Children's Socio-Emotional Skills: Is There a Quantity-Quality Trade-off?

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Child's Socio-Emotional Skills: Is There a Quantity-Quality Trade-off?*

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Abstract

Though it is largely admitted that non-cognitive skills matter for adult outcomes, little is known about how the family environment affects their formation. In this paper, we use a cohort study of children born in 2000-2001 in the U.K. (*Millennium Cohort Study*) to estimate the effect of family size on socio-emotional skills, measured by the Strengths and Difficulties Questionnaire. To account for the endogeneity of fertility decisions, we use a well-known instrumental approach that exploits parents' preference for children's gender diversity. We show that an increase in family size negatively affects the socio-emotional skills of the two first children in a persistent manner. However, we show that this negative effect is entirely driven by girls. We provide evidence that this gender effect is partly driven by an unequal response of parents' time investment in favor of boys and, to a lesser extent, to an unequal demand for household chores.

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1 Introduction

It is now largely admitted that non-cognitive skills are key determinants of adult outcomes. Over the last 15 years, several studies have shown that they are as important as cognitive skills in determining a variety of outcomes such as educational attainment, labour market outcomes, crime rates and health outcomes (Nyhus & Pons 2005, Heckman *et al.* 2006, Conti *et al.* 2010, Lindqvist & Vestman 2011, Cobb-Clark & Tan 2011, Fletcher 2013). A recent study by Deming (2017) shows that the returns of non-cognitive skills on the labour market are even greater for more recent cohorts.

Childhood is generally considered as a critical period in the acquisition of these skills. Due to complementarities across periods, high levels of skills in childhood make investments at later stages in life more productive (Cunha & Heckman 2007). While the literature explored extensively the childhood determinants of cognitive skills, very little is comparatively known about the determinants of the formation of non-cognitive skills. We already know that the latter is influenced by maternal time (Del Bono *et al.* 2016), parenting style (Fiorini & Keane 2014), maternal education (Carneiro *et al.* 2013), and family income (Fletcher & Wolfe 2016). Björklund & Jäntti (2012) and Grönqvist *et al.* (2017) show evidence in line with the existence of an intergenerational transmission of non-cognitive skills. Finally, Black *et al.* (2017) show that birth order predicts socio-emotional skills and occupational choices.

We complement these results by asking whether the family size influences the formation of children socio-emotional skills. The popular quantity-quality model (Becker 1960, Becker & Lewis 1973, Becker & Tomes 1976) and the resource dilution theory are often used in the literature to explain the negative correlation between family size and childhood outcomes (Bjorklund & Salvanes 2011). However, the number of work rejecting a quality-quantity trade-off regarding the formation of cognitive skills based on quasi-experimental variations is growing (Black *et al.* 2005, Cáceras-Delpiano 2006, Angrist *et al.* 2010, Aslund & Grönqvist 2010, Angrist *et al.* 2010, Black *et al.* 2010). Note that Black *et al.* (2010) find a negative effect of an increase in family size instrumented by twin-birth while Aslund & Grönqvist (2010) find a small negative impact on children grades in compulsory and secondary school, but only for vulnerable children, as defined by low parental education, large sibships and high birth order.

We here check whether an increase in family size has a negative impact on the accumulation

of non-cognitive skills, as predicted by the Beckerian quantity-quality model and the resource dilution theory. The net effect of an increase in family size is ambiguous because one may as well expect social interactions between siblings to affect the acquisition of non-cognitive skills. An extensive literature in psychology demonstrates that sibling relationships can, depending on the context, lead to either more aggressive behaviours (Slomkowski *et al.* 2001, Stauffacher & DeHart 2006) or warmer attitudes that foster the development of social skills (Volling & Belsky 1992, Stormshak *et al.* 1996).

We empirically address this question by using a longitudinal dataset on children born in 2000-2001 in the UK, namely the *Millennium Cohort Study*, to study the effect of an increase in family size on the formation of socio-emotional skills. The main identification challenge is that fertility decisions are unlikely to be randomly distributed across families. Indeed, these decisions depend on both observable and unobservable family characteristics, such as parents' socio-economic status, their life satisfaction, their own non-cognitive skills or parenting style, that are likely to be correlated with the formation of socio-emotional skills during childhood. To account for the endogeneity of fertility decisions, we use a well-known instrumental approach developed by Angrist & Evans (1998) which exploits the fact that parents whose first two children have the same sex have a higher probability to have an additional child than parents with children of opposite sex. Contrarily to most of the studies using this instrumental approach, we are able to follow children over time and to observe how they behave *before* and *after* an increase in family size. The richness of this cohort study data enables us to confirm that there is no pre-existing differences between children from families whose first-two children are of the same sex and children from families whose first-two children are of opposite sex.

Using the parental preferences for child sex variety as a quasi-natural source of variation in fertility decisions, we show that an increase in family size negatively affects the formation of socio-emotional skills for both the first and the second born. We especially find that this effect is stronger when the birth occurs when the children are young (below age 6). More surprisingly, we find no effect of family size for boys: the negative effect of an increase in family size is entirely driven by girls. Investigating the potential mechanisms at play, we provide evidence that this differential effect across gender is partly driven by an unequal response of parents' time investment in favor of boys and, to a lesser extent, to an increase in

the demand for household chores for girls. We also show that the negative effects of family size persist even 9 years after the event.

To the best of our knowledge, two works are close to ours. Using different methods and respectively British and US data, Silles (2010) and Juhn *et al.* (2015) find negative associations between family size and the development of non-cognitive skills of children. Our paper contributes to the literature on several key aspects. First, we make use of the Strengths and Difficulties Questionnaire, a well-established measure in Psychology, to study separately two distinct dimensions of non-cognitive skills: behavioural skills and emotional skills. As shown in Layard *et al.* (2014) and Clark & Lepinteur (2019), behavioural and emotional skills have different influences on future adult outcomes (e.g. unemployment experience, educational attainment, well-being...). Second, we use an instrumental variable approach to estimate the causal impact of family size on the different dimensions of the Strengths and Difficulties Questionnaire and provide a thorough examination of the potential sources of heterogeneity and channels. More specifically, we are the first to show a family-size penalty for girls regarding the development of both behavioural and emotional skills. We explain such penalty by exploring channels already investigated in Juhn *et al.* (2015), i.e. parental investment, but we also provide evidence of a new channel: as family size increases, girls tend to be more likely to perform household chores. Finally, Silles (2010) and Juhn *et al.* (2015) rely respectively on generations born in 1958 and at the end of the 1980's, respectively. Our paper provides evidence for a much younger cohort, the Millennium Cohort born between 2000-2001, for whom the acquisition of non-cognitive skills is of higher importance than previous generations (Deming 2017).

