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ABSTRACT

Born to Lead? The Effect of Birth Order on Non-Cognitive Abilities[1]

We study the effect of birth order on personality traits among men using population data on enlistment records and occupations for Sweden. We find that earlier born men are more emotionally stable, persistent, socially outgoing, willing to assume responsibility, and able to take initiative than later-borns. In addition, we find that birth order affects occupational sorting; first-born children are more likely to be managers, while later-born children are more likely to be self-employed. We also find that earlier born children are more likely to be in occupations that require leadership ability, social ability and the Big Five personality traits. Finally, we find a significant role of sex composition within the family. Later-born boys suffer an additional penalty the larger the share of boys among the older siblings. When we investigate possible mechanisms, we find that the negative effects of birth order are driven by post-natal environmental factors. We also find evidence of lower parental human capital investments in later-born children.

JEL Classification: J12, J24
Keywords: birth order, personality, occupation choice

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Introduction

What are the origins of personality? Are some people born leaders, while others are followers? Research has shown that personality—for example leadership abilities or motivation—matters greatly for life success.[2] While evidence shows that the family is important in the formation of personalities[3], there are still large differences among children from the same family, with at least a third of the total variation being within family. The question then becomes, where do these within-family differences come from? Is there a role for birth order in the formation of personalities?

As early as 1927 with the work of Alfred Adler, psychologists have hypothesized that at least some of these personality differences are systematically related to birth order, with the oldest child developing a taste for power.[4] Since that time, there has been much work on the topic, with a recent focus on evolutionary theory as the dominant explanation for birth order differences in personality (Sulloway, 1996). Siblings are thought to strategically compete for limited parental resources, and do so by differentiating themselves by filling different "niches" within the family. The first born is believed to be more responsible and focused on pleasing the parents, thus acting as a role-model for the later born children, while later-born children are hypothesized to be more easy-going and sociable and with a need to be more innovative in filling a family niche.[5]

To date, however, there is little conclusive evidence on this relationship. This is likely due to the stringent data requirements for estimating the relationship between birth order and personality. Later born children only exist in larger families, and to the extent that parents who choose to have

[2] See work by Lindqvist and Vestman (2011); Heckman, Stixrud and Urzua (2006); Heckman and Rubinstein (2001); Borghans, Duckworth, Heckman and Ter Weel (2008); Bowles, Gintis, and Osborne (2001).
[3] Plomin and Daniel (1987); Plomin (2011); Grönqvist, Öckert and Vlachos (forthcoming); Björklund and Jäntti (2012); Anger (2012).
[4] Alder's hypothesis was that the oldest child develops a taste for power but suffers from the dethronement at the arrival of siblings; the youngest is pampered with lack of independence and social empathy; while the middle child is ambitious and competitive (Adler 1927; 1928).
[5] Sulloway (1995, 1996) hypothesizes that first-borns rate higher than later borns in conscientiousness, neuroticism, the dominance aspect of extraversion and lower on agreeableness, openness and the sociability facet of extraversion.

larger families are inherently different, calculating a simple correlation between birth order and measures of personality without conditioning on family size would spuriously attribute these differences to birth order. In addition, mothers tend to be older when they have later born children, so estimates that do not control for mother's age might mistakenly attribute that effect to birth order. And later born children are born in more recent cohorts than their siblings, so to the extent that there are trends in outcomes over time, estimation strategies that do not adequately control for cohort effects might again mistakenly attribute these trends to birth order. As a result, estimating the relationship between birth order and personality characteristics requires large datasets in order to control for all possible confounders.[6]

Recent research on the relationship between birth order and other child outcomes has been able to address these issues using administrative datasets that have become available. These studies have documented that first-borns have higher educational attainment and earnings, have a higher IQ, and are likely to be healthier.[7] However, there is little convincing evidence on the effect of birth order on personality.[8] This is primarily due to the difficulty in obtaining measures of an individual's personality in a large representative dataset.

[6] The previous psychological literature is mainly based on small data sets. Ernst and Angst (1983) concluded from a review of the literature from 1946-1980 that findings of birth order effects on personality are artifacts of poor research design: in studies accounting for family size and socio-economic differences the effects of birth order on personality is negligible. Sulloway (1995, 1996, 2010) strongly contested this conclusion. Based on the same studies that control for family size and socioeconomic status and using a Meta-analytic strategy, Sulloway argues that the literature is in support of birth order influencing the Big Five dimensions of personality. Also the more recent literature is based on small samples with results both in support (see Dixon et al. 2008; Healey and Ellis 2007; Michalski and Shackelford 2001; Paulhus, Trapnell and Chen 1999; Pollet et al. 2010; Rohde et al. 2003) and with no, or limited support, (see Bleske-Rechek and Kelley 2014; Dunkel, Harbke and Papini 2009; Jefferson, Herbst and McCrae 1998; Marini and Kurtz 2011; Parker 1998; Saroglou and Fiasse 2003) of birth order effects on personality.

[7] See Barclay (2015); Black, Devereux and Salvanes (2005, 2011, 2016); Kristensen and Bjerkedal (2007); Kantarevic and Mechoulan (2006); Booth and Kee (2008); Bu (2014).

