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BLESSED ARE THE FIRST: THE LONG-TERM EFFECT OF BIRTH ORDER ON TRUST

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Blessed are the first:
The long-term effect of birth order on trust

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Abstract
The renewed interest by the economic literature in the effect of birth order on children's outcomes has neglected trust as a long-term output of familial environment. Acknowledging childhood as a crucial stage of life for the formation of social preferences, we go deeper into the early-life determinants of trust, a widely recognized driver of socio-economic success. We analyze if and how differences in the order of birth predict heterogeneous self-reported trust levels in Britain. We draw hypotheses from psychology, economics and sociology, and test alternative explanations to the association between birth order and trust. Relying on an index measuring birth order independently from sibship size, we find a negative and robust effect of birth order, with laterborns trusting less than their older siblings. This effect is not accounted for by personality traits, strength of family ties, risk aversion and parental inputs. It is only partially explained by complementary human-capital outcomes, and it is robust when we use alternative dependent variables and control for endogenous fertility. Multilevel estimates suggest that trust is mostly driven by within- rather than between-family characteristics. The effect of birth order is eclipsed by education outcomes only for women, while it is counterbalanced by mother's education for the entire sample, thereby leading to relevant policy implications.

Keywords: Trust, Birth order, Family size, Parental investment, Personality traits, Risk aversion, Family ties, BHPS.

JEL Classification: A13 (Relation of Economics to Social Values); D10 (Household Behavior and Family Economics); J10 (Demographic Economics); Z13 (Economic Sociology).

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1. Introduction

Trust in others is growingly offered as an explanation for why societies succeed in many dimensions including growth (Algan and Cahuc 2010; Zak and Knack 2001), financial development (Guiso et al. 2004), institutional quality (La Porta et al. 1997), innovation (Gulatim and Wang 2003), and happiness (Bjørnskov 2003; Helliwell et al. 2017). However, economists have mainly focused on the outcomes of trust, with only a few number of papers looking at its determinants. The inquiry into the roots of trust is nonetheless important to identify policy interventions targeting particular groups (e.g. women) on specific dimensions (e.g. education), which might push societies towards 'good' institutional equilibria. The present study contributes in this direction by going deeper into the demographics of trust, with a particular focus on the long-term effects of birth order.

The economic theory of the family has traditionally framed fertility choices as a trade-off between 'quality' and 'quantity' of children (Becker 1960), with quality meaning health and education. We deem trust an additional quality dimension that is worth exploring in a lifecycle perspective. In this regard, research in psychology has shown that trust is formed in the early stages of life (Erikson 1950; Allport 1961), depending on responsive caregiving (Crain 2005), and the type of attachment between infants and caregivers (Bowlby 1979; Ainsworth & Bowlby 1991). Mostly transmitted by parents during childhood (Dohmen et al. 2012), trust becomes an integral part of personality, and tends to change slowly thereafter as a result of experience (e.g. Uslaner 2000). The importance of the household environment is further underlined by the growing evidence showing that two characteristics of the family where children grow old, i.e. family size and birth order, can predict their future success (e.g. Black et al. 2005a). To the best of our knowledge, for the first time in the literature, we examine whether the order of birth of a child predicts his/her future level of trust.

To this purpose, we draw hypotheses about the underlying mechanisms from related studies in economics, psychology and sociology, which drive us along four possible pathways from birth order to trust. First, the birth-order effect would originate from the unequal parental investment in children's human capital, of which trust might be a particular dimension or a separate, though complementary, result. It is fairly established in economics that birth order matters for a variety of children's outcomes, mostly because of the unequal time parents spend with children or the financial constraints they face in the allocation of human-capital endowments (e.g. Birsdsall 1991 Behrman 1988; Hanushek 1992). Second, in the psychological literature birth order is shown to produce differences in the personality traits that positively correlate with trust, e.g. openness and agreeableness (Courtiol et al. 2009; Sulloway 1996).

Third, children born later tend to be more open to experience and 'rebellion' than firstborns (Sulloway 1996). As a consequence, they might be inclined to take risks (Bertoni and Brunello 2016; Wang et al. 2009) and trust unknown persons. The fourth channel is the strength of family ties, provided that birth order influences familial sentiment (Kennedy 1989; Kidwell 1981 Salmon and Daly 1998) and that strong family ties endanger trust in strangers (Ermisch and Gambetta 2010; Yamagishi and Yamagishi 1994 and Yamagishi et al. 1998). These potential explanations lead to alternative hypotheses. What is the sign of the relationship between birth order and trust is therefore an empirical issue.

Against this backdrop, we assess the birth-order effects on trust relying on retrospective information from the 13th wave of the British Household Panel Survey (BHPS). These data allows us not only to measure the effect of birth order, but also to identify the mechanisms outlined above. For instance, we ascertain to what extent the birth-order effect on trust is driven by parental inputs or by other children's outcomes. Through measures of risk aversion, personality traits and family ties retrieved from other waves, we also assess if any of these forces drives the birth-order effect. Moreover, since sibship size is likely correlated with unobserved parental attributes and children's outcomes, we use a measure of birth order, i.e. the 'birth order index' (Booth and Kee 2009), which is independent from sibship size and allows for parsimonious estimates.

We find that birth order has a negative impact on trust, that is respondents born later report lower levels of trust. The effect is robust when controlling for parental cohorts, sibship size, family background, current economic well-being, personality traits, risk aversion and strength of family ties. It survives many robustness checks such as the use of different proxies for trust, and the control function correction for endogenous fertility. Importantly, the parental investment hypothesis explains only half of the birth-order effect, with other channels playing a negligible role, paving the way for further research. Results are mainly driven by male respondents, whereas for women the effect of birth order is eclipsed by education outcomes. Multilevel estimates further suggest that most of the variation in trust is driven by within-family characteristics, while for a small share of respondents birth-order differences decrease in birth spacing. Finally, we find that high mother's education offsets the negative birth-order effect, thereby leading to relevant policy implications.

In the next section we discuss the background literature from which we draw hypotheses. Then, the data and the variables we use are detailed. In Section 4 we present our baseline results, and in Section 5 a set of robustness checks. In the final section we summarize our findings and provide concluding remarks.

2. Background and hypotheses

While the economic literature has looked at wealth and education as the main children's outcomes from parental investment, to the best of our knowledge this is the first work exploring the effects of birth order on a new 'quality' dimension, i.e. trust in others. There are therefore no specific theories about the relationship between these two variables. However, related studies in economics, psychology, and sociology drive us to hypothesize at least four main channels through which the order of birth of a child may affect its future levels of trust.

First, the household environment in childhood might play an important role either if we assume that trust results from better educational attainments (e.g. Hooge et al 2012; Borgonovi 2012; Li et al. 2005), or if we consider it as an additional, separate, human-capital dimension. In both cases, the economic literature suggests that the effect of birth order on children's outcomes stems from time or financial constraints, which lead parents to allocate resources unequally among children. Lack of sibling competition for parental time, additional quality-time received at young age, decreasing marginal returns from parenting, support to ageing parents in adulthood, and the superior energy of young parents would explain, on the one hand, a more favorable treatment of early-born children, and why they reach better outcomes than laterborns (e.g. Birsdsall 1991; Black et al. 2005a; Kessler 1991; Price 2008).[1] There are arguments, on the other hand, suggesting that laterborns do better than their older siblings. For instance, they would benefit from the increase in family income over time (Parish and Willis 1993), from the higher intellectual environment in the household due to education expansion favoring all family members, and from the higher share of time inputs provided by older siblings or by parents when elder children leave the house (Hanushek 1992). Nevertheless, apart from the study by Ejrnæs and Pörtner (2004) on Philippines data, most empirical evidence has converged upon the negative effects of birth order on several children's outcomes such as IQ, educational attainment and wages (Black et al. 2005a; Booth and Kee 2009; Bertoni and Brunello 2016; Kessler 1991; Kantarevic and Mechoulan 2006; Lehmann et al. 2016). We therefore expect that trust decreases with birth order, and that this effect decreases in magnitude or becomes non-statistically significant when controlling for the human-capital endowment from the family of origin (proxied for by socio-economic status in childhood) or the human-capital outcomes of the respondent (proxied for by socio-economic status in adulthood).

[1] Firstborns tend also to receive better natural endowments since they are born to younger mothers, who tend have children of higher birth weight (Behrman 1988).

Second, birth order influences specific personality traits and values that are mostly associated with trust in others. The psychological literature has argued that the differences in personality driven by birth order are due to the age and developmental stage of the child, which affect its ability to compete for parental investment (Sulloway 1996). In an evolutionary perspective, firstborns appear older, physically stronger and cognitively more developed than children born later. In addition, they reproduce earlier and are more likely to survive to adulthood, given that they survived when mortality rates were higher. All these features provide firstborns with a high reproductive value and increase the fitness gains from parental investment (Jeon 2008). With respect to children's personality, confidence in parental favoritism and responsibility of their siblings would make firstborns advocates of parental values and the status quo, supporters of the authority and more conservative than their younger siblings. In contrast, since laterborns tend to look for an unoccupied family niche, they would be highly opened to new experiences and inclined to be 'rebels' (Sulloway 1996). The empirical counterpart of this theory is that, within the Big Five Personality Traits (PTs) framework, firstborns should score higher in conscientiousness and neuroticism, while laterborns higher in extraversion, openness and agreeableness. Since extraversion, openness and agreeableness positively correlate with trust (Dohmen et al. 2008; McCarthy et al. 2017), we expect a positive effect of birth order on trust, with laterborns scoring higher in those personality traits. However, the effect of birth order should disappear when controlling for the Big Five if personality is the main driver.

A third channel through which birth order may shape trust is propensity to take risks, which appears to be positively associated with experimental and attitudinal measures of trust (Eckel and Wilson 2004; Ermisch et al. 2009; Schechter 2007). The psychological literature has emphasized that laterborns search for a niche mainly through experimentation, and hence they tend to be more exploratory than firstborns (Sulloway 2007). Such characteristics, jointly with the higher pressure on laterborns to realize the same returns from more limited resources, would make laterborns more likely to undertake risky behavior than their older siblings (Bertoni and Brunello 2016; Wang et al. 2009). Behavioral evidence in this direction is also provided by Sulloway and Zweigenhaft (2010), who show that laterborns engage into riskier sports than firstborns and, when playing the same sport, they get often involved into riskier actions. For these reasons, we hypothesize that risk aversion can explain the relationship between birth order an trust. More specifically, laterborns would be more prone to take the risk of being exploited in social interactions and trust unknown persons than their older siblings.

The fourth mechanism is the strength of family ties. Sociological studies have shown that in societies characterized by low social uncertainty, i.e. where socio-economic transactions hinge on reciprocal obligations within small circles of closely related persons (e.g. relatives), the risk of being cheated is mitigated by commitment formation, and therefore trust in unknown persons is endangered (Yamagishi and Yamagishi 1994; Yamagishi et al. 1998). In other words, strong and stable relations, such as family ties, would reduce social uncertainty by providing 'assurance' of mutual cooperation (Yamagishi and Yamagishi 1994), and consequently less need for relying on - and hence trusting – persons outside these relations (Ermisch and Gambetta 2010).[2] A rationale for why family ties vary by birth order is offered by the evolutionary psychology literature, which suggests that firstborns and lastborns consider their parents as sources of support to a greater extent than middleborns do. In facts, being the first or the last born is shown to positively predict familial sentiment, as proxied for by reliance on parents as social supports, relevance of one's family to one's self-concept, and one's interest in family (Kennedy 1989; Kidwell 1981 Salmon and Daly 1998). Hence we expect an inverse u-shaped relationship between birth order and trust, provided that middleborns are less family-oriented than their siblings, and that trust is low when family ties are strong. If attitudes towards risk are the main driving forces, we might also expect that the birth-order effect is absorbed into our measures of risk propensity.

Summarizing, most economic studies based on the unequal parental investment hypothesis suggest that the effect of birth order on trust should be negative, i.e. firstborns have higher trust than laterborns. Secondly, the Sulloway's hypothesis instead seems to imply higher levels of trust for laterborns, who tend to have a more prosocial personality. Thirdly, laterborns should be more trusting also because they tend to be more willing to take risks. Fourthly, since laterborns and firstborns appear more attached to their relatives, they should have lower trust levels than middleborns. Thus, with the data at our disposal we test the direction and the significance of the birth-order effect on trust, and whether this effect is consistent with any of the four mechanisms outlined above. In particular, we check if the effect of birth order persists when accounting for current and family socio-economic status (SES), PTs, risk aversion, and family ties.

[2] A similar idea dates back to the 'amoral familism' hypotheses developed by Banfield (1958) in his study about the roots of the underdevelopment of a small south Italian village. The backwardness of this village would result, according to the author, from a low generalized-trust equilibrium, with people exclusively trusting their immediate family (and expecting the others to do the same). In testing this hypothesis, Alesina and Giuliano (2011) show a negative association between the strength of family ties and trust in others, while the association turns positive when trust in the family is considered.

3. Dataset and variables

Our main data source is the 13th wave of the British Household Panel Survey (BHPS) conducted in 2003-2004. The BHPS is a nationally representative random-sample survey of private households in Britain containing detailed information on sibling number and birth order, individual socio-economic characteristics as well as retrospective family-level attributes when the respondent was a child.

3.1 Birth order and family size

We measure birth order and family size by relying on self-reported data on the composition of the respondent's family of origin. More specifically, respondents are asked 'How many brothers and sisters have you ever had?' and 'Including yourself, what is the number of children in your family?'. We combine answers to these two questions to construct a continuous variable capturing the total number of children in the family (*FAM SIZE*). With respect to the order of birth, respondents are asked 'Where you born in relation to your brother(s) and sister(s), that is, were you the first, second, third or subsequent child?'. We use this information to create a dummy variable equal to one if the respondent was the first (*FIRST CHILD*), second (*SECOND CHILD*), third (*THIRD CHILD*), fourth (*FOURTH CHILD*) or fifth or higher-order born child (*FIFTH+ CHILD*).