The remainder of the paper is organized as follows. Section 2 describes the dataset and the main measure of socio-emotional skills exploited in this paper. Section 3 presents our instrumental approach and provides evidence on the validity of the identifying assumption. Section 4 shows the effect of an increase in family size on children non cognitive skills. The final section concludes.

2 Data and the measurement of socio-emotional skills

2.1 The Millennium Cohort Study

The estimation sample used in in this paper is based on the *Millennium Cohort Study* (MCS). This longitudinal birth cohort study tracks the lives of 19,517 children born in the UK between 2000 and 2001. One of the main advantages of the MCS is that it covers children from all the United Kingdom. The sample was designed in order to be representative of the total population of all regions of the United Kingdom, but also to provide enough observations to study ethnic minorities, and areas of high child poverty.

Since the beginning of the survey, the cohort members have been surveyed six times: at age nine months, three, five, seven, eleven and fourteen years. Interviewers visited the cohort members' homes and conducted face-to-face interviews with both resident parents. Parents also answered some questions via self-completion. The survey has collected rich information on the family background (parental education, parental health, parenting activities), on the family structure (family composition, employment and income) and on diverse aspects of the lives of the cohort members (health, schooling, well-being, cognitive and non-cognitive development).

2.2 Measuring Socio-Emotional Skills

Our measures of socio-emotional skills come from the Strengths and Difficulties Questionnaire (henceforth SDQ). The SDQ is a behavioural-screening questionnaire for children about 3 to 16 years old and consists of 20 questions that are answered by an adult regarding the child's concentration span, temper tantrums, happiness, worries and fears, whether the child is obedient, often lies or cheats...

The answers to these questions can be used to produce four sub-scales (each consisting of five items) referring to emotional health, behavioural problems, hyperactivity/inattention and peer-relationship problems. Following Goodman *et al.* (2010), we use two broader subscales: the *externalising* and *internalising* behaviour. The internalising behaviour score is the sum of the emotional and peer subscales, and can be argued to measure emotional health, while externalising behaviour is made up of the behavioural problems and hyperactivity subscales and refers to behaviour (see Table A.1 for a complete description of the questionnaire). Both

internalising and externalising SDQ are scored on a 0-20 scale; we reversed the scales so that higher values indicate better outcomes. The outcomes are standardized by age for a mean of zero and a standard deviation of one.[1] The SDQ in MCS is reported by the primary care giver in waves 2 to 6 (age 3 to 15).[2]

The SDQ is a popular measure of socio-emotional skills that has been developed by psychologists. An extensive literature in this discipline provides evidence regarding its validity and predictive power[3]. The SDQ reported by primary caregiver is highly correlated with different measures of non-cognitive skills such as the Rutter questionnaires (Goodman 1997), the Child Behaviour Checklist (Goodman & Scott 1999) and clinician-rated Health of the Nation Outcome Scales for Children and Adolescents Mathai *et al.* (2003). We here follow Clark *et al.* (2019) and interpret respectively the externalising SDQ and the internalising SDQ as measures of "Behavioural Skills" and "Emotional Skills".

Over recent years, economists have widely exploited this measure (Gupta & Simonsen 2010, Nghiem *et al.* 2015, Fleche 2017, Kuehnle & Oberfichtner 2017, Attanasio *et al.* 2018, Cornelissen & Dustmann 2018). Using the socio-emotional skills reported by the mother during childhood based on the SDQ questionnaire, recent studies show that socio-emotional skills are the most important predictors of adulthood life satisfaction (Layard *et al.* 2014, Clark *et al.* 2019) and of labour market outcomes: Clark & Lepinteur (2019) demonstrate that better socio-emotional skills in childhood reduce significantly the time spent unemployed during active-life.

3 Empirical Strategy

3.1 Instrumental strategy: parents' preference for children sex diversity

Our objective is to estimate the impact of an increase in family size on the development of children socio-emotional skills between age 3 and 15. The main identification challenge is that fertility decisions are unlikely to be randomly distributed across families. Indeed, these

[1] We replicated our analysis with the raw score of SDQ and found no difference with the estimates displayed in this article. Results are available upon request.

[2] The non-cognitive skills are also measured by teachers, but it is provided only for the fourth wave. Moreover, parents had to give their consent which drastically reduces the sample size and raises concerns of selection regarding the remaining observations (see Cornelissen & Dustmann 2018).

[3] See Pike *et al.* (2006) and Hartas (2011) for a longer discussion

decisions depend on both observable and unobservable family characteristics (parents' socio-economic status, parenting style, parents' life satisfaction or their non-cognitive skills) that are likely to be correlated with the formation of socio-emotional skills during childhood.

To account for the endogeneity of fertility decisions, we use an instrumental variable (IV) approach developed by Angrist & Evans (1998). Under the assumption of parental preferences for children sex diversity, parents whose two first children have the same sex have a higher probability to have an additional child than parents with two children of opposite sex. Since the sex of a child is random by nature, the sex composition of the two first children is arguably randomly distributed across families with two children. While this instrument has been used extensively in the literature to assess the impact of family size on a variety of outcomes (Angrist *et al.* 2010, Black *et al.* 2010, Cools & Hart 2017), we provide additional evidence on the validity of this instrument in the subsection 3.3.

We consider here families with two children in wave two and we instrument an increase in family size (i.e. the birth of a third child) in waves three to six by the sex composition of the two first children. We first note t_0 our initial period of observation (i.e. wave two). Given our instrumental approach, we restrict our initial sample to families with two children in t_0, and we construct an instrumental variable $same\ sex_{i0}$ that equals one if the two first children in the family have the same sex and zero if they are of opposite sex. Note that our instrumental variable $same\ sex_{i0}$ is time-invariant; hence, we cannot use individual or family fixed-effects. We then use $same\ sex_{i0}$ as an instrument for an increase in family size (i.e., the birth of a third child) in subsequent waves. We use wave two only to construct our instrument and all regressions are estimated using wave three to six. Wave two can here be seen a "pre-treatment" period. Formally, we estimate the following model using a Two-Stages Least Squares (2SLS) procedure:

$$Third\ Child_{it} = \alpha_1 same\ sex_{i0} + \gamma_1 X_{it} + \delta_t + \beta_1 Y_{i0} + \epsilon_{it}$$

$$Y_{it} = \alpha_2 \widehat{Third\ Child}_{it} + \gamma_2 X_{it} + \delta_t + \beta_2 Y_{i0} + \mu_{it} \tag{1}$$

where $Third\ Child_{it}$ is a dummy equal to one if there is a third child in the family, i.e. if the birth of a third child took place in child i's family between t_0 and t, with $t > t_0$.[4] Y_{it}

[4] We also instrumented the family size in an alternative specification and found results that are qualitatively comparable.

represents the socio-emotional skills of child i in period t. X_{it} is a vector of controls including children individual characteristics (sex, age, birth order, month of birth, age of the mother at birth) and family characteristics (income, marital status, presence of the father, age of mother at first birth).[5] Finally, δ_t is the full set of wave dummies.