[8] There are some notable exceptions in the psychology and economics literature. A few studies use large data sets and a between-family strategy, but these studies are based on only one or few cohorts (see Rohrer, Egloff and Schmukle 2015; Damian and Roberts 2015; Avarett, Argys and Rees 2011; Silles 2010; Argys et al. 2006). By implicitly conditioning on cohort they introduce a potential bias since children with different birth order who are born the same year also have mothers who are either born in different years, initiated their fertility at different ages, or have different spacing. Other studies use a within-family strategy but with smaller samples (see Rohrer, Egloff and Schmukle 2015; Lehmann, Nuevo-Chiquero and Vidal-Fernandez forthcoming). These studies do not find any birth order effects. Sulloway (1999, 2001) uses a within-family strategy with survey data and find birth order effects on the Big Five domains of personality, but the sample is non-representative and with only one respondent per family rating themselves as well as their closest siblings' personalities the result may capture contrast effects and stereotype bias. See section III for a methodological discussion.

To address this issue, we use data on the population of men in Sweden, where personality is measured in an evaluation by a certified psychologist conducted when one enlists in the military as well as revealed by occupational sorting.[9] In the economics literature, personality traits are often referred to as *non-cognitive abilities*, and denote traits that can be distinguished from intelligence (Borghans et al. 2008). Even if cognitive abilities and personality traits can be unrelated from a theoretical perspective, empirical measures of cognitive abilities and personality traits are likely correlated. However, we are able to address this by controlling for measures of cognitive ability as well.

This is the first study using representative population data from multiple cohorts on objective measures of personality assessed at the same age and exploiting within-family variation in birth order to account for (e.g. socioeconomic) confounders. We also examine the underlying causes of the relationships we observe. More generally, this paper relates to the literature on how malleable non-cognitive abilities are to influences in childhood and adolescence.[10] In addition we propose an alternative, less data-demanding estimator that yields the same results as a family fixed effects model.

We find that first-born children are advantaged on non-cognitive dimensions capturing emotional stability, persistence, social outgoingness, willingness to assume responsibility and ability to take initiative, and these conclusions are robust to the inclusion of family fixed effects. Third-born children have non-cognitive abilities that are 0.2 standard deviations below first-born children. Importantly, we also demonstrate that occupational sorting is systematically related to birth order. First-born children are almost 30 percent more likely to be Top Managers compared to

[9] Grinberg (2015) study the impact of birth order on occupational choice with a between-family design using NLSY79 data, but by implicitly conditioning on cohort she is introducing a potential bias.
[10] This literature has focused on the acquisition of skills in childhood (Cunha et al. 2006; Cunha and Heckman 2007, 2008; Fredriksson, Öckert and Oosterbeek 2013) and adolescence (Grönqvist and Lindqvist 2016) or used data on twins or adoptees to separate nature and nurture in the transmission of non-cognitive abilities (Cesarini 2009; Grönqvist, Öckert and Vlachos forthcoming).

third-borns, and managerial positions tend to require higher non-cognitive abilities. We also find that first-born children are more likely to be employed in occupations requiring all Big Five domains of personality—openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability. Later-born children are more likely to be self-employed.

We are also able to examine how birth order interacts with sibling sex composition. Interestingly, we find that birth order patterns vary depending on the sex composition of the older children—effect sizes are exacerbated when the later-born son has older brothers relative to older sisters.

There are a number of possible explanations as to why birth order may be related to non-cognitive abilities. There could be biological reasons—as the mother has more children, her womb becomes more effective at nurturing the fetus (Khong, Adema and Erwich 2003), or successive children may be hypo-masculinized by maternal immunization to the H-Y antigen (Beer and Horn 2000).

Beyond biology, parents could have other influences. Childhood inputs, especially in the first years of life, are considered crucial for skill formation (Cunha and Heckman 2007; Heckman, Stixrud and Urzua 2006). First-born children have the full attention of parents, but as families grow the family environment is diluted and parental resources become scarcer (Zajonc 1976; Zajonc and Marcus 1975; Price 2008). In contrast, parents are more experienced and tend to have higher incomes when raising later born children. In addition, for a given amount of resources, parents may treat first-born children differently from second or later-born children.[11] Parents may have incentives for more strict parenting practices towards the first born so as to gain a reputation for "toughness" necessary to induce effort among later born children (Hotz and Pantano 2015).

[11] See Becker and Tomes (1976) and Yi et al. (2015) for discussions on how parents differentiate resources across children.

Children, on the other hand, may also act strategically in competing for parental resources. Rivalry and conflict are common features of sibling dynamics (Furman and Buhrmester 1985; Dunn 1993; Shantz and Hartup 1992), where such conflicts, at least in early childhood, tend to center around possession, personal property and access to the mother (Dunn and Munn 1987). Older siblings take a more dominant role in such conflicts and engage in more elaborate conflict strategies (Howe et al. 2002; Phinney 1986). In this context Havnes (2010) proposes an economic model where conflict between siblings causes parents to optimally invest more in the dominant, older, sibling. Sulloway (1996) offers a similar argument for birth order effects, based on evolutionary psychology, suggesting that first borns have an advantage in following the status quo, while later borns—by having incentives to engage in investments aimed at differentiating themselves—become more sociable and unconventional in order to attract parental resources. This also implies that the peer environment that each child grows up in is different—first born children have no role models aside from parents but may themselves act as role models, while later-born children can learn from their elder siblings.