However, identification issues may arise when estimating both family size and birth order. Indeed, birth order is not independent from family size since firstborns have a higher probability of being in a small family than laterborns. Differently, laterborns are only observed in larger families and have a higher chance of being born to older parents (Black et al. 2005a; Booth and Kee 2009). The correlation between birth order and sibship size might lead to biased estimates for two main reasons. First, parents opting for a large family size may have different attributes from parents opting for a small family size. This might bias our results if unobserved parental characteristics (e.g. socio-economic status) are also associated with children's trust. Second, family size is likely to affect children's outcomes such as education, income and health. If such outcomes are correlated with trust, the association between birth order and trust is likely to be biased. Since birth order may capture unobserved factors correlated with sibship size, it is therefore difficult to identify its effect on trust.

Apart from relying on a rich set of controls for individual and parental characteristics, to mitigate further these concerns we employ a birth order index (*BIRTH ORDER INDEX*) as proposed by Booth and Kee (2009), which purges sibship from birth order (e.g. it measures

birth order independently from family size). Using the Booth and Kee (2009) terminology, the birth order index is equal to $B = \emptyset/A$, where $\emptyset$ is the absolute birth order of the respondent and A denotes the average birth order in each family. More specifically, $\emptyset$ takes the value of one for the first born, the value of two for the second born, and so on up to a top value for the tenth and above born child. Denoting N as the number of siblings, A is calculated as $(N + 1)/2$, and it is increasing in family size. Therefore the birth order index is the ratio of the respondent's birth order to the average birth order of her family. Deflating the absolute birth order $\emptyset$ by the average birth order within the family A ensures that the birth order index B is mean-independent from family size.[3]

3.2 Trust

Our measure of trust is built on the standard binary generalized trust question (Rosemberg 1956), which is widely used in social surveys and in empirical analysis of trust within the social sciences (e.g Algan and Cahuc 2010; Delhey and Newton 2005; Uslaner 2002). The question asks: 'Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people? (0 = you can't be too careful; 1 = most people can be trusted)'. In a further robustness check we use two behavioral measures of our dependent variable, i.e. voluntary work and civic engagement, which – as suggested by the social-capital literature – are both associated with trust (Putnam 2000; Uslaner and Brown 2005).

3.3 Family background

The 13th wave of BHPS also collects retrospective information, which allows us to measure the respondent's socio-economic status (SES) during the childhood. To this purpose, we use three main proxies. First, we use the presence of books in the parental home when the respondent was a child. More specifically, we construct dummies for individuals whose parents had many books (*LOTS BOOKS*), quite few books (*QUITE BOOKS*) and not many books in the house (*LESS BOOKS* – baseline). Second, we control for a dummy variable taking the value of one in case the father (*DAD EDUCATION*) or the mother (*MUM EDUCATION*) gained further qualifications after leaving school, or in case the father (*DAD DEGREE*) or the mother (*MUM DEGREE*) obtained a university degree. Third, we construct a dummy variable taking the value of one in case the

[3] By construction, the mean of B is one, and it is constant across all family types (see Booth and Kee 2009 for further details on the construction of the index). The simple correlation between family size and the birth order index is 0.026 that compares very favourably with the high correlation between family size and absolute birth order of 0.699.

mother was working when the respondent was fourteen years old (*WORKING MOTHER*). This variable allows us to proxy for both financial security and maternal time as working mothers may be less financially constrained but also more time constrained than non-working mothers. As an additional control for parental background, we build a dummy variable taking value of one if the respondent lived in a family where both natural parents were present at least until the child reached the age of sixteen (*FAM NORM*). The inclusion of this variable is justified by previous studies showing that children from broken families spend less time with each parent, lose economic and emotional security, achieve an inferior social and psychological maturation, and are at high risk of emotional distress (Anderson 2014; Booth and Kee 2009).[4]

We consider also parental cohorts effects because, conditional on child cohort, parents of firstborns are likely to be younger than parents of third or fourth born children (Black et al. 2005a; Booth and Kee 2009). Differences in parents' age when the child was born might translate into unobserved heterogeneity in terms of inputs of time, energy and experience, thereby biasing our estimates. Moreover, since trust appears to change due to age, cohort and period effects (Clark and Eisenstein 2013; Sutter and Kocker 2007; Robinson and Jackson 2001), children born to young parents might be nurtured with trust attitudes that are different from the trust attitudes of children born to older parents, for instance because the latter might have been exposed to large-scale conflicts (e.g. the Second World War) that produced a long-term impact on social capital (Conzo and Salustri 2017). Hence, to disentangle birth-order from parental-cohort effect we exploit the age of each parent when the child was born, and include in all our model specifications the age group of the respondent's mother and father (*DAD20-*baseline*, DAD2125, DAD2630, DAD3140, DAD41UP; MUM20* - baseline*, MUM2125, MUM 2630, MUM 3140, MUM 41UP*).[5]

Finally, we also use information on the type of area in which the family mostly lived when the respondent was a child. This allows us to control for the controversial effects that social networks, varying by the size of the community in which they are embedded (e.g. rural vs. urban areas), may have on trust (e.g. Delhey and Newton 2005; Yamagishi et al. 1998). We therefore include dummies equal to one if the area of residence was the inner city (*KID INNER*), a suburban area (*KID SUBURBAN*, baseline), a town (*KID TOWN*), a village (*KID VILLAGE*), a rural area (*KID RURAL*) or if the family moved around (*KID MOVED*).

[4] There is also a part of the literature claiming that although children from broken families are at increased risks of negative long-term outcomes, the difference between children experiencing family breakdowns and those with a stable familial environment are small and not persistent in in the long run (Mooney et al. 2009).

[5] The inclusion of these family-level characteristics mitigate the potential endogeneity in fertility choices, which might lead to biased estimates if birth order is not fully orthogonal to family size.

3.4 Socio-demographic and economic characteristics

The BHPS also allows us to control for a vector of individual socio-demographic and economic characteristics at the time of the interview such as the respondents' age group[6], gender (*FEMALE*), marital status (*MARRIED*), ethnical background (*WHITE BRITISH*, baseline, *OTHER WHITE* and *NON WHITE*), number of children (CHILDREN NUMBER), annual income (*ANNUAL INCOME*)[7] and type of occupation (*OCCUPATION 1, OCCUPATION 2, OCCUPATION 3, OCCUPATION 4, NOT EPMLOYED/RETIRED*, baseline).[8] In addition, we rely on a proxy for health status – i.e. a dummy taking the value of one in case (s)he is a smoker (*SMOKER*) – and build categorical variables for education levels (*EDUC 1* - baseline, *EDUC 2*, *EDUC 3*, *EDUC 4*, *EDUC 5*, and *EDUC 6* from the lowest to the highest level of education).

Finally, we control for the macro-area of residence of respondents using dummy variables taking the value of one in case the respondent resides in England (*REGION 1*), Wales (*REGION 2*), Scotland (*REGION 3*) or Northern Ireland (*REGION 4* - baseline). See Variable Legend for further details (Table A1 in Appendix).

3.5 Descriptive statistics

Table A2 in Appendix reports general descriptive statistics. Our sample is composed by individuals aged on average 46, and it is almost perfectly balanced by gender. Roughly half respondents are married (53 percent) and the majority of them are white British (63 percent). Ten percent of respondents are only-child, while 35 percent are firstborns, 32 percent are secondborns and 17 percent are thirdborns. Only a few number of respondents rank high in birth order, i.e. seven percent are fourthborns and ten percent are fifth or later born children. Consistent with the majority of respondents falling into the first three birth-order categories, the median family size is three. As expected, our birth order index is on average equal to one, thereby guaranteeing that the implementation of this index leads to estimating birth-order effect net of the contextual effect of family size.[9]

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[6] Age groups are built through dummy variables for respondents aged between 24 and 40 (*AGE2440*), 41 and 55 (*AGE4155*), 56 and 70 years old (*AGE5670*) or 71 and more (*AGE71*).

[7] Annual income includes both labour and non-labour (pension, benefits, transfer and investment) income.

[8] Types of occupation are derived from the standard occupational classification 2000 (SOC 2000). More specifically, *OCCUPATION 1* includes Managers and Senior Officials, *OCCUPATION 2* includes professional occupation, associate professional and technical occupations, *OCCUPATION 3* includes administrative and secretarial, skill trades and personal service occupation and finally *OCCUPATION 4* includes sales and customer service occupation as well process plant and machine workers.

[9] Booth and Kee (2009) also show on the same sample as ours that predicted variance of the birth order index conditional on family size is very close to (and in some cases slightly less than) the one found in the data.

About half sample (44 percent) declares that other persons in general can be trusted. Roughly 22 percent of respondents have any education diploma (*EDUC 1*), while 39 percent of them report a higher qualification or a university degree (*EDUC 5* and *EDUC 6*). Most respondents are born to fathers in the age-group 31-40 and to mothers in adjacent age-group (26-30). Moreover, 24 percent of respondents declare that their mother was working when they were fourteen years old. Only one third of the sample has a father with tertiary education (*DAD DEGREE*), while the percentage of respondents having a mother with tertiary education is about 20 percent (*MUM DEGREE*). About 30 percent of respondents report having few books in the house during childhood (*LESS BOOKS*).

Figure 1 shows the unconditional effect of absolute birth order on trust. This descriptive evidence suggests a negative relation between the two variables, with laterborns showing lower levels of trust. The effect seems to be sizeable when firstborns or secondborns are compared with thirdborns, while firstborns and secondborns do not seem to differ in their propensity to trust strangers.

[FIGURE 1 AROUND HERE]

4. Econometric results

Our main estimating equation writes:

$$TRUST_i = \beta_1 FAM\ SIZE_i + \beta_2 BIRTH\ ORDER\ INDEX_i + \Sigma_k \beta_k X_i + \gamma_j + \varepsilon_i \qquad (1)$$

where $TRUST_i$ is the value of generalized trust of individual i, $FAM\ SIZE_i$ and $BIRTH\ ORDER\ INDEX_i$ measure the sibship size and the birth-order rank respectively. We include stepwise the aforementioned set of k socio-demographic and economic controls, keeping sample size constant across model specifications. All model specifications include parental cohort dummies (γ). Given the binary nature of our dependent variable, we estimate Eq. (1) using a logistic regression model, both for the entire sample and separately for men and women. Standard errors are clustered at the level of respondents' current family.

We first consider the effect of absolute birth order, i.e. by using dummies for the respondent's birth-order status (first child is the omitted category). When controlling for age, gender and ethnic background, results show that trust decreases when birth order increases (Table 1, column 1). The magnitude is not negligible ---being the second relative to the first child decreases the propensity to trust by three percentage points, while being the third child

reduces it by almost eight percentage points (Table 1, column 2). Moreover, sibship size is also negatively and significantly associated with trust.

[TABLE 1 AROUND HERE]

We then estimate Eq. 1 using the birth order index.[10] As shown in column 1 of Table 2 the negative effects of birth order and sibship size are confirmed (marginal effects are in Table A3 in the Appendix).

[TABLE 2 AROUND HERE]

This baseline evidence provides support to the unequal parental investment hypotheses predicting that firstborns receive more parental resources than laterborns, because, for instance, of their higher reproductive value or because they have been the only child in the household for a longer period (e.g. Hertwig et al. 2002). These preliminary results seem also consistent with economic theory of the family postulating a trade-off between quantity of the children (sibship size) and their quality (human capital, and in our case, trust in others).

However, these estimates conceal potential heterogeneity in parental investment (human capital inputs and outputs), personality traits, risk preferences and family ties. In what follows we assess to what extent the birth order and sibship effects are robust to the inclusion of variables capturing these factors.

4.1 Human capital investment

To test the parental investment hypotheses we augment our baseline model with, in the order, proxies for parental inputs measuring SES during childhood, proxies for human capital outputs capturing current SES, and both. Results are reported in Table 2, columns 2-4.

Acknowledging the potential endogeneity of the SES proxies (described in Sections 3.3 and 3.4), we however find that the inclusion of SES in adulthood halves the birth order coefficient, and significantly reduces the significance and the magnitude of the sibship effect. The latter turns non-statistically significant when both SES in adulthood and in childhood are controlled for, whereas the birth-order effect remains significant. Interestingly, the effect of birth order seems to be driven mainly by male respondents, while for women birth order is not significant in any estimate (Table 2, columns 5 and 6). We further investigate this gender result

[10] Only-child effects accounted for when both birth order index and family size are equal to one.

in Section 5.4. Finally, consistent with related studies (e.g. Li et al. 2005), variables proxing for high SES - e.g. number of books, education levels and health status - are positively associated with high levels of trust.

Overall this evidence suggests that the influence of birth order on trust is only in part due to unequal parental investment in human capital, especially when the latter is measured in terms of outputs (SES in adulthood). Second, heterogeneity in the association between sibship size and trust is entirely driven by the respondents' outcomes rather than early parental inputs (SES in childhood).[11] The fact that sibship turns non-statistically significant in the full model while birth order does not further suggests that birth order plays an independent role from that of family size. Because the effect of birth order on trust is not explained by parental time or financial constraints (SES in childhood), the residual part of the effect might be either direct or mediated by other forces such as differences in personality, risk preferences or family ties. We explore this second possibility in the next sections.

4.2 Personality traits

As outlined in Section 2, the Sulloway's hypothesis would imply higher trust for laterborns because they tend to score higher in extraversion, openness and agreeableness.

Even though the evidence presented so far goes against the predicted direction of the birth-order effect by this theory, to assess whether differences in personality matter nevertheless, we rely on the Big Five PTs, namely *Extraversion*, *Agreeableness*, *Conscientiousness*, *Neuroticism* and *Openness*. The Big Five are defined within the five-factor model developed in Personality Psychology (Digman 1990). More specifically, *Extraversion* represents a measure of sociability ---extravert individuals tend to be more sociable, talkative and assertive. *Agreeableness* is a proxy of the willingness to help others, to be caring, gentle and with a higher propensity to forgive. *Conscientiousness* is related to the likelihood of following rules and being self-disciplined. *Neuroticism* relates, instead, to emotional stability and to the tendency of being anxious, depressed and insecure. Finally, *Openness* is associated with a tendency of avoiding conventions, being imaginative and curious. The empirical evidence shows that personality is fairly stable in time and hence we can assume that even if the Big Five may change during the life course, these changes are negligible (Srivastova et al. 2003). We derive the respondent's score in each of the five PTs by averaging his/her answers to the short

[11] This is an important result because, if there is residual correlation between birth order index and family size, the inclusion of current SES cleans birth order off the confounding factors related to sibship, thereby mitigating the potential endogeneity of fertility choices (see also Section 5.3).