Since our measures of children socio-emotional skills are reported by the mother, one may worry about the existence of reporting-biases correlated with the decision to have a third child. To tackle this issue, we control for children socio-emotional skills in t_0 in both equations. The introduction of this term, noted Y_{i0}, is sufficient to neutralize mothers' reporting bias under the assumption that this bias is constant over time. Note that we replicated our empirical analysis without including Y_{i0} and results, available upon request, are similar.

3.2 Estimation sample

Given that our instrumental variable strategy is based on the sex composition of the two first children, we restrict the analysis to children from families with two children in our initial period of observation (t_0). We then keep all observations from this sample for which the dependent variables, the sex composition of the first two siblings as well as the set of controls are non-missing, from the third to the sixth wave.

In total, this produces an initial sample of 5,983 children coming from 5,907 families in t_0. Table A.2 reports descriptive statistics on children and family characteristics for all cohort members included in our initial sample. The average (reversed) total SDQ is 30.77 and the average behavioural skills (externalising SDQ) and emotional skills (internalising SDQ) are respectively equal to 13.46 and 17.31. Children are on average 3.15 years old in t_0, and female cohort members represents half of the estimation sample.

We then track all the cohort members from our initial sample to create our estimation sample[6]. This produces an estimation sample of 20,131 observations. Table 1 reports descriptive statistics on children and family characteristics for all cohort members included in our initial sample. The average (reversed) total SDQ is now 32.08. This is unsurprisingly slightly

[5] One may wonder why we do not control for the birth-spacing between the two-first born. As we already control for the age of the mother at the birth of the cohort member and the age of the mother at the first birth, the birth-spacing is a linear combination of these two variables for second born (60% of our estimation sample) and this is why we chose not to control for it in our main analysis. Note that we also replicated our results controlling for the birth-spacing and results remain the same.

[6] This sample thus corresponds to the same children observed at periods $t > t_0$

higher than in wave two since the SDQ score gets better when children grow up (Meltzer *et al.* 2003). This is mostly explained by a drop in behavioural issues, as revealed by the increase in behavioural skills' score (see Table A.2 and Table 1). Figures 1 and 2 respectively display the distribution of total SDQ of the estimation sample and the distribution of internalising and externalising SDQ. The values of the different types of SDQ are skewed towards high values and indicates that primary care givers reports on average a limited number of behavioural and emotional problems. The distributions of total SDQ, internalising SDQ and externalising SDQ are consistent with previous findings from the literature in Psychology (Meltzer *et al.* 2003).

Note that 4,439 cohort members are left in our estimation sample in wave six. This implies that we lose about a quarter of the initial individuals by the end of the period of observation. This may look like a large attrition rate but it is standard with cohort studies (see Mostafa & Ploubidis 2017, for technical details regarding attrition in MCS). We address the concerns due to attrition with two different methods: first we replicated our analysis using attrition weights and second using only children observed in every waves. Our conclusions always remain the same and let us think that attrition has little to do with our results (see Table A.4 for detailed results).

3.3 Instrument validity

Our instrumental approach relies on the assumption that parents with two children of the same sex are more likely to have a third child with respect to parents who had two children of different sex (as in Angrist & Evans 1998). The key identification assumption here is that having a sibling of the same sex or having a sibling of the opposite sex has no direct effect on children socio-emotional development. While we cannot directly test our exclusion restriction, we provide evidence that there is no pre-existing difference between children from families with two children of the same sex and children from families with children of opposite sex. To do so, we check that there is no imbalance between the two kinds of families in terms of individual and family characteristics in t_0, *before* any potential birth has occurred in subsequent periods. According to Table A.5 in Appendix, there is no significant difference between the two types of families regarding both children socio-emotional skills and a large set of characteristics. These balancing tests suggest that growing up with a sibling of the same sex or with a sibling

of a different sex is orthogonal to the development of non-cognitive skills of a child and to other family characteristics potentially influencing these skills. [7]

To make sure that our instrument only reflects a parental taste for diversity in the gender composition of the children and not an absolute taste for a specific gender, we regress the probability to have a second child in $t \geq t_0$ on a dummy that equals one if the first child is a female on the sample of families with one child in wave two. The estimate in Table A.6 shows that the sex of the first child has no effect on the probability to have a second child: MCS parents do not have absolute preference for a specific gender. [8]

4 The effect of Family Size on children Socio-Emotional Skills

4.1 Main Results

Before discussing the effect of an increase in family size on children socio-emotional skills, we first ask whether our instrument produces sufficient exogenous variation in fertility decisions. To address this issue, we look at the estimate of the first stage in the top panel of Table 2. Consistently with previous findings from the literature, our instrument $same\ sex_{i0}$ predicts a statistically significant increase in the probability of having a third child. Note that we also display the Cragg-Wald-F-Statistics at the bottom of Table 2 and they are always

[7] We constructed an additional test to provide further evidence on the absence of direct effect of growing up with a sibling of the same sex on children non cognitive development. To construct this test, we restricted our sample to families with two children of opposite sex in t_0 who will have a third child in subsequent waves, and we look at the effect of having a third sibling of the same sex (as compared to having a third sibling of the opposite sex) on children socio-emotional skills, exploiting the fact that the sex of the third child is random. This allows us to capture the effect of having a sibling of the same sex keeping the family size constant. Results, available in Table A.3, indicate that children in families with two children of opposite sex in t_0 and who experience an increase in family size in subsequent periods are not affected by the sex of the third child. Again, it suggests that the gender composition of the siblings has no direct impact on children non cognitive development. Having a brother might have a negative effect for boys, in that case, we would over-estimate the effect of family size on boys.