Even if we are unable to disentangle many of these possible mechanisms, we do attempt to understand the differential role of family environment and biology. Taking advantage of the distinction between social and biological birth order induced by adoption or the death of older siblings combined with the richness of our dataset, we first show that the negative birth order patterns we observe are driven by post-natal environmental differences. In fact, we find that biological factors tend to *favor* later-born children. We then augment our data with a survey of children at age 13 and their parents to identify differences in children's study behavior and parental investments. We find that later-born children spend substantially less time on homework and more time watching TV. Interestingly, parents are less likely to discuss school work with later-born

children, suggesting that lower parental investment and attention may be one driving force behind the negative birth order effects.

The paper unfolds as follows. Section 2 describes the data we are using. Sections 3 and 4 describe our estimation strategy and present our main results along with heterogeneous effects by sex composition. Section 5 then discusses possible mechanisms, including biological differences and parental time investment. Finally, Section 6 concludes.

II. Data

To analyze the impact of birth order on personality and occupational choice, we combine information from a variety of Swedish data registers. We begin with the Swedish population register compiled by Statistics Sweden that includes all individuals born in Sweden since 1932. The population register contains information on birth year, a link to biological (and adoptive) parents, and a link to biological (and adoptive) siblings. We use this information to define birth order on the maternal side.

The population register is combined with military enlistment data from the Swedish War Archive. Until 2010, all Swedish men were required by law to enlist in the military. The enlistment consists of a series of physical, psychological and intellectual tests and evaluations. In most cases, the enlistment took place the year a man turned 18. In our sample, over 85 percent of all men in each cohort are represented; only the physically and mentally handicapped were exempted.[12] This data is available for Swedish male citizens born between 1952 and 1982. From this data, we extract

[12] The consequences of refusing the military service included up to one year in prison (1994:1809 Lag om totalförsvarsplikt). Importantly, the probability of having valid enlistment records is unrelated to birth order in our main (family fixed) effects specification.

information on non-cognitive and cognitive abilities. These abilities have been shown to be highly correlated with later outcomes such as employment and earnings.[13]

We also incorporate information on employment and occupation. Annual data on employment and self-employment are available from 1985 to 2009 from Statistics Sweden. Employment is measured during a specific week in November and defined in accordance with ILO's employment definition of at least one hour of paid work during the measurement week. Self-employment is defined according to occupational status at the workplace where an individual receives the highest income in November.[14] We utilize the information at age 45; if employment and self-employment are not observed at age 45 we take the observation closest to age 45.

The occupation data is available for the 1996 to 2009 period and includes individuals between the ages of 16 and 74 who are in the labor market. This data set covers the population of public sector workers and approximately 50 percent of workers in the private sector. In particular, the private sector data cover all firms with more than 500 employees and a stratified random sample of smaller firms by industry. In most cases the information is provided by the employers' organizations (including employers in the public sector) as part of an agreement between unions and the employer organizations. Firms not covered by this agreement are surveyed by Statistics Sweden. To make the most of the occupational data, we take the five observations closest to age 45, but restrict the window to ages 35-55. We then calculate the average of each individual's yearly observations, weighted by the inverse of the sampling probability.

[13] Lindqvist and Vestman (2011) show that non-cognitive ability is a stronger predictor of unemployment, having low annual earnings, as well as having a managerial position, than is cognitive ability, while cognitive ability is a stronger predictor for higher earnings. Furthermore, Grönqvist, Vlachos and Öckert (forthcoming) find that both parents' cognitive and non-cognitive abilities are strongly related to the educational and labor market outcomes of their offspring; in particular, parental cognitive abilities are more important for schooling outcomes, while parental non-cognitive abilities are particularly important for labor force participation.

[14] Income from self-employment is scaled up by a factor 1.6 to account for under-reporting of income from business, for details see Statistics Sweden (2009).

Outcome Variable: Non-Cognitive Abilities[15]

Our measure of non-cognitive abilities is based on a standardized psychological evaluation aimed at determining the conscripts' capacity to fulfill the requirements of military duty and armed combat. Central to this are the abilities to cope with stress and to contribute to group cohesion. The evaluation is performed by a certified psychologist, who conducts a 20-30 minute interview with the conscript.[16] The interview follows a specific, and secret, manual that states topics to discuss and also how to grade different answers. A conscript is given a high score if he is considered to be emotionally stable, persistent, socially outgoing, willing to assume responsibility, and able to take initiative. The non-cognitive abilities are graded by the psychologist in four sub scores measured on a 1-5 scale, which are transformed to an overall measure of non-cognitive abilities on a 1-9 (stanine) scale. In the analysis we use the full interaction of the four sub-measures standardized by year.

The conscript's cognitive ability is also evaluated; this consists of several subtests of logical, verbal, and spatial abilities, as well as a test of technical comprehension. The cognitive tests are speeded multiple-choice tests,[17] and have been subject to minor revisions in 1980, 1994 and 2000. The raw test scores on these four subtests are combined to a discrete variable of general cognitive ability on a 1-9 (stanine) scale, which has been found to be a good measure of general intelligence

[15] See Lindqvist and Vestman (2011) for additional details of the enlistment procedure.