Big Five Inventory (BFI-S), a 15-item instrument that has been administered in wave 15 of the BHPS.[12]

[TABLE 3 AROUND HERE]

When we add the Big Fives to the full model (see Table 3, column 2), as expected, we find that the more (less) pro-social PTs positively (negatively) correlate with trust . Agreeableness and Openness significantly and positively predict trust, while Conscientiousness and Neuroticism seem to play a negative role. However, the birth-order coefficient shows no remarkable changes, thereby excluding differences in personality as the key driver of our results.

A possible rationale for why PTs do not explain the relationship between birth order and trust is that in our sample personality does not significantly differ across birth-order categories. In contrast to the Sulloway's theory, the effect of birth order on the Big Five is not sizeable nor statistical significant in our sample, especially when controls are included (Figure 2). This finding is not surprising since other empirical tests of the Sulloway's hypothesis often produce results that are inconsistent with this theory (e.g. Black et al. 2017; Damian and Roberts 2015; Ernst and Angst 1983; Freese et al. 1999; Roher et al. 2015).[13]

[FIGURE 2 AROUND HERE]

4.3 Risk preferences

If laterborns had been more risk-taking, a preference often associated with high levels of trust, we would have found opposite results to those shown so far. However, we may still test whether risk preferences act as mediators by checking if the birth-order effect decreases in magnitude or loses statistical significance when accounting for risk.

We rely on two proxies for risk preferences contained in wave 18 of BHPS, which have been used also in a related study on risk and trust in Britain (Ermish et al. 2009). The first one

[12] The model used to derive personality characteristics is hierarchical, with the Big Five being extracted from a larger set of more specific personality traits. While extensively used in long surveys where the respondent's time is limited (e.g. GSOEP), the high level of aggregation of the Big Five may conceal many personality differences, thereby potentially limiting the predictive power of the instrument (see, among others, John et al. 2008 and Tavares 2016). The BFI-S is made of fifteen questions (three for each Big Five) answered on a 7-point scale ranging from 1 ('Does not apply to me at all') to 7 ('Applies to me perfectly'). We construct the personality scores only for respondents who answered to all the 15 items of the BFI-S. Cronbach's alphas (α from .42 to .56) are quite in line with the previous literature using the BFI-S (e.g. Lang et al. 2011), and with the alphas of other short scales.

[13] Unsupportive evidence is found especially when the hypothesis is tested through the Big Five PTs (Bleske-Rechek and Kelley 2014; Salmon 2012), while behavioural results tend to be more consistent with the theory (Sulloway and Zweigenhaft 2010). However, the effect of birth order on pro-sociality tends to be moderate also in other studies testing the Sulloway's hypothesis (e.g. Courtiol et al. 2009; Salmon et al. 2016).

measures the propensity to take general risks (*Risk propensity 1*), and it is built on the question: 'Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?'.[14] The second proxy (*Risk propensity 2*) captures the willingness to take risks in trusting unknown persons, and it is based on the question: 'Are you generally a person who is fully prepared to take risks in trusting strangers or do you try to avoid taking such risks?'. Answers to both questions are rated on an 11-point scale ranging from 0 'unwilling to take risks' to 10 'fully prepared to take risks'.[15]

When we look at the relationship between birth order and risk preferences we find a slightly decreasing unconditional birth order effect (Figure A1 in the Appendix), though not statistically significant when controls are included (Figure 3). Conversely, as expected, respondents who are more likely to take risks are those showing higher levels of trust, especially when such risks conceal trusting others (Figure A2 in the Appendix).

[FIGURE 3 AROUND HERE]

The econometric findings in Table 4 (column 2) document that the willingness to take general risks positively affects trust behavior, a result which is consistent with Sapienza et al. (2013 and Schechter (2007). In line with Ermish et al. (2009), the willingness to take risks in trusting strangers significantly predicts individual trust (Table 4, column 6). The magnitude and the significance of birth-order effect on trust, however, do not change when controlling for risk preferences, leading us to exclude attitudes towards risk as a possible channel.

[TABLE 4 AROUND HERE]

4.4 Family ties

To assess whether the birth-order effect on trust is accounted for by the strength of family ties, we exploit a battery of questions contained in the 11th, 12th and 16th wave of the BHPS, which are merged with our sample. More specifically, respondents were asked how often they see their father, mother or adult child living elsewhere. The possible responses are 'daily', 'at least once a week', 'several time a year', 'less often' and 'never'. We aggregate this information in a

[14] The validity of this question (also used in the GSOEP) in predicting actual risk behaviour is supported by a field experiment by Dohmen et al. (2006).

[15] We consider these two measures of risk attitudes since the behavioural evidence on betrayal aversion has shown that persons tend to be less willing to take risks when these risks derive from other persons rather than from nature (Bohnet et al. 2008).

simple index (*FAMILY TIES)* that is the average of six categorical variables measuring the frequency with which each respondent visits her mother (*VISITING MOTHER)*, her father (*VISITING FATHER)* and her children (*VISITING CHILD)*, as well as calls on the phone her mother (*CALLING MOTHER)*, her father (*CALLING FATHER)* and her children *(CALLING CHILD)*. High values of these variables, and consequently of the index, are associated with low frequency of visits, thereby capturing the respondent's *weakness* of family ties (see Ermisch and Gambetta 2010 for a similar approach).[16]

Our evidence goes against the hypothesized non-linear effect of birth order on social ties predicting middleborns to be less family-attached than younger or older siblings (see Section 2). From a descriptive point of view, Figure 4-A shows instead a decreasing and linear relationship between birth order and family ties. The lack of an inverse u-shaped effect emerges also from OLS results of a regression of family ties on birth order, which includes as well current and childhood SES (Figure 4-B).[17] Overall our results suggest that firstborns tend to be less attached to the family than their younger siblings.

[FIGURES 4A-B AROUND HERE]

As Ermish and Gambetta (2010) and Alesina and Giuliano (2011), we find that weak family ties are associated with higher generalized trust (Figure 5-A). However, this association is better described by an inverse u-shape curve (Figure 5-B), suggesting that there might be an optimal level of family ties for trust. Below and above that level perhaps trust is brought down by never-trusting types, i.e. individuals who trust neither family nor non-family members.

[FIGURES 5A-B AROUND HERE]

This finding is also confirmed by our regression results in Table 5 (column 3). Since this result is potentially a novel contribution to the social-capital research, a further investigation is needed, but it is behind the scope of this paper. Back to our research question, the birth order

[16] Different from Ermisch and Gambetta (2010) who relied on a dummy variable equal to one for strong family ties, our index takes into account possible non-linear associations between family ties and trust. Moreover, the authors implicitly assume that respondents without a living child, father or mother living elsewhere have weak family ties (i.e. they see their relatives less than once a week). Since we cannot make inference on the strength of social ties for these respondents, we exclude them from our analysis.

[17] The effect is mainly driven by laterborns calling or visiting more frequently their mother or father (Figure A3 in Appendix).

effect is mostly unaffected by the inclusion of family ties, thereby leading us to exclude also family ties as a possible explanation.

[TABLE 5 AROUND HERE]

5. Additional checks

In this section we assess the robustness of the birth-order effect to the aforementioned channels jointly considered, to alternative dependent variables, to checks for endogenous fertility and to the exclusion of only-child respondents. We also investigate further the gender difference in the birth-order effect, and examine the role of mother's education as well as of unobserved heterogeneity in the familial environment. We conclude by evaluating the effects of birth spacing on a subsample, and discuss how mortality might induce selection bias.

5.1 The joint role of the alternative explanations

Empirical results obtained so far lead to the conclusion that the personality of individuals, the degree of risk aversion and the strength of family ties do not significantly explain the effect of birth order on trust. In order to explore further the relative strength of these forces, we repeat the analysis including all the possible combinations of PTs, family ties and risk preferences.

Results are summarized in Table 6 and confirm that the magnitude and (almost always) the significance of the birth-order effect on trust remain unchanged. In line with Ermisch et al. (2009), openness turns not statistically significant when accounting for the respondents' propensity to take social risks (Table 6, column 2). This result suggests that the effect of such a prosocial trait is absorbed in the respondents' willingness to take risks, which is an important dimension of trust in social interactions.

[TABLE 6 AROUND HERE]

5.2 Behavioral measures of trust

The association between trust and civic engagement is well-established in the social-capital literature, according to which trust is considered either as the cause or the consequence of participation to civic organizations (Uslaner 2002). On the one hand, voluntary organizations require cooperation between strangers for their survival, and hinge on participants' trust for their success (La Porta et al. 1997). On the other hand, voluntary organizations – and in

particular those bridging unknown (and unlike) persons – act as socialization devices, thereby stimulating generalized trust (Putnam 2000).[18] Thus, we examine whether the birth-order effect persists when self-reported trust is replaced by voluntary work and civic engagement, which would capture a common underlying factor (trust in others), but are less affected by self-report bias or demand effects than attitudinal questions (e.g. Glaeser et al. 2000).

From the 14th wave of BHPS we obtain information on whether the respondent participates to local groups or does voluntary work. We then construct a dummy variable for attendance to local groups (*LOCAL GROUPS*) and for carrying out unpaid voluntary work (*VOLUNTARY*). These variables are equal to one if the respondent carries out the activity at least once a year, several times a year, once a month or at least once a week.[19] Results are consistent with the previous findings. In particular, laterborns appear less inclined to meet local groups or do voluntary work than their older siblings (Table A4 in Appendix).

5.3 Endogenous fertility

Fertility is a likely endogenous process underlying sibship size. It can also induce a bias in the estimated birth-order effect, provided that there is some residual correlation between birth order index and sibship size. For instance, some respondents' mothers may still be in their reproductive age, leading to a measurement error in the fertility variable (i.e. sibship size). In addition, parental investment and the decision about the family size could be jointly determined (Emerson and Portela Souza 2008).

In order to mitigate these concerns we perform two robustness checks. First, we restrict our sample to individuals whose mother is 40 years old at the date of the interview, thereby ruling out incomplete fertility issues. Results are reported in Table A5 in Appendix and do not show systematic differences from the previous ones. Second, as in Rosenzweig and Shultz (1987), Foster and Roy (1997) and Emerson and Portela Souza (2008), we use the residuals from a fertility regression as an estimate of the unexplained component of fertility. Indeed, these residuals are correlated with realized fertility, but not with the unexplained component of time allocation choices (net of the explanatory variables). This variable is used in place of

[18] Putnam et al. (1993) measures social capital through engagement in civic groups and voluntary associations.

[19] More specifically, each individual answers on a 1-to-5 response scale ('at least once a week', 'at least once a month', 'several times a year', 'once a year or less' and 'never/almost never'). We construct dummy variables in order to perform logistic regressions consistently with the main analysis using trust as dependent variable. However, we also repeat the analysis with all categories using an ordered logit regression. Results, available on request, do not change significantly.

sibship size in our main trust regression. Results are robust also under this robustness check (Table A6 in Appendix).

Finally, since only-child families might behave differently from multiple-children families, we exclude from the analysis only-child respondents. Again, results are consistent with our main findings (Table A7 in Appendix).

5.4 Understanding gender differences

Previous estimates have shown that the birth-order effect on trust is mainly driven by male respondents. To shed lights on which are the main childhood or adulthood forces behind the gender difference, we apply the decomposition method developed by Gelbach (2016). This approach allows us first to measure the change in the birth-order coefficient due to the stepwise inclusion of covariates, which might be sensitive to the order in which variables are added (especially when these are intercorrelated). Secondly, we can assess the relative contribution of each covariate to the change in the birth-order effect when moving from the baseline model to the model with all regressors. Thirdly, by running this decomposition separately by gender, we are able to identify what are the key current or past characteristics that account for the women's birth-order gap in trust.

Table 7 shows OLS estimates of the birth-order effect on trust when SES in childhood and SES in adulthood are added to our baseline specification (i.e. that in Table 2, column 1). Considering the whole sample (Table 7, columns 1-2), the inclusion of all SES characteristics reduces on average birth-order differences by about 0.05 points, i.e. a drop of about 60 percent from the baseline regression. Confirming the previous findings, this change is mostly due to SES in adulthood, and in particular to the respondent's level of education. A further breakdown of SES in childhood highlights that parents' education and number of books are the major family characteristics that account for the birth-order effect on trust.

[TABLE 7 AROUND HERE]

More interestingly, when we split the sample by gender, we observe that both SES in adulthood and childhood significantly matter in explaining birth-order differences, though to a greater extent for women (Table 7, columns 3-4) than for men (Table 7, columns 5-6). A decomposition of SES characteristics shows that childhood conditions are important only for women, while SES in adulthood also for men, though to a lesser extent. The factors that make birth-order differences non-statistically significant for women are, in order of importance: i) the highest

educational qualification achieved; and ii) the level of education of parents and the number of books at home during the childhood. In other words, for women, education inputs and, above all, education outcomes are the main drivers of the effect of birth order on trust.

The importance of education for women could be due to a more favorable parental investment on daughters (regardless of birth order) than on sons, and by the better educational performance of the former relative to the latter. However, when estimating the effect of birth order on the probability of having high education (controlling for childhood and adulthood SES), we find that the birth-order effect is negative and significant as in previous studies (Black et al. 2005a; Booth and Kee 2009), but it does not sizably vary by gender.[20] Conversely, the effect of higher education on trust is positive and statistically significant as expected, but it is larger for women than for men.[21] These results jointly considered imply that education mediates the association between birth order and trust only for women. The mediation seems to be mostly driven by the higher trust elasticity of education for women, rather than by a gender gap in education outcomes resulting from birth order.