[8] Another way of instrumenting the family size is to use Twin as suggested by Angrist & Evans (1998). When implementing such instrumentation strategy, the F-stat is around 2. Indeed, the limited number of multiple births reduces our statistical power (we observe less than 1000 twin). The instrument is therefore to weak to be able to draw any strong conclusion. For the matter of comparisons, this method has been used in Black *et al.* (2005), Cáceras-Delpiano (2006) and Aslund & Grönqvist (2010) with estimation samples 16 to 40 times larger. Note that we also investigated the possibility to use *in vitro fertilisation* treatment as in Lundborg *et al.* (2017). However, we can only observe whether the mother "already received a fertility treatment" before the birth of the cohort member. In line with our suspicions, this measure is not precise enough to capture a significant variation in the probability to have a third child. We do not find a significant correlation between the probability to have a third child and the exposure to past fertility treatment and the F-stat is roughly equal to 0.7. All our results using the different instrumental variables are available upon request.

greater than 10 which is usually considered as a rule of thumb to discard weak instrument concerns.

Table 2 shows the effect of an increase in family size on children socio-emotional skills based on the estimation of equation (1) using our estimation sample. As can be seen in column (1), an increase in family size produces a statistically significant decrease in total SDQ of 0.650 point of a standard deviation. This is equivalent to twice the estimate we found for the dummy "not having the natural father in the household anymore".

One may suspect the internalising and externalising SDQ to respond differently to a change in family size. Columns (2) and (3) of Table 2 address this concern by reporting the effect of an increase in family size separately on behavioural skills and emotional skills. While only the estimate on emotional skills is statistically different from zero, the magnitude of the two estimates remains comparable.[9] We also look at the impact of having a third child on each sub-component of SDQ in Table A.8. The dimensions "hyperactivity" and "emotion" are the one that are significantly affected by the change in family size. The other estimates are also negative but not significantly different from zero at conventional levels.

The negative effects of an increase in family size on children non cognitive development outlined in this paper are consistent with the idea that parents have a limited amount of resources (time and money) to invest in their children (Becker 1960, Becker & Lewis 1973, Becker & Tomes 1976). The birth of a new child in the family may reduce parental resources from previous children who may, in return, end up with lower socio-emotional skills.

4.2 Heterogeneity Analysis

The average causal effect of an increase in family size is significantly different from zero at 10% level. This is a conventional level but it may also mix groups of children whose accumulation of non-cognitive skills is more sensitive to changes in family size than others. In this section, we then ask whether the effect of family size differs across different groups. We define T as a dummy equal to one if the child belongs to a sub-group of interest, zero otherwise. Following the method described in the Chapter 6 of Wooldridge (2002) we use an interaction term, instrumented itself by the interaction of the instrument *same sex* and T.

[9] We report the OLS estimates for the same estimation sample in Table A.7 in Appendix. While the estimates are qualitatively consistent to the one shown in Table 2, the OLS coefficients are much smaller and reveal a positive selection of the parents.

Formally, we estimate this model:

$$Third\ Child_{it} = \alpha_1 same\ sex_{i0} + \gamma_1 X_{it} + \delta_t + \beta_1 Y_{i0} + \epsilon_{it}$$

$$Third\ Child_{it} \times T_{it} = \alpha_2 same\ sex_{i0} \times T_{it} + \gamma_2 X_{it} + \delta_t + \beta_2 Y_{i0} + \epsilon_{it}$$

$$Y_{it} = \alpha_3 \widehat{Third\ Child}_{it} + \alpha_3 \widehat{Third\ Child}_{it} \times T_{it} + \gamma_3 X_{it} + \delta_t + \beta_3 Y_{i0} + \mu_{it} \quad (2)$$

Note that, once again, the F-Statistics remain larger than 10 in every cases (see the bottom of each Panel in Table 3) and confirm that our identification strategy is not subject to weak instrument concerns. We also used a sample-split approach and found consistent results that are available upon request. We finally report the main estimates per sub-scale of SDQ in Table A.9.

4.2.1 The Effect of Family Size by Birth Spacing

We here ask whether the effect of family size depends on the age of the cohort member at the moment of birth of the third child. In this section, T is a dummy equal to one if the child is at least six years old at the moment of the birth of the third child. T can be seen as birth spacing. The resources of the parents being limited, an increase in the family size is likely to reduce the amount of resources per child and as such limit the development of non-cognitive skills. But the effect of limited parental resources could differ at different stages of childhood. Several studies highlight the importance of parental time in early childhood (see Del Bono *et al.* 2016, Del Boca *et al.* 2017, Cunha & Heckman 2008) and Cunha *et al.* (2010) emphasizes the existence of sensitive periods in the formation of non-cognitive skills.

The first column of Panel A in Table 3 shows that the birth of an additional sibling has a much stronger - and negative - effect for cohort members below age six at the moment of birth. The reduction in total SDQ is of 0.8 standard deviation approximately. The interaction term attracts a positive and significant estimate. This means that cohort members who were more than six years old at the time of the birth are significantly less affected than cohort members who were younger at the time of the birth. The sum of the two estimates is reported at the bottom of the Panel A. While the effect of a birth is statistically lower for cohort members who were at least six years old at the birth of their new sibling, the net effect of the birth on total SDQ remains negative and significant. We observe a similar pattern in columns (2)

and (3) when we separately consider behavioural and emotional skills. To better understand this differential effect, we decompose SDQ into its four original subscales that are "conduct", "hyperactivity", "emotion" and "peer", and re-run our main regression. Results in Panel A of Table A.9 reveal that this effect is mainly driven by the hyperactivity and the emotional issues.[10] These results are in line with the literature showing that early childhood is a key period in the development of socio-emotional skills.

4.2.2 The Effect of Family Size by Birth Order

We know that first-born children have on average better educational attainments (Black *et al.* 2005). Moreover, the main results outlined in section 4.1 might confound heterogeneous responses due to birth order. This is why we ask whether the effect of family size is the same for the first and the second born. T here is a dummy equal to one if the child is a second born and zero otherwise.

As revealed by the Panel B of Table 3, while having a third child negatively affects both the total SDQ and the two SDQ subscales of the first two children, the interaction term do not attract significant estimate. There is then no difference in terms of birth order and our results above were only reflecting an age-at-birth effect. The absence of heterogeneity regarding birth order is also in line with Price (2008) findings. Parents allocate the same amount of time at each child at any point in time, therefore, first born and second born will have the same amount of time and consequently face the same decrease in parental time. Looking more precisely at behavioural skills and emotional skills in columns (2) and (3), it seems that first born suffer more from a birth when we look at their emotional skills, but less when we look at their behavioural skills. Considering the four original subscales ("conduct", "hyperactivity", "emotion" and "peer"), results of Panel B in Table A.9 suggest that the larger effect on second born's behavioural skills is largely driven by hyperactivity issues, while first born are more affected when we look both at emotional and peer problems.