[16] As a basis for the interview, the psychologist has information about the conscript's results on the tests of cognitive ability, physical endurance, muscular strength, as well as grades from school and the answers from a questionnaire on friends, family, hobbies, but the questionnaire does not ask for birth order. The former chief psychologist at the Swedish National Service Administration, Johan Lothigius, who constructed and oversaw the implementation of the instrument, states (telephone interview 16 February 2016) that while relationships with parents and friends were covered in the interview, there was no focus on the relationships with siblings or birth order. It is highly unlikely that the psychologist knew the birth order of the draftee.

[17] The logic test contains verbally formulated instructions as to which answer the test-taker should mark, created to test logical reasoning. The verbal test asks for the synonym of a given word, out of four alternatives. The spatial test asks for the three-dimensional object that corresponds to a two-dimensional unfolded piece of paper. Finally, the technical test consists of illustrated technical and physical problems. See Carlsson et al. (2015) for an example of the test questions.

(Carlstedt 2000). We use the sum of the four sub-scores, standardized by enlistment year, as a measure of cognitive ability.

Outcome Variable: Occupation

We also use occupation as an additional measure of personality independent from the measurement at enlistment. While both cognitive and non-cognitive abilities determine occupational choice, research shows that non-cognitive abilities can be more important for having managerial position (Lindqvist and Vestman 2011).

We first break occupations into a number of broad categories that are generally associated with particular personality characteristics and then relate birth order to the likelihood of being in one of these occupations. At the broadest level, occupations are divided into ten groups. One such group is classified as Managerial Work, and we define Managers as individuals belonging to this group.[18] This category contains a broad range of managerial positions, from top-level managers to middle- and lower-level management. We then characterize Top Managers in the private and public sector using 3-digit codes that include Directors and Chief Executives (ISCO 121) and Legislators and Senior Government Officials (ISCO 111). About 8 percent of the individuals in our population are Managers and 0.6 percent are Top Managers. We contrast Managers to Creative Occupations since the psychological literature suggests that later borns are more creative and open to experience (Sulloway 1995 and 1996). Using the 4-digit level occupational codes, we define architects, writers, painters, musicians, and actors, among others, as Creative Occupations.[19] In our data, we see that individuals who are Managers have substantially higher cognitive and non-

[18] The occupation data is coded according to the Swedish modification of the International Standard for Classifications of Occupations 1988 (ISCO88); at the 3 digit level the Swedish occupational codes are more or less identical to ISCO88.

[19] The creative occupations comprise the following ISCO88 codes: Architects, town and traffic planners (2141), Writers and creative or performing artists (245), Photographers (3131), Image and sound recording equipment operators (3132), Decorators and commercial designers (3471), Radio, television and other announcers (3472), Street, night-club and related musicians, singers and dancers (3473), Clowns, magicians, acrobats, and related professionals (3474), and Fashion and other models (5210).

cognitive abilities than non-managers, and there is a marked difference in non-cognitive abilities between individuals in managerial positions and creative occupations (see Appendix Table A1).

We also use detailed information on skill requirements and abilities of incumbents in specific occupations, using the Occupational Information Network (O*NET), to create measures of personality based on the importance of particular personality characteristics in the daily functioning of jobs. In particular, we construct variables capturing the importance of (1) social abilities and (2) leadership abilities in performing the tasks required in occupations. We also categorize the personal attributes into the Big Five domains of personality: Conscientiousness, Agreeableness, Emotional Stability, Extraversion, and Openness. See Appendix C for details.

Outcome variable: Parental investments

We examine parental investment behavior using self-reported data on human capital investments at age 13 from the Evaluation-Through-Follow-up (ETF) study in which children are surveyed about their effort outside of school and parents are asked about their investments in their children.[20] The ETF-data consists of 10 percent stratified samples of the cohorts born in 1967, 1972, 1982, 1987, 1992 and a 5 percent stratified sample of the cohort born in 1977.

Analysis Sample

In order to observe completed family size, we consider children whose mother was born between 1917 and 1964. We restrict attention to families with at least two children and at most five children.[21] We also exclude all families with twins, as twinning confounds birth order designations. Because we only have military enlistment data for males, our main analyses focuses on men. In

[20] The survey is run by the Department of Education at the University of Gothenburg; see Härnquist (2000) for a description of the data. For some of the cohorts a few of the questions that we use were not answered at age 13, but instead at age 10 or 16. In these cases we use this alternative information.
[21] We lose about 3 percent of the families by only including families with fewer than 6 children.

analyses of non-cognitive abilities from military enlistment we retain individuals from our underlying population with a valid enlistment record. Moreover, since we want to utilize the within family variation we also restrict attention to families with at least two sons; in total we observe 564,789 boys from 260,807 families.[22] When we consider occupations, we again limit our sample to those individuals for whom we observe a valid occupation for at least two sons in the same family.[23]

In the birth order analyses on human capital investments at age 13 we retain males and females with data from the ETF-survey. In total we observe 36,799 individuals (in the analyses the number of observations varies between 11,833-32,639, as some questions are not asked for all cohorts and there is some missing data).[24]

Table 1 and Table 2 present summary statistics for our analytic samples. In both Tables, Column 1 shows the means for the full sample and Columns 2-6 break them down by birth order. For most outcomes there is a clear pattern by birth order; e.g. that later-borns have lower non-cognitive ability. However, these simple descriptive statistics can be misleading. When one looks at background variables by birth order, one sees the same patterns—characteristics such as mother's education and mother's age at first birth are declining with birth order and average family size is increasing, suggesting the need for a more rigorous analysis.