A possible interpretation to this finding is that laterborn men carry on the effects of parental investment in adulthood, with later life experiences not fully compensating for unequal childhood endowments. For women, instead, later life experiences seem to play a major role. By fostering open-mindedness, providing exposure to (and increased knowledge about) social diversity, or raising perceived control over the environment, higher education might offset the diffidence towards strangers women may have learnt by parents in the childhood. Such diffidence could emerge from parents being usually stricter on daughters than on sons about meeting with (and trusting) strangers, since girls are usually perceived at a higher risk (e.g. of sexual violence) than boys. Social diffidence could also originate from a high degree of conservatism in the family of origin, wherein girls absorb traditional norms about premarital sex, interactions with non-relatives, and their role in the household and in the society. Within-family differences in parenting styles across male and female children would also explain why in cross-country studies women tend to report lower generalized trust levels than men (e.g. Mewes 2014).

[20] Higher education is a dummy variable equal to one for respondents with a nursing, teaching, first of higher degree qualification. We estimate the model using a logistic regression. No significant differences in the birth-order effect on education are found when restricting the sample to women and men separately, nor when interacting birth order index with gender in the unrestricted sample. Results are available on request.
[21] Results are available on request.

5.5 The role of mother's education

Many studies have analyzed the effects of parental background on different children's outcomes such as cognitive skills, education, health and income (for a review, see Black and Devereux 2011), highlighting also that part of the variation in children success can be predicted by the education level of the parents, and especially from that of the mother (Black et al. 2005b; Bingley et al. 2009; Chevalier 2004; Pronzato 2012).

Not only highly educated mothers set the conditions for better children's educational outcomes, but they also play an important role for the transmission of values and attitudes. In particular, there is evidence of a significant and stronger transmission of trust from the mother's side than from father's side (e.g. Dohmen et al. 2012). The intergenerational transmission of trust tends to be much stronger for children of highly educated mothers (Ljunge 2014, a result that emerges also from our analysis (Table 2, columns 2 and 4). Among the possible rationales, highly educated mothers would devote a great deal of attention and priority to their children, facilitate norm transmission and successfully direct expenditures towards child-friendly activities and investments. At the same time, they also tend to be less financially constrained than mothers with lower education.

All these arguments lead us to hypothesize that, independently from household income and family size, highly educated mothers would distribute time and financial resources more equally among children. Consequently, high mother's education should counterbalance the lower trust levels that laterborns would otherwise have in the future due to parental favoritism towards firstborns. We therefore test the moderating role of mother's education by interacting the education level of the mother with birth order.[22] Results, summarized in Table 8, show that the effect of birth order is robust to the inclusion of the interaction term. As expected, the latter is positive, statistically significant and large in magnitude especially when considering mothers with university degree, thereby supporting the hypotheses that mothers' education offsets the effect of birth order on trust (see also Figure A5 in Appendix).

[TABLE 8 AROUND HERE]

5.6 Residual contextual effects: a multilevel approach

In spite of the inclusion of many childhood family controls, there might be a residual variation in trust due to unobserved family characteristics. To evaluate the relative strength of

[22] Using a similar approach, but with children's education as main outcome, Booth and Kee (2009) and Black et al. (2005a) find that the effect of birth order is stronger for children from highly educated mothers.

familial environment vis-à-vis individual characteristics, we take into account the hierarchical structure of a subsample, and compare siblings between and within families.

A fraction of respondents have a family bond, which is tracked through either their mother or their father identifier reported in the data. By restricting the analysis only to these respondents (whose sibship status guarantees that they shared similar family traits in childhood) we run a multilevel analysis allowing for variation in trust across individuals and across families. Through this model we decompose the variance of trust into two parts, namely a part attributable to differences between individuals belonging to different families (between-family variance), and a part related to variation between individuals within the same family (within-family variance). We therefore assess the relative importance of the context (family) in determining the outcome of interest (trust). Furthermore, the reduction in the family-level variation due to the inclusion of family-level covariates (i.e. SES in childhood) provides us with an indication of how 'good' are our controls in capturing background household environment.[23]

Table A8 in the Appendix shows results from a multilevel logistic regression model accounting for two-level data, i.e. individuals nested into families (i.e. having the same mother or father). In all specifications we report the variance of the random intercept (e.g. the mother or father identifier) and the Intraclass Correlation Value (ICC), which is the ratio of between-family variance to total variance. The ICC indicates the relative importance of the family, namely the degree to which individuals share common experiences because they have the same parent (large values correspond to a high relative impact of the family). In the models without controls ('Null', columns 1 and 5), the family of origin plays a limited role in explaining trust because the between-family variance accounts for about only 16-18 percent of the total variance. Consistent with findings in Section 4.1, this result suggests that in our sample most of the variation in trust is due to individual rather than family characteristics.

The stepwise inclusion of controls further reduces the between-family variance, with the ICC value falling below three percent in the full model (columns 2-4 and 6-8). This result suggests that our SES-in-childhood variables perform remarkably well in capturing the unobserved family-level characteristics that are related to trust. Another important result is that, in spite of the limited sample size, the coefficient of birth order remains statistically

[23] Consider that a mother or father fixed-effects model is unfeasible in our case because of the limited sample size as a consequence of the family-bond restriction.

significant and negative in all specifications, further underlining the robustness of our findings.[24]

5.7 Birth spacing

Previous studies have suggested that birth-order differences are also associated with birth spacing. As shown by Price (2008), parental time with the child decreases when the child ages, with the adverse birth-order effect being amplified when the birth-interval widens. Firstborns would therefore benefit from a larger parental time allocation than that received by laterborns, especially when the latter are spaced further out. Conversely, if household income grows as time goes by, laterborns from widely-spaced families might rely on a more favorable financial allocation than that of their counterparts from closely-spaced families (Powell and Steelman 1995).

Information on birth spacing can be retrieved, unfortunately, only for few respondents. We compute it considering only households in which both the first and second-born children are present in wave 13 of the BHPS. We restrict the sample to two-children families (the most frequent group in this reduced sample), and analyze whether birth-order differences in trust change when the birth-interval between the two siblings widens. We compute both the conditional and unconditional differences in trust by birth spacing years. As in Price (2008), the conditional differences are based on the difference in predicted values following a logistic regression that includes the same set of covariates as Table 2 (column 4), but with the birth-order variable replaced with the interaction of the birth order index and the age-distance in years among the two children. The unconditional differences are computed as simple differences in trust between secondborns and firstborns by birth-spacing years.

Results show that the birth-order gap turns favorable to secondborns when the age distance is less than two years (Table A9 in the Appendix). This might be due to an equal parental investment between two closely children, though with a slightly larger care towards the youngest. More notably is the reversal in birth-order gap when siblings are spaced further apart. This finding is not necessary inconsistent with our previous results. A widely spaced secondborn may well be treated as a firstborn in terms of time and financial resources received when the older sibling reaches maturity and independence (Hanushek 1992). Since birth-order differences tend to narrow (and even reverse) when the age gap of children increases, our

[24] We have also replicated the analysis on the same sample using a standard logistic regression, without taking into account the hierarchical structure of the data. The birth-order coefficient is negative and statistically significant in all model specifications, ranging from -0.537 to -0.722 (results available upon request).

results also support the hypotheses that laterborns benefit from increased household wealth (Powell and Steelman 1995). However, while suggestive for further analysis, this evidence should be taken with caution because of the limited sample size.

5.8 Selective mortality

A potential source of bias in our estimates is selective mortality as mortality risk in adulthood increases with birth order (Barclay and Kolk 2015). Thus, laterborns might be under-represented in our sample on the basis of characteristics (e.g. their SES) that are correlated with trust. However, since mortality tends to be higher among low-SES individuals, we might miss laterborns whose levels of trust would have been nonetheless lower. As a consequence, even in the worst scenario wherein selective mortality takes place, our results can be interpreted conservatively, namely as lower-bound estimates of the true effect of birth order on trust.

6. Conclusions

The renewed interest by the economic literature in the effect of birth order on human-capital outcomes has thus far neglected social trust as a long-term output of familial environment. In the psychological literature, childhood is a crucial stage of life for the formation of long-term trust, which can be either inherited from parents or affected by the type of the bond infants develop with their caregivers. In spite of the growing number of studies deeming trust as a pillar of socio-economic success, the early-life determinants of trust are still underexplored.

To the best of our knowledge, for the first time in the literature, this paper bridges this gap and assesses if and why differences in the order of birth predict heterogeneous trust levels in the adulthood. We draw hypotheses about the possible channels from psychology, economics and sociology, and empirically investigate if and how these mechanisms explain the association between birth order and trust among British respondents. Relying on an index measuring birth order independently from sibship size, we find a negative and robust effect of birth order on trust. No matter how much they differ in personality, strength of family ties, risk aversion and parental inputs, laterborns tend to have lower levels of trust in others than their older siblings. This effect is only partially explained by respondents' heterogeneity in human capital outcomes, as proxied for by their current socio-economic status. Results are robust when voluntary work and civic engagement are used as alternative dependent variables, and to further corrections for potential endogeneity in fertility choices.

Interestingly, controlling for current and childhood socio-economic characteristics, gender differences emerge, with the birth-order effect remaining significant only for male respondents. By investigating the role of different covariates, we find that education outcomes explain most of the association between birth order and trust only for women. Since in our sample there is no systematic gender gap in education due to birth order, a possible hypothesis to test in future research is that women's education neutralizes the social diffidence girls learn in overprotective families. Parents might perceive women as being exposed to larger risks than men, and therefore teach them not to trust strangers.

Consistent with these results, multilevel analysis on a subsample suggests that most of the variation in trust is due to within- rather than between-family characteristics. Consequently, the shift of parental attitudes or behavior across children could be an explanation to the effect of birth order on trust. Although we cannot formally test this hypothesis because of data limitations, Lehmann et al. (2016) provide evidence that birth-order differences are driven by a change in parenting style and inputs in the first years of children's life. Such change is observed, for instance, in the riskier behavior of mothers during subsequent pregnancies and in the inferior cognitive stimulation laterborns receive at home. Similarly, Hotz and Pantano (2015) show that the negative effect of the order of birth on school outcomes can be attributed to a change of the disciplinary environment across children. In a strategic model of parental reputation, firstborns, as opposed to laterborns, would receive more stringent rules governing their free time and a stronger parental monitoring regarding homework, which positively predicts their superior educational attainments. Even though we show that birth spacing can mitigate (or even reverse) birth-order differences in a selected subsample, the unexplained part of the birth-order effect on trust remains the object of future research.

Our findings have important implications. First, we provide evidence that highly educated mothers buffer laterborns against the adverse effect of their order of birth on trust. Hence, from the policy point of view, expanding mother's education would set laterborns on the same trust trajectory as their older siblings, thereby increasing trust for the entire society. Second, our results display that high education makes birth-order differences less important for women. These findings suggest that, on the one hand, men (more than women) would benefit in the long run from policies reducing parental favoritism such as, for instance, those promoting women's tertiary education and family-work reconciliation. On the other hand, by weakening the adverse effect of birth-order on trust, the expansion of female education would be effective in the short run also for laterborn women. Third, as in Black et al. (2005a), the sibship-size effect on trust disappears when accounting for differences in current socio-

economic conditions. Hence, when evaluating the effects of sibship size on a single outcome (e.g. wealth), potential heterogeneity in other outcomes (e.g. education) should be taken into account since it might be an omitted driver of the observed effect. Finally, the lack of a robust sibship effect rules out the traditional explanation to parental favoritism based on the quantity-quality trade-off. Considering trust as a separate 'quality' outcome, our results suggest that, for a given parental income, children from smaller families will not necessary have more trust. Hence household financial constraints may not be that important.

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Figure 1 - Trust and absolute birth order (excluding only-child)

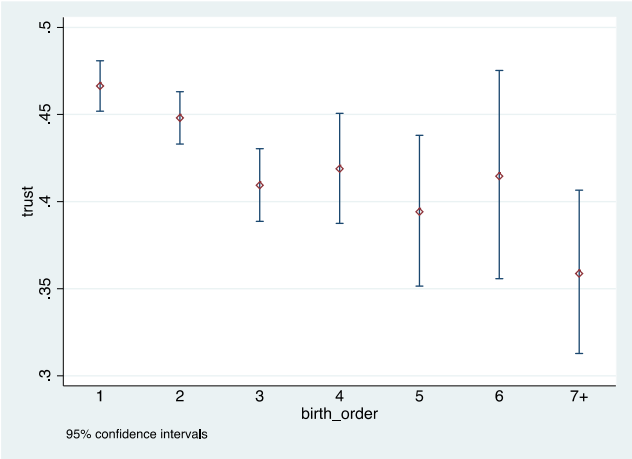
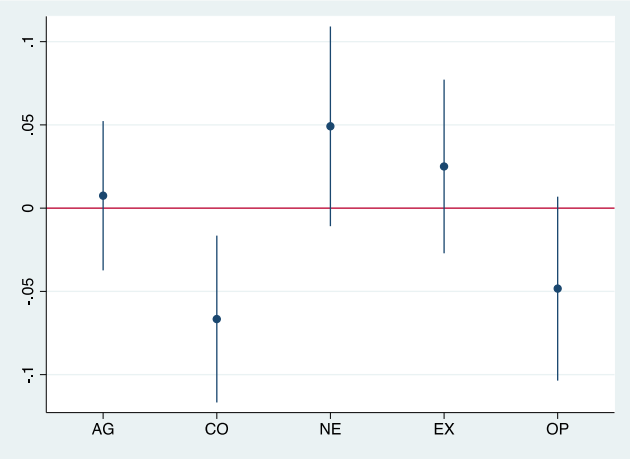
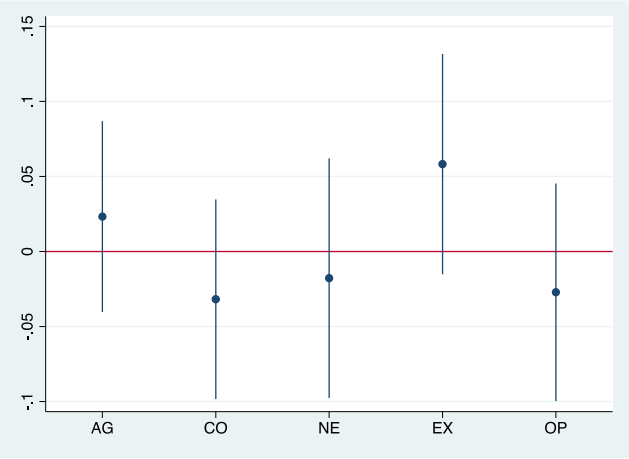


Figure 2 – The effect of birth order on personality

A – no controls are included

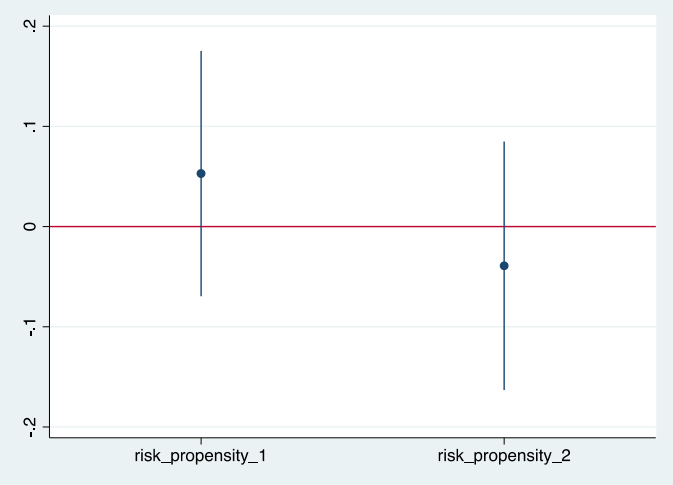


B – controls are included



Notes: OLS coefficients from a regression of personality traits on birth order. AG: Agreeableness; CO: Conscientiousness; NE: Neuroticism; EX: Extraversion; OP: Openness. Controls include: Parental age cohorts, Region dummies, SES in childhood, SES in adulthood.