4.2.3 The Effect of Family Size by Child's Gender

We now ask whether an increase in family size affects the accumulation of non-cognitive skills of boys and girls differently. To do so, we assign a value of one to T if the cohort member

[10] In addition to this, we consider the birth spacing as a continuous variable; we find similar results suggesting a null effect of having a third child in the household above the age of 6.

is a girl and zero if the cohort member is a boy.

Results in the Panel C of Table 3 are appealing: we find negative and statistically significant estimates only for girls. The effect of family size is positive but not statistically different from zero for boys. Looking at the four original subscales that are "conduct", "hyperactivity", "emotion" and "peer", results in the Panel C of Table A.9 reveal that the difference between girls and boys is mostly driven by a higher sensitivity of "hyperactivity" and "peer" issues of girls to increases in family size. Note that we also find a positive and significant effect for boys in the "peer" scale, which supports the idea that boys have better relationships with children of the same age when they have a new sibling[11].

This is the first piece of evidence of a gendered effect of family size on the development of socio-emotional skills[12]. In the next section, we investigate two potential mechanisms that may drive this heterogeneous effect: unequal parental times and unequal demand for participation to household chores.

4.3 Potential Mechanisms Explaining the Gender Effect

In this section, we investigate two potential mechanisms driving the difference in the effect of family size by child's gender. First, an increase in family size may affect the allocation of parental resources across their children differently according to the child's gender. Typically, parents may spend relatively more time with their sons than with their daughters at the birth of a new child, especially if boys and girls react differently to this event or if parents anticipate stronger detrimental effects on boys. Such compensating effect could explain why we observe negative effects only among girls.

We test this hypothesis by measuring the extent to which an increase in family size affects parental time in our estimation sample. Following Del Bono *et al.* (2016), we look at educational and recreational time with the primary care giver (usually the mother)[13]. These

[11] One potential limitation to the external validity of this result which is inherent to the instrumental approach is that the effects are only estimated for compliers. In this specific case, parents who have an additional child *because* they want children from both sexes (i.e., compliers) could endorse gender norms more strongly, which may in turn reinforce the gendered effects of an increase in family size. Nevertheless, given the magnitude of the difference in the estimated effects across gender, we argue that this difference is unlikely to fade out completely in other families.

[12] Juhn *et al.* (2015) also investigate whether family size have a different effect on boys and girls using a family-fixed effect in the US. They don't find significant differences in the effect of family size on children behavioral skills. Nevertheless, they find a stronger negative effect on cognitive skills for girls than for boys.

[13] Following Del Bono *et al.* (2016), we use a principal component analysis to build two measures of maternal time, one picks up educational activities such as reading to the child or helping them with homework; the

variables are only available in waves two, three and four. Table 4 reports the effect of family size on parental time, and the difference between boys and girls in columns (1), and (2). The results suggest that the primary care giver spends relatively more time in educational activities with their sons when there is a third child, but this compensation effect is not observed for daughters. The primary care giver spends more time with their children in recreational activities, but again, girls benefit less from this increase. On average, girls do not benefit from compensations as boys do after the birth of a third child. Since maternal time has a large and long term impact on non-cognitive skills, especially in early childhood (Del Bono *et al.* 2016), this may partly explain the heterogeneous effects by child's gender outlined in the previous section.

A second possible explanation relates to gender norms and the intra-household allocation of housework and caregiving activities. Previous studies show that female children spend more time than male children doing housework or taking care of other members in the family, and tend to reproduce their parents household chores division (Raley & Bianchi 2006, Solaz & Wolff 2015). Doing more household tasks may distract children from activities that are more productive for the formation of socio-emotional skills, such as educational activities or parental quality-time (Price 2008).

We explore this hypothesis in our estimation sample by checking whether the birth of a third child affects the contribution of children to household tasks. From wave 5 onward, parents are asked the extent to which cohort members are involved in household chores. The last column of Table 4 suggests that an increase in family size increases the probability to contribute to the household tasks mostly for girls. While the coefficient for girls is not significantly different from zero at conventional level, the sign of the estimate is consistent with our predictions. Using more complete time-use survey, such as time-use diaries, would arguably increase the precision of our estimates and confirm the result.

second one catches recreational activities such as outdoor recreation, drawing or playing games. We must note that in the second wave, the questions were related to time spent with the primary care giver or other household members. Del Bono *et al.* (2016) provide some validity of these measures. They also show that these two measures are determinants of child's socio-emotional skills.

4.4 Persistence of the effect

In this section we ask whether the negative effects of an increase in family size persist after the time of the shock. Following Jacobson *et al.* (1993), we estimate the following model:

$$Y_{it} = \alpha_0 + \sum_{k\geq -3}^{-1} birth_{it}^{k}\theta_k + \gamma X_{it} + \delta_t + \beta Y_{i0} + \mu_{it} \tag{3}$$

where $birth_{it}^{k}$ indicates that the child had a sibling k periods earlier. We estimate this model only on children from families with a third child, i.e. the birth has occurred. Having a sibling in period $k = 0$ is the benchmark. θ_k measures the difference in the effect of the birth on a child's non-cognitive skills k periods following this event, as compared to just after the event. To account for the endogeneity of the event, we treat the selection bias through the Heckman selection model. This model assumes an underlying relationship between two regressions: the outcome equation (equation 3 here) and the selection equation. Individuals are selected only if there was a birth in their family, i.e., under the following condition (selection equation):

$$Third_{it}^{*} = b_0 + b_1 same\ sex_{i0} + \epsilon_{it}, \qquad Third_{it} = \begin{cases} 1\ if\ Third_{it}^{*} > 0 \\ 0\ if\ Third_{it}^{*} \leq 0 \end{cases}$$

Table 5 shows the results. None of the estimates is statistically different from zero, which suggests that an increase in family size is a shock which negative effects persist over time.

5 Conclusion

This paper evaluates the effect of an increase in family size on the development of socio-emotional skills on a recent cohort of children coming from the Millennium Cohort Study. To account for the endogeneity of fertility decisions, we used a well-known instrumental approach that exploits parents' preferences for children's gender diversity, which consists in using the sex composition of the two first children as an instrument for an increase in family size.

We find that family size has a significant and negative effect on the formation of both behavioural and emotional skills of the two first children. A further examination reveals that the birth of a third child has a much larger impact when the siblings are below age six. We also find that a change in family size only affects the development of non-cognitive skills of

girls. An investigation of the potential mechanisms suggests that both parents' compensating behaviours and the gendered allocation of housework and caregiving activities within the family could explain why the negative effects are only observed for girls. Finally, there is no evidence of a significant recovery on periods following the increase in family size, which suggests that the negative effects on children non cognitive skills are persistent over time.