III. Empirical Strategy

It may be conceptually hard to think about causal effects of birth order, since the birth order of siblings cannot easily be manipulated. The hypothetical experiment we have in mind, however, is

[22] Appendix Table A2 compares mean values for the full population of males to those of our analysis sample.
[23] The cognitive abilities and personality traits measured at the enlistment or as manifested in the occupational choice are strongly and independently related to mid-life wages, see Appendix Table A3. In Appendix Table A4a-b we also report the correlation between the non-cognitive and cognitive ability scores and the different measures of personality traits.
[24] Appendix Table A5 presents summary statistics for this sample.

to randomly assign the order in which two fertilized eggs are placed into a woman's womb. Although this thought experiment is more or less infeasible – with the possible exception of IVF treatments – it makes clear that birth order effects should capture any difference in prenatal or postnatal environment between siblings, but hold the genetic makeup constant. As it turns out, nature provides a close to ideal experiment for studying birth order effects. At conception, each child receives a random half of each parent's genes, which makes them share on average half their genes. Thus, the genetic makeup is not expected to differ systematically between siblings in general or by birth order in particular. The effect of birth order can, thus, be identified by simply comparing personalities of siblings within the same family.

In practice, most studies of birth order estimate versions of the following parsimonious model for individual *i* in family *j*:

$$Y_{ij} = \alpha + \sum_{k=2}^{5} \beta_k I(BO_{ij} = k) + \sum_{l=3}^{5} \gamma_l I(FSIZE_j = l) + \sum_{m=2}^{M} \delta_m I(YOB_{ij} = m) + \sum_{n=2}^{N} \theta_n I(MYOB_j = n) + \sum_{o=2}^{O} \pi_o I(MAGE_j = o) + \tau X_j + \varepsilon_{ij}, \quad (1)$$

where Y_{ij} is a measure of non-cognitive abilities, BO_{ij} is birth order (the omitted category is first-born child), $FSIZE_j$ is family size, YOB_{ij} is the child's year of birth, $MYOB_j$ is mother's year of birth, $MAGE_j$ is mother's age at first birth, and X_j is a vector with family background variables.

The family size controls address the fact that later-born children are more likely to be observed in larger families, and that outcomes of children may differ by family size. When data include all siblings in a family, any time-invariant family characteristic (e.g. mother's year of birth and mother's education) is balanced by birth order once family size is controlled for.[25] More

[25] To see this, assume there are 1,000 families with two children. Then, the 1,000 first-born children will on average have the same parental background as the 1,000 second-born children since they all come from the same 1,000 families.

generally, family background for a given sibship size is expected to be balanced by birth order in random samples of the population. In earlier studies based on non-representative samples conditioning on family size does not, per se, break the correlation between birth order and family background.

With representative data it is sufficient to control for family size to estimate the reduced form effects of birth order. But in order to get a more structural interpretation of the estimates, many studies on birth order also control for the child's year of birth (or age). This is because children with a higher birth order come from more recent cohorts, and the birth order estimates may therefore pick up cohort trends in non-cognitive abilities.[26] An unintended consequence of adding these controls is that it introduces imbalances in family background by birth order. This is because children of higher parity, who are born the same year as children with lower birth order, on average, have mothers who are born earlier, started to have children at a younger age, and have shorter child spacing. This tends to bias the estimates downwards.[27]

It is common that studies also condition on the mother's year of birth, which both accounts for cohort differences in mothers' socio-economic status and mother's age at child's birth. But this may exacerbate the negative bias.[28] In addition, some studies control for mother's age at first birth to account for the correlation between birth order and early childbearing. Much of the remaining between-family variation in birth order then comes from differences in child spacing. To the extent that spacing between children is related to unobserved family characteristics, the estimates of birth

[26] Note that the common practice to standardize outcomes by birth cohort (or age) may not be enough to account for cohort effects, since standardization does not hold family size or birth order constant.
[27] In our data, mothers to third-born children are on average born 7.3 years earlier, and had their first child 0.9 years earlier, than mothers to first-born children, after controlling for dummy variables for family size and child's year of birth. Mothers to third-born children also have 0.8 years less schooling, on average, than mothers to first-born children.
[28] Mothers to third-born children where 6.8 years younger when they had their first child compared to mother's to first-born children, after controlling for dummy variables for family size, child's year of birth and mother's year of birth in our data. They also had 1.3 years less schooling. The net effect of adding the controls for mother's year of birth depends, however, on (1) the selection into early childbearing, (2) the cohort trends in mother's socio-economic status and (3) the effect of mother's age at child's birth.

order may still be biased. In an attempt to reduce any remaining bias, most studies on birth order add socio-economic controls. In this study, we condition on mother's educational level when we estimate equation (1).[29]

In our main specification, we include family fixed effects, thereby differencing out any time-invariant characteristics within a family. This will eliminate any remaining association between birth order and family background. Formally we estimate the following model:

$$Y_{ij} = \alpha' + \sum_{k=2}^{5} \beta_k' I\left(BO_{ij} = k\right) + \sum_{l=2}^{L} \gamma_l' I\left(YOB_{ij} = l\right) + \lambda_j + \varepsilon_{ij}' \qquad (2)$$

where λ_j is a family fixed effect. We are thus comparing siblings within the same family to estimate our birth order effects. Note that we are still including indicators for children's year of birth, although family size, mother's year of birth, mother's age at first birth and mother's education drop out.