Figure 3 – The effect of birth order and risk preferences



Notes: marginal effects from an ordered logit regression of *risk propensity 1* or *risk propensity 2* on birth order index. Controls include: Parental age cohorts, Region dummies, SES in childhood, SES in adulthood.

Figure 4 –Birth order and family ties

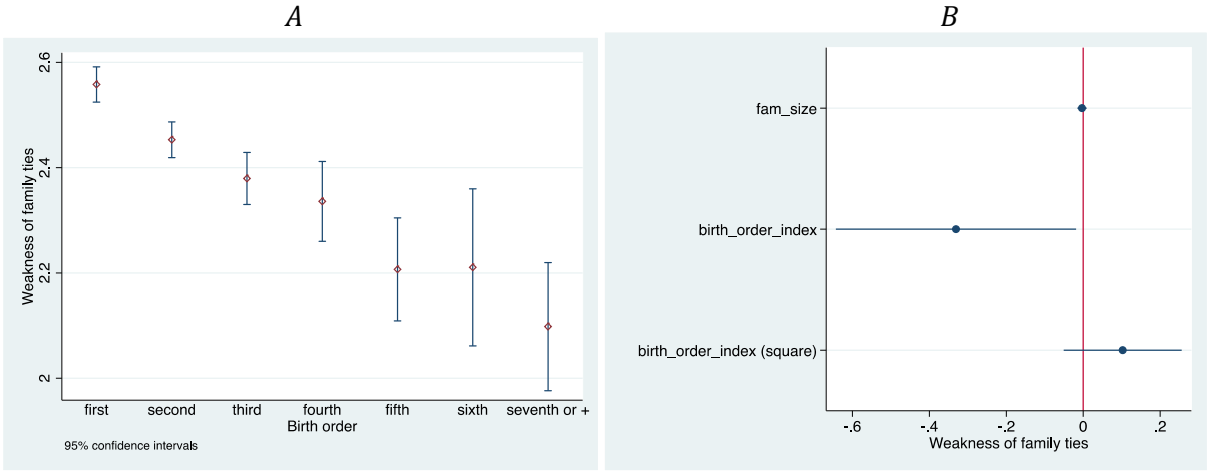


Figure 5 – Family ties and trust

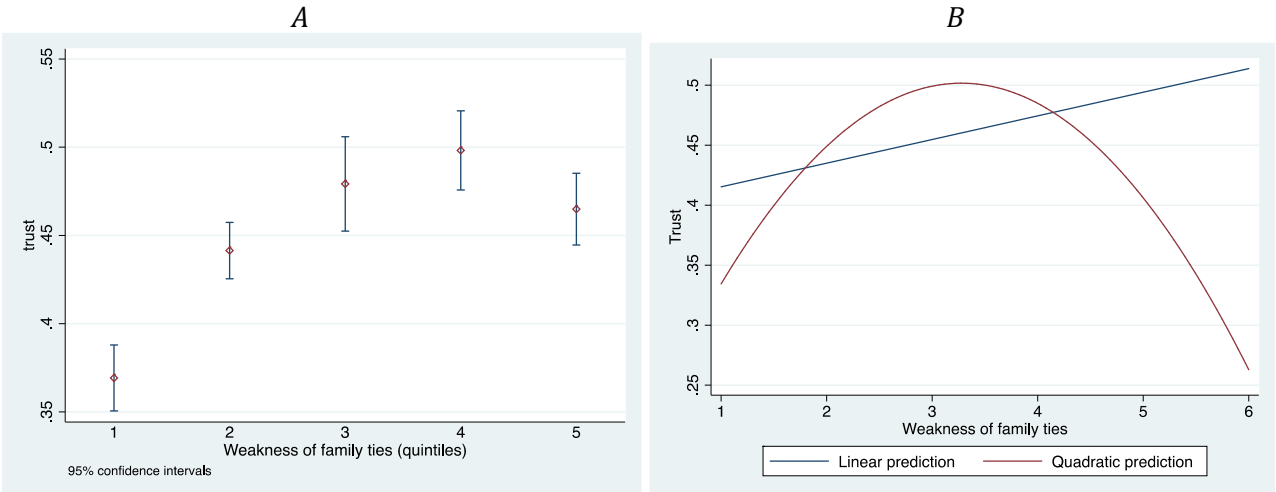


Table 1 – Absolute birth order and trust

Dep. Var.: *Trust*	(1) Coefficients	(2) Marginal effects
Fam size	-0.0485***	-0.0121***
	(0.0138)	(0.00345)
Second child	-0.122**	-0.0305**
	(0.0498)	(0.0124)
Third child	-0.313***	-0.0778***
	(0.0678)	(0.0169)
Fourth child	-0.231**	-0.0575**
	(0.0963)	(0.0240)
Fifth + child	-0.319***	-0.0793***
	(0.116)	(0.0288)
Age2440	0.0435	0.0108
	(0.0721)	(0.0179)
Age4155	0.413***	0.103***
	(0.0724)	(0.0180)
Age5670	0.277***	0.0690***
	(0.0790)	(0.0197)
Age71	0.313***	0.0780***
	(0.0922)	(0.0229)
Female	-0.169***	-0.0420***
	(0.0368)	(0.00917)
Other white	0.0865*	0.0215*
	(0.0448)	(0.0112)
Non_white	-0.384***	-0.0956***
	(0.149)	(0.0370)
Region dummies	NO	NO
Parental cohorts	YES	YES
Observations	10,469	10,469
Wald χ^2	212.97	
Log Likelihood	-7121.24	
Pseudo R^2	0.0155	

Robust standard errors clustered at household level in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Parental age cohorts include Mum2125–Mum41up, Dad2125–Dad41up, with Mum20 and Mad20 as reference groups, respectively.

Table 2 – Birth order index and trust

Dep. Var.: *Trust*	(1)	(2)	(3)	(4)	(5)	(6)
	Whole Sample				Female	Male
Fam size	-0.0804***	-0.0546***	-0.0180	-0.00991	0.0103	-0.0328*
	(0.0104)	(0.0108)	(0.0112)	(0.0113)	(0.0148)	(0.0174)
Birth order index	-0.306***	-0.260***	-0.163***	-0.145**	-0.0683	-0.234**
	(0.0607)	(0.0614)	(0.0625)	(0.0630)	(0.0862)	(0.0923)
Age2440	0.0495	0.0864	-0.285***	-0.245***	-0.111	-0.442***
	(0.0721)	(0.0745)	(0.0850)	(0.0868)	(0.118)	(0.127)
Age4155	0.412***	0.551***	0.116	0.206**	0.419***	-0.0746
	(0.0724)	(0.0767)	(0.0878)	(0.0907)	(0.121)	(0.134)
Age5670	0.279***	0.486***	0.183*	0.287***	0.476***	0.0777
	(0.0790)	(0.0833)	(0.0961)	(0.0987)	(0.130)	(0.145)
Age71	0.316***	0.520***	0.343***	0.434***	0.768***	0.0699
	(0.0921)	(0.0955)	(0.110)	(0.111)	(0.145)	(0.164)
Female	-0.169***	-0.216***	-0.112***	-0.147***		
	(0.0369)	(0.0376)	(0.0410)	(0.0415)		
Other white	0.0843*	0.0987**	-0.0249	-0.0158	-0.0923	0.0694

	(0.0449)	(0.0459)	(0.0568)	(0.0570)	(0.0745)	(0.0823)
Non white	-0.392***	-0.414***	-0.631***	-0.617***	-0.769***	-0.434**
	(0.149)	(0.149)	(0.155)	(0.155)	(0.232)	(0.207)
Working mother		0.0500		0.00788	0.0423	-0.0380
		(0.0491)		(0.0521)	(0.0708)	(0.0783)
Married			0.204***	0.219***	0.277***	0.139*
			(0.0505)	(0.0508)	(0.0636)	(0.0770)
Educ 2			0.0803	0.0484	0.154	-0.0857
			(0.0924)	(0.0927)	(0.122)	(0.145)
Educ 3			0.310***	0.260***	0.314***	0.221*
			(0.0737)	(0.0743)	(0.0984)	(0.114)
Educ 4			0.579***	0.499***	0.615***	0.402***
			(0.0825)	(0.0833)	(0.113)	(0.124)
Educ 5			0.407***	0.329***	0.444***	0.213**
			(0.0707)	(0.0718)	(0.0966)	(0.106)
Educ 6			1.142***	1.013***	1.158***	0.862***
			(0.0893)	(0.0912)	(0.122)	(0.132)
Smoker			-0.287***	-0.291***	-0.293***	-0.277***
			(0.0517)	(0.0519)	(0.0695)	(0.0760)
Annual income			1.95e-06	1.96e-06	8.92e-07	6.79e-06***
			(2.03e-06)	(2.07e-06)	(1.60e-06)	(2.46e-06)
Occupation 1			0.0628	0.0570	0.0116	0.0906
			(0.0923)	(0.0927)	(0.131)	(0.128)
Occupation 2			0.304***	0.291***	0.288***	0.282**
			(0.0778)	(0.0783)	(0.101)	(0.115)
Occupation 3			0.115*	0.121*	0.0659	0.174*
			(0.0643)	(0.0645)	(0.0829)	(0.101)
Occupation 4			-0.0902	-0.0843	0.00410	-0.153
			(0.0691)	(0.0693)	(0.0945)	(0.104)
Children number			-0.00635	-0.00417	0.0326	-0.0505
			(0.0278)	(0.0281)	(0.0363)	(0.0404)
Dad education		0.124***		0.0349	0.0769	-0.0327
		(0.0482)		(0.0496)	(0.0654)	(0.0737)
Mum education		0.285***		0.171***	0.211***	0.127
		(0.0561)		(0.0579)	(0.0770)	(0.0877)
Quite books		0.285***		0.213***	0.298***	0.123
		(0.0525)		(0.0535)	(0.0762)	(0.0756)
Lots books		0.411***		0.281***	0.370***	0.167*
		(0.0558)		(0.0574)	(0.0781)	(0.0861)
Kid inner		-0.155**		-0.0807	-0.114	-0.0106
		(0.0773)		(0.0788)	(0.108)	(0.115)
Kid town		-0.173***		-0.120**	-0.0957	-0.130
		(0.0583)		(0.0596)	(0.0792)	(0.0875)
Kid village		-0.136**		-0.0819	-0.0570	-0.0959
		(0.0631)		(0.0651)	(0.0866)	(0.0953)
Kid rural		-0.215***		-0.0946	-0.150	-0.0313
		(0.0704)		(0.0730)	(0.0974)	(0.108)
Kid moved		-0.00990		-0.0165	-0.0304	0.0325
		(0.113)		(0.118)	(0.150)	(0.189)
Fam norm		-0.0136		-0.0511	0.0273	-0.162*
		(0.0605)		(0.0620)	(0.0844)	(0.0908)
Region dummies	NO	NO	YES	YES	YES	YES
Parental cohorts	YES	YES	YES	YES	YES	YES
Observations	10,469	10,469	10,469	10,469	5,789	4,680
Wald χ^2	214.75	345.56	638.76	670.55	444.57	316.19
Log Likelihood	-7119.32	-7038.98	-6843.41	-6817.34	-3727.60	-3057.01
Pseudo R^2	0.015	0.0269	0.0539	0.0575	0.0636	0.0574

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts include Mum2125–Mum41up, Dad2125–Dad41up, with Mum20 and Mad20 as reference groups, respectively.

Table 3 – Birth order index, personality traits and trust

Dep. Var.: *Trust*	(1) Whole sample	(2)	(3) Female	(4) Male
Fam size	-0.00780	-0.0102	0.00223	-0.0205
	(0.0125)	(0.0127)	(0.0166)	(0.0197)
Birth order index	-0.139**	-0.157**	-0.109	-0.223**
	(0.0680)	(0.0686)	(0.0944)	(0.102)
Agreeableness		0.177***	0.162***	0.207***
		(0.0260)	(0.0360)	(0.0382)
Conscientiousness		-0.190***	-0.191***	-0.185***
		(0.0246)	(0.0329)	(0.0376)
Extraversion		0.0293	0.0466	0.00389
		(0.0213)	(0.0288)	(0.0317)
Neuroticism		-0.142***	-0.175***	-0.0914***
		(0.0187)	(0.0247)	(0.0298)
Openness		0.0719***	0.0919***	0.0491
		(0.0216)	(0.0287)	(0.0331)
Observations	8,852	8,852	4,942	3,910
Wald χ^2	573.65	703.99	457.67	306.15
Log Likelihood	-5765.44	-5686.25	-3130.13	-2525.51
Pseudo R^2	0.0575	0.0704	0.0783	0.0681

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood, SES in adulthood are included.