We think that our results are of interest in order to understand the negative gradient between family size in childhood and adult outcomes. While there is a limited number of articles supporting the quality-quantity trade off argument based on quasi-experimental variations in terms of cognitive skills, we argue that the negative effect of family size on children socio-emotional skills we found in this paper may partially explain the negative correlation that is observed between family size and adult outcomes.

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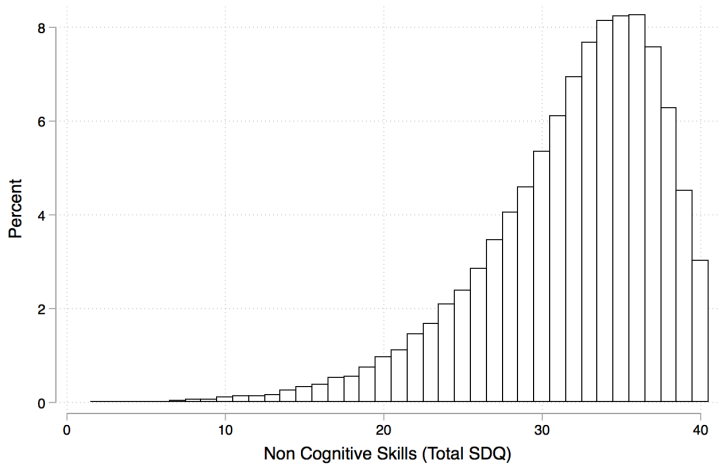
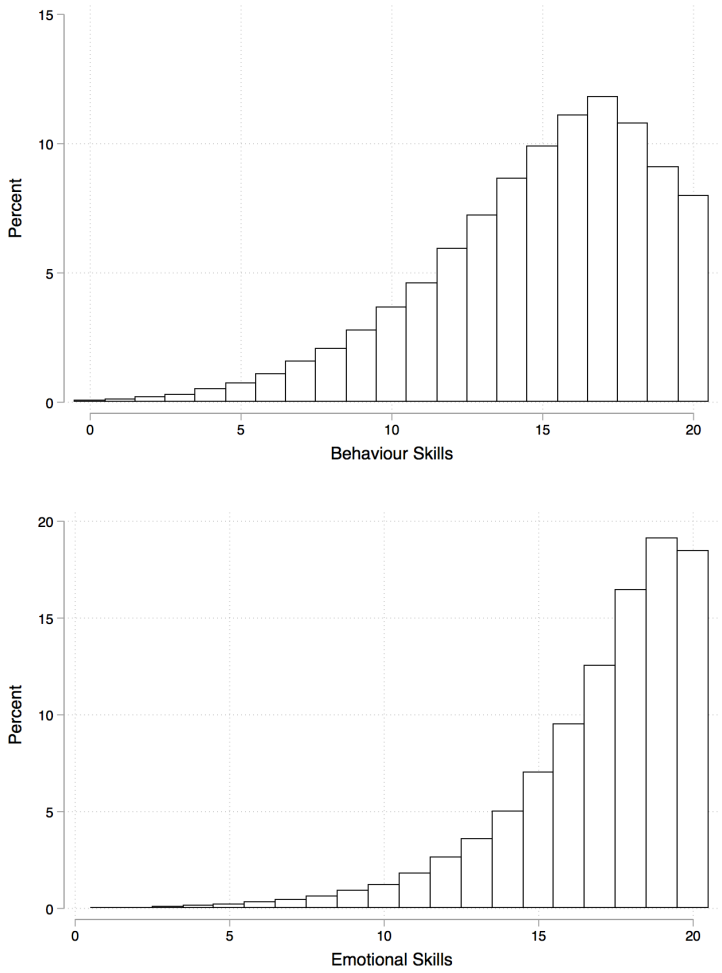
Figures and Tables

Figure 1: Distribution of Total SDQ - Estimation Sample



Source: Estimation Sample drawn from the Millennium Cohort Study. Notes: The scales of the SDQ variables have been reversed such that the higher the SDQ, the better the non-cognitive skills of the cohort member. Note that there are 20,131 observations for 5,983 individuals in 5,907 families.

Figure 2: Distribution of Externalising and Internalising SDQ - Estimation Sample



Source: Estimation Sample drawn from the Millennium Cohort Study. Notes: The scales of the SDQ variables have been reversed such that the higher the SDQ, the better the non-cognitive skills of the cohort member. Note that there are 20,131 observations for 5,983 individuals in 5,907 families.

Table 1: Descriptive Statistics: Estimation Sample

	Mean	SD	Min	Max
Cohort Member Characteristics:				
Non Cognitive Skills (Total SDQ)	32.98	5.23	2	40
Behaviour Skills (Externalising SDQ)	17.28	2.81	1	20
Emotional Skills (Internalising SDQ)	15.70	3.40	0	20
Female	0.50		0	1
Age	9.25	3.50	4	16
Age of Mother	29.77	5.31	15	52
First born	0.41		0	1
Second born	0.59		0	1
Wave 3	0.28		0	1
Wave 4	0.26		0	1
Wave 5	0.25		0	1
Wave 6	0.22		0	1
Family Characteristics:				
Age of Mother at first birth	27.74	5.19	12	52
Household Income (in logs)	6.98	1.93	2.84	11.16
Natural Father in Household	0.79		0	1
Parents are Married	0.68		0	1
Observations	20131			

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The scales of the SDQ variables have been reversed such that the higher the SDQ, the better the non-cognitive skills of the cohort member. Note that there are 20,131 observations for 5,983 individuals in 5,907 families.