Estimating family fixed effects is not feasible in many data sets, since it requires repeated observations of siblings from the same family along with a family identifier. We therefore propose a third, less data demanding, specification that yields the same results as the family fixed effects. The defining characteristic of the family fixed effects estimator is that it exploits only the variation in birth order within families of the same type. In particular, it compares differences in outcomes by birth order in families of the same size and with children born in specific years. This can, however, also be obtained by adding fixed effects for all combinations of family size and sibling's year of birth. Formally, we would estimate the following family type fixed effects model:

$$Y_{ij} = \alpha'' + \sum_{k=2}^{5} \beta_k'' I\left(BO_{ij} = k\right) + \sum_{l=2}^{L} \gamma_l'' I\left(YOB_{ij} = l\right) +$$

[29] The education categories are: less than 9 years of primary education; 9 years of primary education, 1-2 years of upper-secondary education, 3-4 years of upper-secondary education; 1-2 years of post-secondary education; 3 years or more of post-secondary education; second stage of tertiary education.

$$\sum_{m=2}^{M}\sum_{n=2}^{N}\sum_{o=2}^{O}\sum_{p=2}^{P}\sum_{q=2}^{Q}\kappa_{mnopq}I\left(YOB_j^1=m,YOB_j^2=n,YOB_j^3=o,YOB_j^4=p,YOB_j^5=q\right)+\varepsilon_{ij}'', \quad (3)$$

where YOB_j^k is the year of birth for a sibling with birth order k in family j.[30] Although this estimator has less stringent data requirements than the family fixed effects estimator, it still balances family background by birth order.[31] It also reduces the number of fixed effects substantially.[32] We will use the family type fixed effects estimator when studying possible mechanisms behind the effects in the smaller ETF-dataset.

One identifying assumption that we implicitly are imposing—that we share with all studies on birth order effects—is that family size is pre-determined, or at least not endogenous to children's realized outcomes. For example, if parents followed an optimal stopping rule where they stopped having children when they had a "bad draw", we would find negative effects of being later born even if there were no such birth order effects. We attempt to check how sensitive our estimates are to violations of the assumption of pre-determined family size by making the alternative extreme assumption—that all families ideally want to have the same family size but are following the optimal stopping rule and, because of that, some stop before reaching that size. For these families, we then impute the "missing"—or unobserved—child and estimate birth order effects; we are thus bounding the potential bias induced by our original assumption.

More specifically, we take advantage of the fact that, in Sweden, there is a strong two-child norm, and we therefore investigate how the effect of being second-born would have changed if

[30] We set year of birth to zero when birth order exceeds family size.
[31] For example, for the family type with two children born 1970 and 1973, the first-born children born in 1970 will on average have the same background as the second-born children born in 1973. Since the dummy variables for birth order and year of birth are exactly collinear with the same family type, the cohort effects are identified by comparing the within-family difference in personality by birth order for families with different combinations of children's year of birth.
[32] In our data, the number of fixed effects is reduced by more than 90 percent in the family type fixed effects estimator compared to the family fixed effects estimator.

single-child families had not deviated from this norm.[33] To do so, we randomly draw a hypothetical second child for single-child families under the assumption of no birth order effects.[34] The observed sample of first-born children, along with the randomly drawn second-born children in single-child families, is then added to the observed sample of first- and second-born children in larger families, and the effect of being second born is re-estimated. We repeat this procedure 1,000 times and report the average point estimates and standard errors.

It is likely that this exercise tends to bias the estimates toward zero for two reasons. First, we draw the potentially missing children from the outcome distribution of first-born children, implicitly assuming that there are no birth order effects. Second, we assume that all single-child families would have had another child if the outcome of the first child would have been different. In practice, all single-child families cannot get a second child for biological reasons even if they want more children. To restrict the number of missing children somewhat, we also draw second-born children only until we reach women's age-specific fertility (Eijkemans et al. 2014).