Table 4 – Birth order index, risk aversion and trust

Dep. Var.: *Trust*	(1)	(2) Whole sample	(3) Female	(4) Male	(5)	(6) Whole sample	(7) Female	(8) Male
Fam size	-0.00122	-0.00278	0.000506	-0.00286	-0.00139	-0.00246	0.00598	-0.00929
	(0.0137)	(0.0139)	(0.0178)	(0.0217)	(0.0138)	(0.0143)	(0.0185)	(0.0222)
Birth order index	-0.190**	-0.195***	-0.123	-0.290***	-0.186**	-0.183**	-0.0865	-0.300***
	(0.0750)	(0.0755)	(0.102)	(0.112)	(0.0750)	(0.0771)	(0.106)	(0.114)
Risk propensity (1)		0.0903***	0.0957***	0.0831***				
		(0.0123)	(0.0165)	(0.0185)				
Risk propensity (2)						0.243***	0.275***	0.207***
						(0.0128)	(0.0175)	(0.0187)
Observations	7,522	7,522	4,241	3,281	7,521	7,521	4,243	3,278
Wald χ^2	533.07	577.68	382.08	261.41	533.41	818.40	552.32	339.75
Log Likelihood	-4879.86	-4851.90	-2698.98	-2124.10	-4878.75	-4677.13	-2578.36	-2067.10
Pseudo R^2	0.0628	0.0681	0.0775	0.0660	0.0629	0.1016	0.1192	0.0902

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood, SES in adulthood are included.

Table 5 – Birth order index, family ties and trust

Dep. Var.: *Trust*	(1)	(2)	(3)	(4)	(5)
		Whole sample		Female	Male
Fam size	-0.0187	-0.0188	-0.0173	-0.000187	-0.0383*
	(0.0128)	(0.0128)	(0.0129)	(0.0168)	(0.0195)
Birth order index	-0.129*	-0.119*	-0.119*	-0.0836	-0.181*
	(0.0708)	(0.0709)	(0.0709)	(0.0961)	(0.106)
Family ties		0.0787***	0.573***	0.553***	0.592***
		(0.0254)	(0.101)	(0.134)	(0.153)
Family ties^2			-0.0853***	-0.0758***	-0.0927***
			(0.0167)	(0.0232)	(0.0243)
Observations	8,401	8,401	8,401	4,735	3,666
Wald χ^2	600.73	606.94	623.17	416.67	300.82
Log Likelihood	-5434.00	-5429.08	-5415.91	-3016.99	-2362.99
Pseudo R^2	0.0649	0.0657	0.0680	0.0741	0.0701

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood, SES in adulthood are included.

Table 6 – Birth order index, personality traits, risk propensity, family ties and trust

Dep. Var.: *Trust*	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fam size	-0.000934	-0.000209	-0.0174	-0.0124	-0.0142	-0.00989	-0.0110
	(0.0145)	(0.0148)	(0.0143)	(0.0153)	(0.0158)	(0.0161)	(0.0164)
Birth order index	-0.199**	-0.183**	-0.133*	-0.161*	-0.141*	-0.174**	-0.150*
	(0.0779)	(0.0795)	(0.0763)	(0.0823)	(0.0842)	(0.0849)	(0.0868)
Agreeableness	0.212***	0.191***	0.179***			0.213***	0.186***
	(0.0298)	(0.0303)	(0.0288)			(0.0322)	(0.0330)
Conscientiousness	-0.200***	-0.153***	-0.181***			-0.181***	-0.131***
	(0.0276)	(0.0284)	(0.0269)			(0.0298)	(0.0308)
Extraversion	0.0345	0.0161	0.0328			0.0313	0.0145
	(0.0237)	(0.0244)	(0.0231)			(0.0254)	(0.0262)
Neuroticism	-0.130***	-0.120***	-0.120***			-0.117***	-0.108***
	(0.0213)	(0.0216)	(0.0204)			(0.0231)	(0.0235)
Openness	0.0532**	0.0234	0.0608**			0.0360	0.00554
	(0.0243)	(0.0249)	(0.0237)			(0.0264)	(0.0271)
Risk propensity (1)	0.0734***			0.0902***		0.0755***	
	(0.0132)			(0.0133)		(0.0143)	
Risk propensity (2)		0.235***			0.250***		0.240***
		(0.0133)			(0.0139)		(0.0144)
Family ties			0.569***	0.576***	0.528***	0.611***	0.565***
			(0.110)	(0.117)	(0.122)	(0.122)	(0.127)
Family ties^2			-0.0810***	-0.0839***	-0.0770***	-0.0846***	-0.0783***
			(0.0183)	(0.0195)	(0.0204)	(0.0203)	(0.0211)
Observations	7,153	7,153	7,332	6,409	6,410	6,104	6,106
Wald χ^2	642.48	839.81	629.82	540.08	756.24	580.92	762.88
Log Likelihood	-4550.15	-4397.33	-4677.89	-4099.98	-3946.14	-3858.10	-3725.25
Pseudo R^2	0.0812	0.1120	0.0779	0.0763	0.1111	0.0875	0.1192

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood, SES in adulthood are included.

Table 7 – The relative effect of covariates inclusion by gender (Gelbach decomposition)

OLS	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.: *Trust*	Whole sample		Female		Male	
Birth order index	-0.083***	-0.033**	-0.076***	-0.015	-0.091***	-0.054**
	(0.015)	(0.014)	(0.020)	(0.020)	(0.022)	(0.021)
SES Childhood	No	Yes	No	Yes	No	Yes
SES Adulthood	No	Yes	No	Yes	No	Yes
Total difference		-0.050***		-0.061***		-0.037***
		(0.004)		(0.006)		(0.006)
Difference due to:						
a) SES Childhood		-0.008***		-0.013***		-0.002
		(0.002)		(0.003)		(0.002)
Working mother		0.00008		0.0005		0.0004
		(0.001)		(0.001)		(0.001)
Parents' education & n. books		-0.008***		-0.013***		-0.003*
		(0.002)		(0.002)		(0.002)
Location		-0.001		0.0007		-0.001
		(0.001)		(0.002)		(0.001)
Biological family		0.001		0.002		0.002
		(0.001)		(0.001)		(0.001)
b) SES Adulthood		-0.042***		-0.049***		-0.036***
		(0.004)		(0.005)		(0.005)
Married & n. of children		-0.001		-0.0006		-0.001
		(0.001)		(0.001)		(0.0009)
Education		-0.028***		-0.034***		-0.021***
		(0.003)		(0.004)		(0.003)
Health		-0.006***		-0.006***		-0.006***
		(0.001)		(0.001)		(0.001)
Income		-0.0008		-0.0003		-0.003**
		(0.001)		(0.001)		(0.001)
Occupation		-0.006***		-0.007***		-0.005**
		(0.001)		(0.002)		(0.005)
Observations	10,469	10,469	5,789	5,789	4,680	4,680

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts and region dummies, are included in (1), (2), (3) and (4).

Table 8 – Birth order index and the role of mother's education

Dep. Var.: *Trust*	(1)	(2)
Fam size	-0.0101	-0.0112
	(0.0161)	(0.0161)
Birth order index	-0.236***	-0.210**
	(0.0915)	(0.0866)
Mum education	-0.215	
	(0.194)	
Mum education*Birth order index	0.338*	
	(0.186)	
Mum degree		-0.665*
		(0.375)
Mum degree*Birth order index		1.010***
		(0.387)
Observations	6,104	6,104
Wald χ^2	583.57	589.08
Log Likelihood	-3856.48	-3851.21
Pseudo R^2	0.0879	0.0891

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood, SES in adulthood, Agreeableness, Conscientiousness, Extraversion, Neuroticism, Openness, Risk propensity 1, Family ties and Family ties^2 are included.