Table 2: Family Size and Non-cognitive skills: 2SLS Results

First Stage:	Third Child (1)	Third Child (2)	Third Child (3)
Same Sex	0.051***	0.051***	0.051***
	(0.009)	(0.009)	(0.009)
Second Stage:	Total SDQ (1)	Behaviour Skills (2)	Emotional Skills (3)
Third Child	-0.650*	-0.496	-0.627*
	(0.342)	(0.340)	(0.354)
Observations	20131	20131	20131
F-Statistics	88.765	89.910	87.896

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

Table 3: Family Size and Non-cognitive skills: 2SLS Results - Heterogeneity Analysis

Panel A: Age at Birth	Total SDQ	Behaviour Skills	Emotional Skills
	(1)	(2)	(3)
Third Child	-0.799*	-0.601	-0.780*
	(0.428)	(0.421)	(0.443)
Third Child X Age 6 at birth or older	0.591*	0.420	0.602*
	(0.320)	(0.314)	(0.332)
Observations	20131	20131	20131
F-statistic	37.529	38.149	36.947
Total effect for children:			
Before age 6 at birth	-0.799*	-0.601	-0.780*
	(0.428)	(0.421)	(0.443)
After age 6 at birth or older	-0.208*	-0.181	-0.178
	(0.121)	(0.120)	(0.125)
Panel B: Birth Order	Total SDQ	Behaviour Skills	Emotional Skills
	(1)	(2)	(3)
Third Child	-0.688*	-0.329	-0.837**
	(0.359)	(0.330)	(0.393)
Third Child X Second Born	0.106	-0.468	0.591
	(0.718)	(0.751)	(0.731)
Observations	20131	20131	20131
F-statistic	22.336	22.343	21.995
Total effect for:			
First-Born	-0.688*	-0.329	-0.837**
	(0.359)	(0.330)	(0.393)
Second Born	-0.582	-0.797	-0.246
	(0.653)	(0.707)	(0.646)
Panel C: Gender	Total SDQ	Behaviour Skills	Emotional Skills
	(1)	(2)	(3)
Third Child	0.343	0.451	0.195
	(0.473)	(0.489)	(0.468)
Third Child X Female	-2.040***	-1.945**	-1.687**
	(0.775)	(0.764)	(0.759)
Observations	20131	20131	20131
F-statistic	40.153	40.164	39.588
Total effect for:			
Boys	0.343	0.451	0.195
	(0.473)	(0.489)	(0.468)
Girls	-1.696***	-1.494**	-1.491**
	(0.631)	(0.602)	(0.615)

Source: Estimation Sample drawn from the Millennium Cohort Study.

Notes: The dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

Table 4: Family Size and Mechanisms: 2SLS Results

	Maternal Educational Time (1)	Maternal Recreational Time (2)	Household Tasks Contribution (3)
Third Child	2.054**	0.956	-0.005
	(1.033)	(0.645)	(0.236)
Third Child X Female	-2.264*	-0.341	0.368
	(1.330)	(1.141)	(0.335)
Observations	10520	10520	14470
F-statistic	12.622	12.622	36.175

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. "Education Time" and "Recreational Time" are computed following Del Bono *et al.* (2016). "Household Tasks contribution" is a dummy equal one if the cohort meber is contributing to chores at least once per week.

Table 5: Persistence of the Effect of Family Size on Non-Cognitive skills

	Total SDQ (1)	Behaviour Skills (2)	Emotional Skills (3)
Birth (-1)	0.052	0.049	0.051
	(0.037)	(0.038)	(0.040)
Birth (-2)	0.033	0.065	0.010
	(0.059)	(0.062)	(0.061)
Birth (-3)	0.079	0.077	0.088
	(0.088)	(0.092)	(0.088)
Third Child			
Same sex	0.187***	0.189***	0.184***
	(0.036)	(0.036)	(0.036)
Constant	-1.002***	-1.003***	-1.000***
	(0.026)	(0.026)	(0.026)
Observations	19479	19479	19479

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

Appendix

Table A.1: Strengths and Difficulties Questionnaire (SDQ) in the Millennium Cohort Study

Please give your answers on the basis of cohort member's behaviour over the last six months.		Not True	Somewhat True	Certainly True
Restless, overactive, cannot stay still for long	[E]	1	2	3
Often complains of headaches, stomach-aches or sickness	[E]	1	2	3
Often has temper tantrums or hot tempers	[E]	1	2	3
Rather solitary, tends to play alone	[I]	1	2	3
Generally obedient, usually does what adults request	[E]	1	2	3
Many worries, often seems worried	[I]	1	2	3
Constantly fidgeting or squirming	[E]	1	2	3
Has at least one good friend	[I]	1	2	3
Often fights with other children or bullies them	[E]	1	2	3
Often unhappy, down-hearted or tearful	[I]	1	2	3
Generally liked by other children	[I]	1	2	3
Easily distracted, concentration wanders	[E]	1	2	3
Nervous or clingy in new situations, easily loses confidence	[I]	1	2	3
Often lies or cheats	[E]	1	2	3
Picked on or bullied by other children	[I]	1	2	3
Thinks things out before acting	[E]	1	2	3
Steals from home, school or elsewhere	[E]	1	2	3
Gets on better with adults than with other children	[I]	1	2	3
Many fears, easily scared	[I]	1	2	3
Sees tasks through to the end, good attention span	[I]	1	2	3

Notes: [E] and [I] respectively indicate the externalising SDQ (Behaviour Skills) questions and the internalising SDQ (Emotional Skills) questions.

Table A.2: Descriptive Statistics: Estimation Sample in t_0

	Mean	SD	Min	Max
Cohort Member Characteristics:				
Non Cognitive Skills (Total SDQ)	30.77	5.10	8	40
Behaviour Skills (Externalising SDQ)	13.46	3.74	0	20
Emotional Skills (Internalising SDQ)	17.31	2.38	5	20
Female	0.49		0	1
Age	3.15	0.37	2	5
Age of Mother	29.55	5.41	15	52
1st born	0.40		0	1
2nd born	0.60		0	1
Observations	5983			
Family Characteristics:				
Age of Mother at first birth	27.46	5.24	12	52
Family Size	2.00		2	2
Household Income (in logs)	5.71	0.70	3	7
Natural Father in Household	0.88		0	1
Parents are Married	0.73		0	1
Same Sex	0.49		0	1
Same Sex : girls	0.24		0	1
Same Sex : boys	0.25		0	1
Observations	5907			

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The scales of the SDQ variables have been reversed such that the higher the SDQ, the better the non-cognitive skills of the cohort member. Note that there are 5,987 individual observations for 5,907 families.

Table A.3: Instrument Validity: Any own gender effect?