Under the assumption that all single-child families would have had another child, and assuming no birth order effects in the imputation of "missing" children, the estimated effect of being second-born falls by roughly 30 percent.[35] Thus, even under extreme assumptions, the lion's share of the effect of the birth order remains. If we instead impose the restriction that older women are less likely to have additional children, the estimated effects of being second-born fall by about 20 percent. Analogously, if we were to reduce the share of "missing" second-born children further, we would slowly come back to our baseline estimate. In sum, this exercise suggests that the birth order effects may be somewhat overstated if families determine family size in response to the

[33] In Sweden, about 80 percent of all families have at least two children, and almost 50 percent have exactly two children.
[34] In practice, we divide families into different strata defined by the interaction between mother's year of birth (10 classes), mother's age at first birth (30 classes), mother's highest educational level (7 classes) and father's income (20 classes). Within each stratum, the missing second-born children are randomly drawn from the outcome distribution of first-born children.
[35] See Appendix Table A6.

realization of their offspring's outcomes. Still, it is not possible to rule out quite substantial birth order effects even in the extreme case that all observed single-child families had endogenously decided to stop having children.[36]

IV. Results

In Table 3, Panel A, Column 1, we estimate the relationship between the standardized non-cognitive ability measure and birth order using the equation (1) model, with the first born as the omitted category, controlling for dummy variables for family size, child's year of birth, mother's year of birth, mother's age at first birth and mother's educational level. Columns 2-5 then estimate the birth order effects by family size, to allow for heterogeneous effects of birth order by family size. Two things are clear from these results. First, non-cognitive ability is monotonically declining by birth order, with second-borns performing worse than first-borns and third-borns performing worse than second-borns, etc. Second, the patterns are similar when we estimate the model with family size dummies and when we estimate effects separately by family size.

In Panel B of Table 3 we show the results from the family fixed effects model presented in equation (2). We observe very similar patterns to those from the previous specification, although the magnitudes are larger with family fixed effects. Moving from a first born to a third born child will result in approximately 0.20 standard deviations lower non-cognitive ability, and the results are similar when estimated by family size.[37] Below we concentrate the analysis on the family fixed effects model (equation 2) unless otherwise noted.

Given that cognitive and non-cognitive abilities are correlated (they have a correlation of 0.38 in our data), an obvious issue is whether the effect of birth order on non-cognitive abilities

[36] The results reported below are estimated under the assumption of pre-determined family size.
[37] Appendix Table A7 presents the corresponding results for cognitive abilities.

merely reflects the effect of cognitive abilities. Table 3 Column 6 addresses this issue by examining the effects of birth order on non-cognitive abilities, controlling for cognitive ability. The effects of birth order on non-cognitive ability are reduced by almost 40% with the inclusion of controls for cognitive ability. However, there remain sizable effects of birth order on non-cognitive ability, with a move from first born to third born resulting in 0.11 standard deviations decline in non-cognitive ability.[38]

These birth order effects are larger and more stable than those found by Damian and Roberts (2015) but smaller than the estimates reported in the meta-analysis by Sulloway (2010).[39]

Occupation[40]

Another metric of personality is reflected in occupational sorting. Before considering occupation, we first examine employment probabilities. Table 4 Column 1 shows the estimated relationship between birth order and employment. Note that in all models we are estimating linear probability models. There is a clear pattern of declining employment with increasing birth order, with third-born children almost one percentage point less likely to be employed, from a mean of 0.88. This is consistent with non-cognitive abilities being especially important for explaining outcomes in the lower end of the distribution (e.g. Lindqvist and Vestman 2011).[41]

We next consider the probability of self-employment; because of the uncertainty in earnings,

[38] Since cognitive abilities is an outcome variable the results should be interpreted with some caution. However, if we instead use the correlation between the skill measures (0.38), and reduce the estimates with this share, we find very similar results.

[39] To compare our estimates with Damian and Roberts (2015) and Sulloway (2010) we have estimated the partial correlations for first borns versus later borns. Damian and Roberts find the partial correlation for first versus later borns in the range between 0.00 (Vigor dimension of Extraversion) and 0.04 (Mature personality dimension of Conscientiousness). The correlations reported by Sulloway are in the range 0.00 to 0.18, but these estimates may be inflated by contrast effects and stereotype effects since subjects explicitly rate their personality relative to their older/younger sibling. We find the correlation for birth order to be 0.041 for overall non-cognitive ability, and we find almost identical birth order effects for each of the non-cognitive sub-measures which suggest that there may not be any significant cost to considering the aggregate measures of non-cognitive abilities.

[40] While we only report results for men in the text, the corresponding results for women are qualitatively the same. These results are available in Appendix B.

[41] In appendix Table A1 we see that a one standard deviation increase in non-cognitive skills is associated with 4.25 percentage points higher employment probability in our data. The corresponding number for cognitive abilities is 3 percentage points.

self-employment is often considered a decision undertaken by more risk-loving individuals. We find that later born children are more likely to be self-employed than first-born children. Note, however, that while self-employment may be viewed as a risk-loving choice, we cannot distinguish whether the higher likelihood of self-employment is a response to worse labor market prospects or due to a lower level of risk aversion.