APPENDIX – not for publication

Figure A1 – Birth order and risk preferences

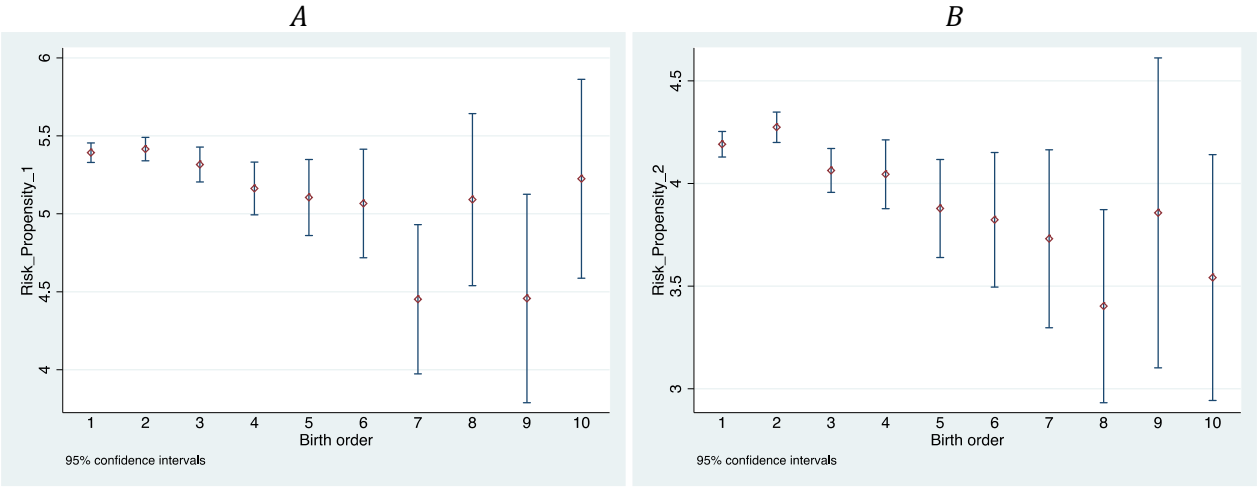


Figure A2 – Risk propensity and trust

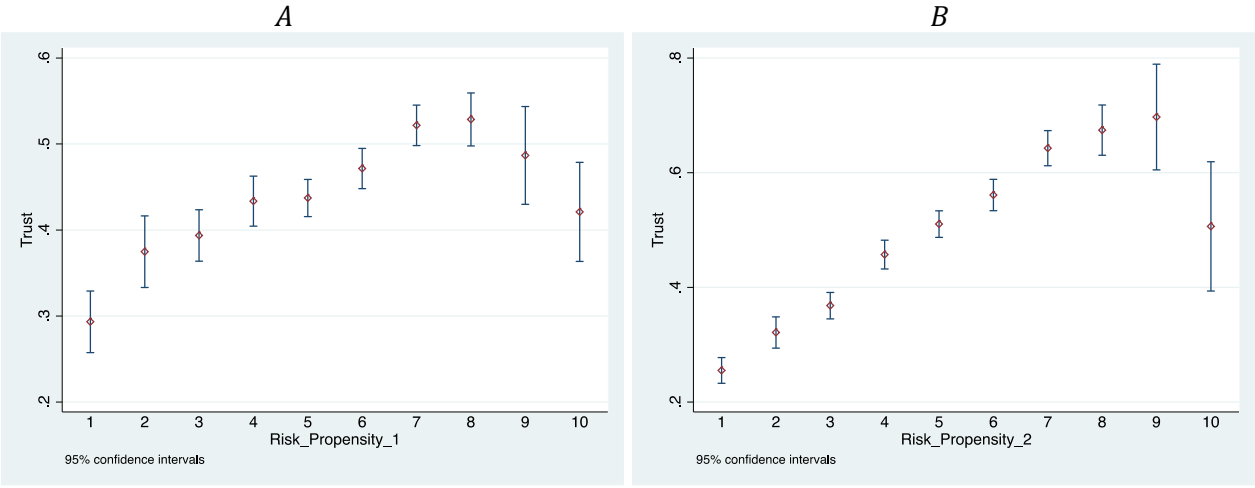


Figure A3 - Family ties and trust

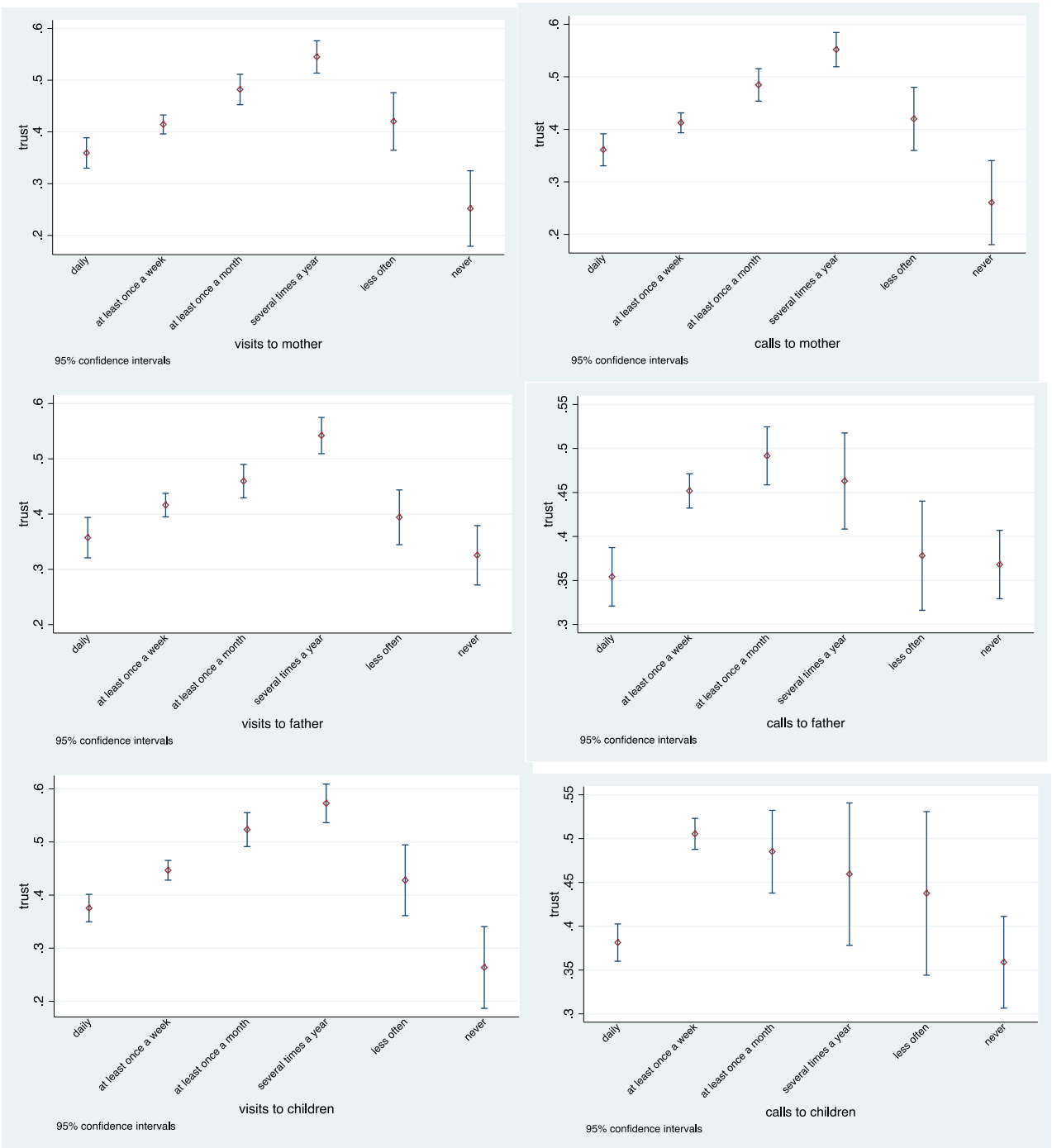


Figure A4 – Birth order and family ties

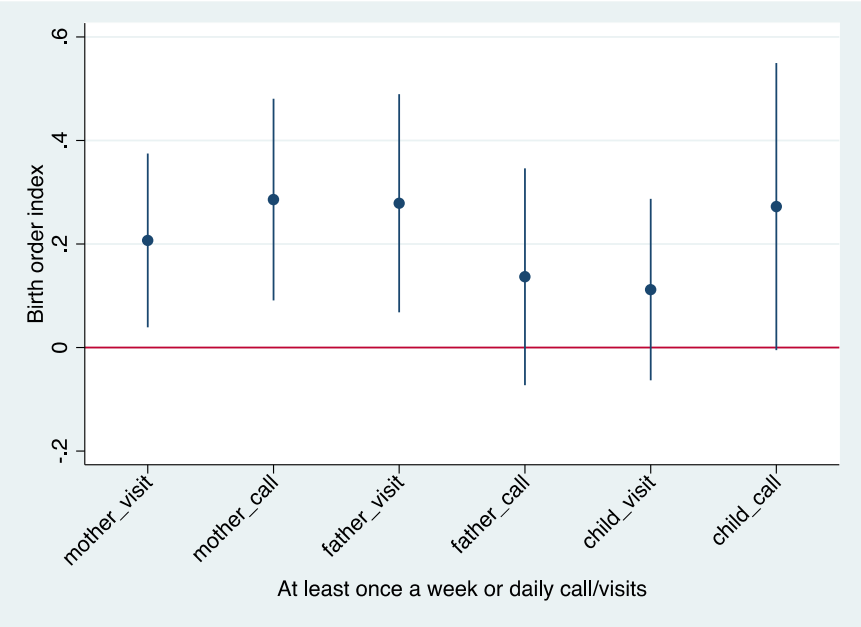


Figure A5 – The moderating effect of mother's education

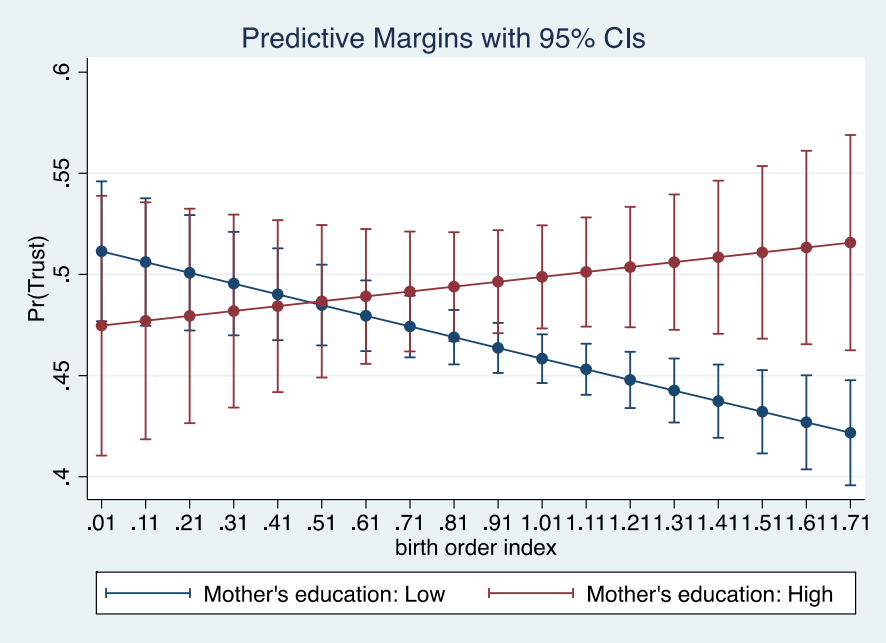


Table A1 – Variable Legend

	Dependent variables
Trust	Dummy = 1 if respondent says that most people can be trust, 0 otherwise
Voluntary	Dummy = 1 if respondent does unpaid voluntary work, 0 otherwise
Local groups	Dummy = 1 if the respondent attends meetings for local groups, 0 otherwise
	Individual characteristics
Age2440 (baseline)	Age cohort between 24 and 40 years old
Age4155	Age cohort between 41 and 55 years old
Age5670	Age cohort between 56 and 70 years old
Age71	Age cohort more than 70 years old
Female	Dummy equal to 1 if the respondent is female and 0 otherwise
White British (baseline)	Dummy equal to 1 if ethnic group is white British and 0 otherwise
Other white	Dummy equal to 1 if ethnic group is other-white and 0 otherwise
Non white	Dummy equal to 1 if ethnic group is non-white and 0 otherwise
	SES in adulthood
Married	Dummy equal to 1 if the respondent is married and 0 otherwise
Educ 1 (baseline)	Dummy equal to 1 if respondent has no qualification/apprenticeship, 0 otherwise
Educ 2	Dummy equal to 1 if respondent has apprenticeship or other qualification, 0 otherwise
Educ 3	Dummy equal to 1 if respondent has O level qualification, 0 otherwise
Educ 4	Dummy equal to 1 if respondent has A level qualification, 0 otherwise
Educ 5	Dummy equal to 1 if respondent has nursing, teaching of other higher qualification, 0 otherwise
Educ 6	Dummy equal to 1 if respondent has first of higher degree qualification, 0 otherwise
Region 1	Dummy = 1 if the respondent resided in England
Region 2	Dummy = 1 if the respondent resided in Wales
Region 3	Dummy = 1 if the respondent resided in Scotland
Region 4 (baseline)	Dummy = 1 if the respondent resided in Northern Ireland
Annual income	Annual labor and non-labor (pension, benefit, transfer, investment) income
Occupation 1	Dummy = 1 if respondent works as manager or senior official, 0 otherwise
Occupation 2	Dummy = 1 if respondent works has a professional occupation, 0 otherwise
Occupation 3	Dummy = 1 if respondent works has a sales and customer service occupation, 0 otherwise
Occupation 4	Dummy = 1 if respondent works has elementary occupation, 0 otherwise
Not employed/retired (baseline)	Dummy = 1 if the respondent is not employed or retired
Children number	Number of children in the family of the respondent
Smoker	Dummy = 1 if the respondent is a smoker
	SES in childhood
Fam norm	Dummy = to 1 if living with both biological parents from birth till age 16, 0 otherwise
Fam size	Number of children in respondent's own family
First child (baseline)	Dummy = 1 if respondent is the eldest in the family, 0 otherwise
Second child	Dummy = 1 if respondent is the second born in the family, 0 otherwise
Third child	Dummy = 1 if respondent is the third born in the family, 0 otherwise
Fourth child	Dummy = 1 if respondent is the fourth in the family and, 0 otherwise
Fifth + child	Dummy = 1 if respondent is the fifth or more in the family, 0 otherwise
Birth order index	Ratio of the respondent's birth order to the average birth order of her family
Dad20 (baseline)	Dummy = 1 if dad < 20 when respondent was born, 0 otherwise
Dad2125	Dummy = 1 if dad between 21 and 25 when respondent was born, 0 otherwise
Dad2630	Dummy = 1 if dad between 26 and 30 when respondent was born, 0 otherwise
Dad3140	Dummy =1 if dad between 31 and 40 when respondent was born, 0 otherwise
Dad41up	Dummy = 1 if dad more than 40 when respondent was born, 0 otherwise
Mum20 (baseline)	Dummy = 1 if mum < 20 when respondent was born, 0 otherwise
Mum2125	Dummy = 1 if mum between 21 and 25 when respondent was born, 0 otherwise
Mum2630	Dummy = 1 if mum between 26 and 30 when respondent was born, 0 otherwise
Mum3140	Dummy = 1 if mum between 31 and 40 when respondent was born, 0 otherwise
Mum41up	Dummy = 1 if mum more than 40 when respondent was born, 0 otherwise
Dad education	Dummy =1 if dad has gained certificates after leaving schooling, 0 otherwise
Dad degree	Dummy =1 if dad has a university degree or further, 0 otherwise
Mum education	Dummy =1 if has gained certificates after leaving schooling, 0 otherwise
Mum degree	Dummy =1 if mum has a university degree or further, 0 otherwise

Less_books (baseline)	Dummy = 1 if respondent had not many books during childhood, 0 otherwise
Quite books	Dummy = 1 if respondent had quite a few books during childhood, 0 otherwise
Lots books	Dummy = 1 if respondent had lots of books during childhood, 0 otherwise
Kid inner	Dummy = 1 if lived in the inner city as child, 0 otherwise
Kid suburban (baseline)	Dummy = 1 if lived in a suburban area as child, 0 otherwise
Kid town	Dummy = 1 if lived in town as child, 0 otherwise
Kid village	Dummy = 1 if lived in a village as child, 0 otherwise
Kid rural	Dummy = 1 if lived in a rural area as child, 0 otherwise
Kid moved	Dummy = 1 if moved around as child, 0 otherwise
Working mother	Dummy =1 if mother working when 14 years old
	Personality traits
Extraversion	Whether the respondent is talkative, sociable and not reserved
Agreeableness	Whether the respondent is not rude and kind to others and has a forgiving nature
Conscientiousness	Whether the respondent is not lazy, does things efficiently and does a thorough job
Neuroticism	Whether the respondent worries a lot, gets nervous easily and is not relaxed
Openness	Whether the respondent is original, has artistic values and an active imagination
	Risk preferences
Risk propensity (1)	Willingness to take risk taking behavior in general
Risk propensity (2)	Willingness to take risk taking behavior in trusting strangers
	Family frequency of visit
Visiting mother	Frequency of the respondent visiting her mother living elsewhere
Calling mother	Frequency of the respondent calling her mother living elsewhere
Visiting father	Frequency of the respondent visiting her father living elsewhere
Calling father	Frequency of the respondent calling her father living elsewhere
Visiting child	Frequency of the respondent visiting her child living elsewhere
Calling child	Frequency of the respondent calling her child living elsewhere
Family ties	Frequency of respondent in visiting and calling mother, father or child living elsewhere

Table A2 – Summary statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
		Dependent variables			
Trust	14,869	0.439	0.496	0	1
Voluntary	13,879	0.189	0.392	0	1
Local groups	13,879	0.255	0.436	0	1
		Individual characteristics			
Age2440 (baseline)	16,238	0.306	0.461	0	1
Age4155	16,238	0.253	0.434	0	1
Age5670	16,238	0.188	0.391	0	1
Age71	16,238	0.126	0.332	0	1
Female	16,238	0.537	0.499	0	1
White British (baseline)	15,332	0.625	0.484	0	1
Other white	15,332	0.351	0.477	0	1
Non white	15,332	0.0241	0.153	0	1
		SES in adulthood			
Married	16,236	0.531	0.499	0	1
Educ 1 (baseline)	15,028	0.226	0.418	0	1
Educ 2	15,028	0.0812	0.273	0	1
Educ 3	15,028	0.177	0.382	0	1
Educ 4	15,028	0.124	0.329	0	1
Educ 5	15,028	0.260	0.438	0	1
Educ 6	15,028	0.132	0.339	0	1
Region 1	15,978	0.465	0.499	0	1
Region 2	15,978	0.174	0.379	0	1
Region 3	15,978	0.183	0.387	0	1
Region 4 (Baseline)	15,978	0.177	0.382	0	1