	Boys		
	Total SDQ	Behaviour Skills	Emotional Skills
Same sex 3rd child	-0.174*	-0.132	-0.170*
	(0.098)	(0.100)	(0.099)
Observations	930	930	930
Nb of clusters	344	344	344
	Girls		
	Total SDQ	Behaviour Skills	Emotional Skills
Same sex 3rd child	0.047	0.091	-0.016
	(0.077)	(0.077)	(0.078)
Observations	927	927	927
Nb of clusters	326	326	326

Source: Estimation Sample drawn from the Millennium Cohort Study, focusing on families with two children of opposite sex in the second wave (t_0).
Notes: Dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. Standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to 1 if a birth of a third child happens between t_0 and t. We control for individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, parents' marital status, and the presence of a father, the age of mother at first birth) and include wave fixed-effects. We also control for the non-cognitive skill in wave 2 to account for the measurement error of the mother. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4: Family Size and Non-cognitive skills: 2SLS Results

Panel A: Attrition weights	Total SDQ	Behaviour Skills	Emotional Skills
	(1)	(2)	(3)
Third Child	-0.743**	-0.561	-0.751*
	(0.358)	(0.352)	(0.367)
Observations	8996	8996	8996
F-Statistics	68.807	78.858	78.278
Panel B: Balanced Panel	Total SDQ	Behaviour Skills	Emotional Skills
	(1)	(2)	(3)
Third Child	-0.880**	-0.645*	-0.907**
	(0.376)	(0.366)	(0.394)
Observations	15008	15008	15008
F-Statistics	85.548	86.804	83.943

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively. The lower sample size in Panel A comes from the fact that the attrition weights, computed by the data provider, are not available for all the observations.

Table A.5: Difference in Observable Characteristics between Family Type: Initial Sample

	Families with 2 children of:		
	Different Sex	Same Sex	Gap b/se
Cohort Member Characteristics:			
Non Cognitive Skills (Total SDQ)	0.07	0.06	0.01
			(0.02)
Behaviour Skills (Externalising SDQ)	0.05	0.03	0.02
			(0.03)
Emotional Skills (Internalising SDQ)	0.08	0.09	-0.01
			(0.02)
Female	0.50	0.49	0.01
			(0.01)
Age	3.16	3.15	0.01
			(0.01)
Age of Mother	29.54	29.56	-0.02
			(0.14)
1st born	0.40	0.41	-0.01
			(0.01)
2nd born	0.60	0.59	0.01
			(0.01)
Observations	5983		
Family Characteristics:			
Age of Mother at first birth	27.45	27.47	-0.02
			(0.14)
Household Income (in logs)	5.71	5.70	0.01
			(0.02)
Natural Father in Household	0.88	0.88	0.00
			(0.01)
Parents are Married	0.72	0.73	-0.01
			(0.01)
Observations	5907		

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The scales of the SDQ variables have been reversed such that the higher the SDQ, the better the non-cognitive skills of the cohort member. Note that there are 5,983 individual observations for 5,907 families. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

Table A.6: Probability to have a second child and the sex of the first-born: OLS results

	Having a second child
	(1)
First child is a girl	0.012
	(0.018)
Observations	3134

Source: Families with only one child in t_0 from the Millennium Cohort Study.
Notes: The dependent variable is a dummy equal one if the family had at least a second child between the wave 2 and wave 6. The standard errors in parentheses are clustered at the family level. No controls are added. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

Table A.7: Family Size and Non-cognitive skills: OLS Results

	Total SDQ	Behaviour Skills	Emotional Skills
Third Child	-0.044**	-0.043**	-0.022
	(0.021)	(0.022)	(0.022)
Observations	20131	20131	20131
Adjusted R^2	0.296	0.306	0.162

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

Table A.8: Family Size and SDQ Subscales: 2SLS Results - Main Results

	Conduct	Hyperactivity	Emotion	Peer
	(1)	(2)	(3)	(4)
Third Child	-0.077	-0.757**	-0.729**	-0.266
	(0.327)	(0.375)	(0.371)	(0.337)
Observations	20131	20131	20131	20131
F-statistic	90.255	88.545	87.978	87.549

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.

Table A.9: Family Size and SDQ Subscales: 2SLS Results - Heterogeneity Analysis

Panel A: Age at Birth	Conduct	Hyperactivity	Emotion	Peer
	(1)	(2)	(3)	(4)
Third Child	-0.075	-0.932**	-0.906*	0.327
	(0.401)	(0.472)	(0.467)	(0.416)
Third Child X Age 6 at birth	-0.006	0.693**	0.702**	0.242
	(0.299)	(0.353)	(0.349)	(0.310)
Observations	20131	20131	20131	20131
F-statistic	38.394	37.367	37.079	36.825
Total effect for:				
Before age 6 at birth	-0.028	-0.932**	-0.906*	0.327
	(0.456)	(0.472)	(0.467)	(0.416)
After age 6 at birth or older	-0.081	-0.240*	-0.204	-0.085
	(0.115)	(0.132)	(0.131)	(0.119)
Panel B: Birth Order	Conduct	Hyperactivity	Emotion	Peer
	(1)	(2)	(3)	(4)
Third Child	-0.042	-0.438	-0.869**	-0.439
	(0.327)	(0.354)	(0.408)	(0.365)
Third Child X Second Born	-0.095	-0.898	0.395	0.486
	(697)	(0.866)	(0.765)	(0.704)
Observations	20131	20131	20131	20131
F-statistic	22.854	21.792	22.007	21.954
Total effect for:				
First-Born	-0.042	-0.438	-0.869**	-0.439
	(0.327)	(0.354)	(0.408)	(0.365)
Second Born	-0.137	-1.335	-0.475	0.046
	(0.647)	(0.832)	(0.681)	(0.632)
Panel C: Gender	Conduct	Hyperactivity	Emotion	Peer
	(1)	(2)	(3)	(4)
Third Child	-0.028	0.442	-0.520	1.069*
	(0.456)	(0.522)	(0.481)	(0.550)
Third Child X Female	-0.099	-2.463***	-0.429	-2.741***
	(0.632)	(0.891)	(0.724)	(0.843)
Observations	20131	20131	20131	20131
F-statistic	39.211	40.181	39.315	39.507
Total effect for:				
Boys	-0.028	0.442	-0.520	1.069*
	(0.456)	(0.522)	(0.481)	(0.550)
Girls	-0.127	-2.021***	-0.948*	-1.672**
	(0.453)	(0.732)	(0.558)	(0.657)

Source: Estimation Sample drawn from the Millennium Cohort Study.
Notes: The dependent variables are reported by the primary care giver and have been standardized by age group (mean of 0 and standard deviation of 1). The scale of the dependent variables has been reversed to ease the interpretation. The standard errors in parentheses are clustered at the family level. Third Child is a dummy equal to one if a birth of a third child happens between t_0 and t. The controls include individual characteristics (sex, age, birth order, month of birth, the age of the mother at birth), family background (income, marital status of the parents, the presence of the natural father, the age of mother at first birth) and wave fixed-effects. We also control for the dependent variable in wave 2. *, **, *** indicate significance at the 10%, 5% and 1% levels respectively.