that only children, on average, show higher cognitive scores than children who grow up with siblings but also that the advantage has weakened over time. They also show that the only-child advantage varies when one disaggregates the group of cohort members with siblings based on sibship size. In all the cohort studies, only children perform similarly to cohort members who grow up with one sibling and better than cohort members who grow up with two or more siblings – but again differences appear to be smaller in the 2001 cohort study compared to the rest. Finally, within each cohort study, differences in the cognitive outcomes between only children and other sibship groups are attenuated on adjustment by family socio-demographic characteristics.

To address the second aim of this study, that is if the association between being an only child and cognitive ability is heterogenous according to family structure, we run Model (1) including an interaction term between the sibship status variable and whether the cohort member is living with both parents at age 10/11. For ease of exposition, we refer to cohort members who are living with both parents at the age 10/11 interview as children who have not experienced parental separation and to cohort members who are not living with both parents to have experienced parental separation.³ The predicted scores obtained from running this model are presented in Figure 2. The results show that, in all the cohort studies, cohort members who at age 10/11 are not living with both parents have lower cognitive scores compared to their counterparts living with both parents. In the 1946 cohort study, the differences are smaller and not statistically significant which could be due to the low prevalence of parental separation in this birth cohort and the fact that children born to unmarried mothers were excluded from the study. In contrast, differences in the 1958, 1970 and 2001 cohort studies (with the exception of the group with 3+ siblings where differences are statistically significant only for the 1958 cohort study) are statistically significant – showing evidence in line with the large body of work on the disadvantages associated with not growing up with both biological parents (McLanahan, 2004). Only children exposed to parental separation show significantly lower cognitive scores compared to only children who at age 10/11 live with both parents. On one side, the results underscore the importance of considering the broader context in which only childness takes place. Except in the 1946 cohort study, parental separation – through its determinants and/or consequences for household income - appear to play a larger role in explaining variation in cognitive outcomes than the number of siblings a child has. In other words, the results show that an only child who has experienced parental separation is unlikely to outperform children who are part of larger sibship groups but who grow up with both parents. On the other side, *conditional* on parental separation i.e. within the parental separation groups, only children perform similarly to cohort members with one sibling, often better than cohort members with two siblings and consistently better than cohort members with three or more siblings. Although

³ There could be other reasons explaining why cohort members are not living with both parents at age 10/11 such as parental death, single parenthood since birth, or one of the parents living elsewhere. We think parental separation or single parenthood are the most likely cause. The numbers would be too small to further disaggregate the only child category by whether the cohort member has been living with a single parent since birth or has experienced parental separation from birth to age 10/11.

this pattern is generally in line with the one observed in the main model results, the results (supported by Appendix Figures 1 and 2) for the 2001 cohort study are more aligned to those of the other cohort studies compared to Figure 1. In the 2001 analyses stratified by parental separation only children have significantly higher cognitive scores than cohort members with two siblings and show larger (closer to the rest of the birth cohorts) differences compared to cohort members with three or more siblings. The results therefore suggest that once we take into account the fact that there is a higher level of parental separation in the only child group in the 2001 cohort compared to the previous cohorts, cross-cohort differences in the association between being an only child and cognitive ability are attenuated. In other words, the degree of parental separation – or its determinants and consequences for resources available in the family - in the only child group could moderate the association between sibship size and cognitive outcomes.

Whilst the slopes of both lines are consistent with the tenets of the resource dilution and confluence theories, that is children benefit from not sharing resources with siblings and by being exposed to an adult only intellectual environment, the results also show that – in each sibship size group - there is a substantial drop in cognitive scores when the number of parents in the household drops from two to one such that being an only child is a less resourceful environment is not associated with higher cognitive scores compared to growing up with two siblings in a more resourceful environment. The findings expose the limitations of these theories when applied to only children i.e. in treating only children as a uniform group and in not explicitly accounting for the overall level of resources available in the family: how many siblings a child shares resources with might matter, but possibly less so than the level of overall level of resources available. Taken together, the findings reinforce the idea that selection into being an only child matters in explaining the link between only childness and cognitive ability, possibly more than the only child status per se. The results therefore caution us in extrapolating results from one group of only children to other groups of only children – being an only child reflects a multitude of different experiences and selection processes which matter for development and, importantly, which might vary over time.

Additional analyses

- MCS with adjustment for ethnicity: results virtually identical
- Transform outcomes into percentiles – results consistent
- Age 5 outcome BCS and MCS: only children have better outcomes than children with siblings, consistent with results at age 10. However, there are no differences between the two cohorts.

Conclusions (not yet developed)

- Importance of studying this topic/motivation for the paper
- The reasons for the inconsistencies in existing research are still not fully understood and many fundamental questions and gaps in knowledge remain about the well-being of only children.
- Results
 - Is being an only child a disadvantage and has the advantage/disadvantage changed over time?
 - The answer is that it ‘depends’
 - The characteristics of only child families have changed over time and the advantage has weakened.
 - How much of an advantage changes over time
 - why
 - Only children show higher scores but the association is nuanced – even in a context where it is consistently positive, the strength of the association varies over time.
- Implications
 - Go back to the discussion on the theories on only children. Limitations around the application of the RD and confluence theories to only children
 - Conditional resource dilution (but term already used to consider contextual factors).
 - Being an only child is not a timeless concept but one that varies and is conditional to time and location i.e. the demographics of only-child families.
 - We should not generalise findings from one study/context/time period to all only children
 - Heterogeneity in the only child category even with the same context and during the same time period
 - Fixed effects research
- Why are the negative stereotypes persisting? How can we challenge them?
 - Stereotypes concerning because of the views that society can have towards only children if
 - Parents have a second child mainly to avoid first born being maladjusted
 - Schools/teachers treat only children differently – which can have effects on their development
 - If they are held by mental health clinicians (Mancillas). There is evidence that clinicians have negative stereotypes against only children (Steward 2004 cited in Mancillas)
- Although it is often not possible to distinguish one child families formed by choice or by circumstance, the perceptions of outsiders of the reasons underlying the decision may be important in determining how the decision is regarded.
- Expand work by looking at Eastern European countries where only child families have become more prevalent.
- Strengths/limitations
 - Results not generalizable to other contexts because they show uniqueness of only child status in a specific context and time period.
 - What is generalizable is that it is not advisable to generalize on this group

The U.K. context

- For example, in the U.K. 18% of U.K. women who were born around 1970 had one child, in contrast to 13% who were born around 1945 (i.e. their mothers' generation) (ONS 2011, 2017).

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