Annual income	15,347	13,937	17,529	0	1.191e+06
Occupation 1	16,238	0.0756	0.264	0	1
Occupation 2	16,238	0.147	0.355	0	1
Occupation 3	16,238	0.207	0.405	0	1
Occupation 4	16,238	0.173	0.378	0	1
Not employed/retired (baseline)	16,102	0.430	0.495	0	1
Children number	16,238	0.513	0.931	0	7
Smoker	15,343	0.263	0.440	0	1
SES in childhood					
Fam norm	15,298	0.804	0.397	0	1
Fam size	15,338	3.495	2.168	1	22
First child (baseline)	13,858	0.348	0.476	0	1
Second child	13,858	0.319	0.466	0	1
Third child	13,858	0.165	0.371	0	1
Fourth child	13,858	0.0739	0.262	0	1
Fifth + child	13,858	0.0942	0.292	0	1
Birth order index	15,333	0.992	0.396	0.111	1.818
Dad20 (baseline)	12,691	0.0365	0.187	0	1
Dad2125	12,691	0.195	0.396	0	1
Dad2630	12,691	0.315	0.464	0	1
Dad3140	12,691	0.360	0.480	0	1
Dad41up	12,691	0.0940	0.292	0	1
Mum20 (baseline)	13,365	0.102	0.302	0	1
Mum2125	13,365	0.288	0.453	0	1
Mum2630	13,365	0.308	0.461	0	1
Mum3140	13,365	0.270	0.444	0	1
Mum41up	13,365	0.0333	0.179	0	1
Dad education	13,702	0.321	0.467	0	1
Dad degree	13,702	0.069	0.254	0	1
Mum education	14,133	0.199	0.400	0	1
Mum degree	14,133	0.045	0.207	0	1
Less_books (baseline)	15,180	0.302	0.459	0	1
Quite books	15,180	0.359	0.480	0	1
Lots books	15,180	0.340	0.474	0	1
Kid inner	15,342	0.111	0.315	0	1
Kid suburban (baseline)	15,342	0.211	0.408	0	1
Kid town	15,342	0.285	0.452	0	1
Kid village	15,342	0.209	0.406	0	1
Kid rural	15,342	0.145	0.352	0	1
Kid moved	15,342	0.0389	0.193	0	1
Working mother	16,238	0.240	0.427	0	1
Personality traits					
Extraversion	12,384	4.460	1.174	1	7
Agreeableness	12,384	5.456	1.001	1	7
Conscientiousness	12,384	5.287	1.087	1	7
Neuroticism	12,384	3.663	1.319	1	7
Openness	12,384	4.425	1.224	1	7
Risk aversion					
Risk propensity (1)	10,533	5.348	2.158	1	10
Risk propensity (2)	10,536	4.158	2.120	1	10
Frequency of family visit					
Visiting mother	6878	2.562	1.201	1	6
Calling mother	6877	2.562	1.201	1	6
Visiting father	5520	2.834	1.340	1	6
Calling father	5520	2.707	1.487	1	6
Visiting child	6245	2.707	1.487	1	6
Calling child	6245	2.359	1.172	1	6
Family ties	12,186	2.451	1.053	1	6

Table A3 – Birth order index and trust (marginal effects at mean)

Dep. Var.: *Trust*	(1)	(2)	(3)	(4)	(5)	(6)
Fam size	-0.0200***	-0.0136***	-0.00449	-0.00247	0.00255	-0.00821*
	(0.00259)	(0.00268)	(0.00278)	(0.00282)	(0.00365)	(0.00434)
Birth order index	-0.0761***	-0.0646***	-0.0405***	-0.0360**	-0.0169	-0.0586**
	(0.0151)	(0.0153)	(0.0156)	(0.0157)	(0.0213)	(0.0231)
Observations	10,469	10,469	10,469	10,469	5,789	4,680
Wald χ^2	214.75	345.56	638.76	670.55	444.57	316.19
Log Likelihood	-7119.32	-7038.98	-6843.41	-6817.34	-3727.60	-3057.01
Pseudo R^2	0.015	0.0269	0.0539	0.0575	0.0636	0.0574

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1

Table A4 – Birth order index and social engagement (marginal effects).

	(1)	(2)	(3)	(4)	(5)	(6)
Dep var.:	*Voluntary Work*			*Civic Engagement*		
	Whole sample	Female	Male	Whole sample	Female	Male
Fam size	-0.0126***	-0.0115***	-0.0138***	-0.00713***	-0.00622**	-0.00777**
	(0.00257)	(0.00346)	(0.00383)	(0.00227)	(0.00305)	(0.00345)
Birth order index	-0.0564***	-0.0583***	-0.0531***	-0.0441***	-0.0373**	-0.0501***
	(0.0140)	(0.0194)	(0.0201)	(0.0123)	(0.0167)	(0.0176)
Observations	9,872	5,487	4,385	9,872	5,487	4,385
Wald χ^2	725.16	437.08	339.12	509.00	332.25	241.19
Log Likelihood	-5405.55	-3090.81	-2290.79	-4758.55	-2963.51	-2038.30
Pseudo R^2	0.0777	0.0802	0.0790	0.0609	0.0687	0.0609

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood and SES in adulthood are included.

Table A5 – Birth order index and trust – Only mothers aged 40+ (marginal effects)

Dep. Var.: *Trust*	(1)	(2)	(3)	(4)	(5)
Fam size	-0.00234	-0.00239	-0.00406	-0.00226	-0.00248
	(0.00283)	(0.00316)	(0.00358)	(0.00403)	(0.00412)
Birth order index	-0.0351**	-0.0389**	-0.0334*	-0.0431**	-0.0366*
	(0.0158)	(0.0172)	(0.0191)	(0.0213)	(0.0218)
Personality traits	NO	YES	YES	YES	YES
Risk propensity (1)	NO	NO	NO	YES	NO
Risk propensity (2)	NO	NO	NO	NO	YES
Family ties	NO	NO	YES	YES	YES
Observations	10,344	8,759	7,277	6,060	6,062
Wald χ^2	659.92	695.33	623.95	577.08	757.38
Log Likelihood	-6739.13	-5628.08	-4640.51	-3829.04	-3696.26
Pseudo R^2	0.0574	0.0704	0.0785	0.0879	0.1198

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood and SES in adulthood are included.

Table A6 – Birth order index and trust - Control function approach for endogenous fertility.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regression model:	OLS				LOGIT			
Dep. Var.:	Fam size	Trust	Trust	Trust	Trust	Trust	Trust	Trust
Birth order index		-0.145**	-0.157**	-0.195***	-0.183**	-0.119*	-0.174**	-0.150*
		(0.0630)	(0.0686)	(0.0755)	(0.0771)	(0.0709)	(0.0849)	(0.0868)
Fam size (residuals)		-0.00991	-0.0102	-0.00278	-0.00246	-0.0173	-0.00989	-0.0110
		(0.0113)	(0.0127)	(0.0139)	(0.0143)	(0.0129)	(0.0161)	(0.0164)
Working mother	-0.712***	0.0149	-0.00199	0.0440	0.0409	-0.00430	0.0248	0.0213
	(0.0437)	(0.0522)	(0.0569)	(0.0603)	(0.0615)	(0.0571)	(0.0659)	(0.0675)
Dad education	-0.299***	0.0379	-0.00681	0.0559	0.0486	0.0252	0.00806	-0.00328
	(0.0438)	(0.0495)	(0.0544)	(0.0590)	(0.0603)	(0.0558)	(0.0660)	(0.0675)
Mum education	-0.282***	0.174***	0.150**	0.182***	0.168**	0.150**	0.113	0.101
	(0.0508)	(0.0580)	(0.0637)	(0.0691)	(0.0709)	(0.0663)	(0.0779)	(0.0801)
Quite books	-0.621***	0.219***	0.209***	0.221***	0.205***	0.276***	0.233***	0.219***
	(0.0478)	(0.0534)	(0.0588)	(0.0639)	(0.0660)	(0.0595)	(0.0716)	(0.0737)
Lots books	-0.695***	0.288***	0.277***	0.301***	0.259***	0.334***	0.314***	0.277***
	(0.0500)	(0.0574)	(0.0638)	(0.0687)	(0.0705)	(0.0641)	(0.0781)	(0.0799)
Kid inner	0.454***	-0.0852	-0.0373	-0.123	-0.103	-0.0457	-0.0268	0.00884
	(0.0705)	(0.0789)	(0.0867)	(0.0940)	(0.0967)	(0.0889)	(0.104)	(0.107)
Kid town	0.165***	-0.121**	-0.0994	-0.124*	-0.0976	-0.107	-0.0707	-0.0480
	(0.0529)	(0.0596)	(0.0648)	(0.0700)	(0.0714)	(0.0669)	(0.0786)	(0.0799)
Kid village	0.158***	-0.0835	-0.124*	-0.136*	-0.119	-0.151**	-0.190**	-0.178**
	(0.0572)	(0.0651)	(0.0718)	(0.0770)	(0.0788)	(0.0723)	(0.0857)	(0.0876)
Kid rural	0.793***	-0.102	-0.101	-0.158*	-0.120	-0.128	-0.191*	-0.170*
	(0.0628)	(0.0729)	(0.0800)	(0.0873)	(0.0898)	(0.0820)	(0.0989)	(0.102)
Kid moved	0.213**	-0.0186	0.0753	0.0729	0.108	-0.0394	0.132	0.156
	(0.104)	(0.118)	(0.130)	(0.142)	(0.141)	(0.128)	(0.154)	(0.154)
Fam norm	0.222***	-0.0534	-0.0643	-0.0154	0.0140	0.000346	0.0703	0.0959
	(0.0551)	(0.0619)	(0.0688)	(0.0734)	(0.0752)	(0.0696)	(0.0834)	(0.0856)
Personality traits	NO	NO	YES	NO	NO	NO	YES	YES
Risk propensity (1)	NO	NO	NO	YES	NO	NO	YES	NO
Risk propensity (2)	NO	NO	NO	NO	YES	NO	NO	YES
Family ties	NO	NO	NO	NO	NO	YES	YES	YES
Observations	11,360	10,469	8,852	7,522	7,521	8,401	6,104	6,106
Wald χ^2		670.65	703.99	577.68	818.40	623.17	580.92	762.88
Log Likelihood		-6817.34	-5686.25	-4851.90	-4677.13	-5415.91	-3858.10	-3725.25
Pseudo R^2		0.0575	0.0704	0.0681	0.1016	0.0680	0.08765	0.1192

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood and SES in adulthood are included in (2), (3), (4), (5), (6), (7) and (8).

Table A7 – Birth order index and trust – Excluding only-child respondents (marginal effects)

Dep. Var.: *Trust*	(1)	(2)	(3)	(4)	(5)	(6)
Fam size	-0.00602*	-0.00643*	-0.00469	-0.00371	-0.00700	-0.00649
	(0.00312)	(0.00349)	(0.00402)	(0.00410)	(0.00446)	(0.00456)
Birth order index	-0.0413**	-0.0430**	-0.0510**	-0.0481**	-0.0446**	-0.0393*
	(0.0160)	(0.0175)	(0.0199)	(0.0204)	(0.0217)	(0.0222)
Personality traits	NO	YES	YES	YES	YES	YES
Risk propensity (1)	NO	NO	YES	NO	YES	NO
Risk propensity (2)	NO	NO	NO	YES	NO	YES
Family ties	NO	NO	NO	NO	YES	YES
Family ties^2	NO	NO	NO	NO	YES	YES
Observations	9,507	8,028	6,456	6,455	5,526	5,527
Wald χ^2	643.69	669.59	609.69	798.32	549.22	713.74
Log Likelihood	-6171.69	-5142.07	-4092.08	-3951.14	-3479.01	-3356.09
Pseudo R^2	0.0605	0.0731	0.0846	0.1160	0.0912	0.1234

Robust standard errors in parentheses clustered at household level. *** p<0.01, ** p<0.05, * p<0.1. Parental age cohorts, Region dummies, SES in childhood and SES in adulthood are included.

Table A8 – Two-level logistic estimates with family random intercept

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Random intercept level:		*Mother*				*Father*		
Dep. Var.: *Trust*	Null	Augmented models			Null	Augmented models		
Fam size		-0.0854	-0.0241	-0.0259		-0.0491	0.0122	0.0637
		(0.0812)	(0.0930)	(0.0967)		(0.0887)	(0.103)	(0.108)
Birth order index		-0.624**	-0.682**	-0.547*		-0.709**	-0.749**	-0.674*
		(0.289)	(0.319)	(0.323)		(0.317)	(0.357)	(0.357)
Var(random intercept)	0.652	0.286	0.348	0.0842	0.707	0.124	0.295	1.51e-31
	(0.342)	(0.324)	(0.375)	(0.352)	(0.423)	(0.319)	(0.405)	(1.34e-15)
Intraclass correlation (ICC)	0.165	0.0799	0.0956	0.0250	0.176	0.0364	0.0824	4.59e-32
Parental cohorts	NO	YES	YES	YES	NO	YES	YES	YES
SES in childhood	NO	NO	YES	YES	NO	NO	YES	YES
SES in adulthood	NO	NO	NO	YES	NO	NO	NO	YES
Observations	743	612	549	515	546	486	443	413
Number of groups	365	327	304	297	268	254	243	237

Standard errors in parentheses. The sample is restricted to respondents having at least a family tie, i.e. having the mother (col. 1-4) or the father (col. 5-8) in common. No controls are included in models in columns 1 and 5. Baseline controls in columns 2-4 and 6-8 are the same as in Table 2 (column 1). The multilevel logistic models are estimated without imposing constraints on within-group errors correlation. *** p<0.01, ** p<0.05, * p<0.1.

Table A9 – Birth order difference in trust by birth spacing (two-child families only)

	(1)	(2)	(3)	(4)
		Conditional trust		Unconditional trust
Birth spacing	*N*	$Trust^{second} - Trust^{first}$	*N*	$Trust^{second} - Trust^{first}$
Less than 2 years	50	0.11**	72	0.16
3 years	73	-0.004	84	-0.02
4 years	31	-0.03	37	-0.003
5 years and more	34	0.36***	48	0.33**
N	*188*		*241*	

Note: Columns 2 and 4 report the birth order difference between second- and first-born children in two-child families. The figures in column 1 are based on the difference in predicted values following a logistic regression that includes the same set of covariates as Table 2 (col. 4), but with the birth order index replaced with the interaction between birth order index and birth spacing. Column 2 reports unconditional differences by birth spacing between the proportion of secondborns and firstborns declaring to trust others. The sample is restricted to households in which both the first- and second-born children are present in wave 13 of the BHPS. *** p<0.01, ** p<0.05, * p<0.1