Columns 3 and 4 consider the likelihood that an individual will be in a management position, with the first column (Top Managers) the most narrowly defined to include only CEOs and top executives, and the second column to include a broader definition of managers. It is interesting to note that, in both cases, we see that later-born children are less likely to be in a management position, regardless of definition. In fact, first-borns are 28 % more likely to be a Top Manager compared to third borns. Finally, when we examine creative occupations (Column 5), we see no such pattern. [42]

To more directly relate occupations to non-cognitive abilities, we next consider the probability of being in an occupation where success is dependent upon certain personality traits, with these personality traits taken from the O*NET dataset and measured on a scale of one to five (with five being most important) and then standardized. The traits we consider are Sociability, Leadership Ability, Conscientiousness, Agreeableness, Emotional Stability, Extraversion, and Openness. The five latter characteristics correspond to the Big Five personality traits, which is often used by psychologists to describe personality. When we examine birth order patterns, we see in Table 5 that there are very strong birth order effects, with first-born children being in occupations with the highest requirements along all these dimensions. Interestingly, the magnitudes

[42] For women (see Appendix Table B2) we however find that birth order is positively related to the likelihood of being in a creative occupation, thus suggesting that later-born daughters may be more creative and open to new experiences than older sisters are. (See Sulloway 1995 and 1996.)

of the coefficients are quite similar across characteristics. Openness and Conscientiousness appear to have the strongest relationship to birth order.

Given our earlier findings, it is not surprising that later born children are in jobs requiring less Conscientiousness or Leadership ability. However, it *is* surprising that later-borns are sorted into occupations that require less Social ability, Agreeableness, Emotional stability and Openness to experience—characteristics that are associated with later born children by Sulloway (1995, 1996). The pattern that first borns are stronger in all Big Five dimension is however consistent with the overall findings by Damian and Roberts (2015) [43]

Heterogeneous Effects

The next question that we consider is whether the effects of birth order differ depending on the sex composition of the family. For example, a third born son who is the first male child in the family may have a different experience, and outcome, from a third born son who is the third male child in the family. Existing research has been mixed as to the effect of the sex composition of siblings on children's outcomes—work by Dahl and Moretti (2004), Butcher and Case (1994), Conley (2000), and Deschenes (2007) all find some evidence of sex-composition effects, while Kaestner (1997) and Hauser and Kuo (1998) find no evidence for such heterogeneities.

Table 6 addresses this issue by allowing for heterogeneous effects of birth order depending on the sex composition of the family. We parameterize the gender composition of the siblings by allowing for two birth order variables—the standard measure and then a measure of the birth order among the boys in the family.[44] When we estimate this new specification, again including family fixed effects and cohort effects, we find that there are differential effects for being born late when

[43] The partial correlations for first borns versus later borns with our data are 0.025 for Social ability, 0.024 for Leadership ability, 0.029 for Conscientiousness, 0.021 for Agreeableness, 0.024 for Emotional stability, 0.025 for Extraversion, 0.033 for Openness.
[44] Using a measure of the share of boys among the older siblings generated very similar results.

there are more boys among the older siblings. In Column 1 we see that for the composite measure of non-cognitive ability, the negative effects of birth order are more than twice as large if one is a later-born boy with older brothers.[45] Birth order among boys is also strongly related to employment, as is shown in column 2. When we examine occupational outcomes in Columns 3-6, the effects are less consistent. However, it is notable that when we consider creative occupations, later-born boys are less likely to enter these occupations if they have older sisters while being more likely to enter these occupations if they have older brothers.[46] Unfortunately, we cannot determine whether these effects are due to parental investments or male peer influence such as increased sibling competition where younger brothers have problems competing with older brothers.

V. Mechanisms

Given the patterns we observe, we next attempt to disentangle possible underlying mechanisms.

Nature v. Nurture

As noted earlier, there are a number of possible explanations for birth order effects in non-cognitive abilities. The first is biological: Is there something about the experiences in-utero that affect the development of a child's personality?

To attempt to isolate this mechanism, we exploit two features of our data that allow us to distinguish biological from social birth order. Building on earlier work by Kristensen and Bjerkedal (2007), we exploit the fact that some families experienced the death of an older sibling or if an older sibling was put up for adoption—as a result, the biological birth order is different from the social birth order in these families. Table 7 presents the results when we estimate the relationship between biological and social birth order and non-cognitive abilities.[47] Column 1 presents the

[45] Table A8 reveals that the effects of birth order among brothers are smaller for cognitive abilities than for non-cognitive abilities.
[46] Appendix Table A9 presents heterogeneity by sex composition for job skill requirements. Point estimates suggest that the negative effects of birth order tend to be exacerbated among boys with older brothers, but the results are not statistically significant.
[47] When we estimate the results separately for adoptees and deaths, our results are consistent but much less precisely estimated.

results from the earlier specification with family fixed effects and Column 2 shows results where social and biological birth order are allowed to vary.[48] The results support the idea that the negative effect of birth order works entirely through social birth order, suggesting that earlier born children have better outcomes as a result of their postnatal experiences.[49] In fact, we find evidence for a positive effect of biological birth order, which is consistent with studies documenting higher birth weight and better placenta for later-born children (e.g. Brenøe and Molitor 2015; Juntunen, Laara and Kauppila 1997; Khong, Adema and Erwich 2003; Wilcox Chang and Johnson 1996). The overall effect is thus an underestimate of the social influence of the family, as it also incorporates the positive biological impact of birth order on non-cognitive abilities.

Parental Investment Behavior

Given the environmental nature of birth order effects, we next incorporate survey data of children at age 13 to examine how parental investments and children's study habits relate to birth order.

While there has always been much interest in parental investment in children, there is surprisingly little compelling work on differences in parental behavior by birth order of children, most likely due to the stringent data requirements. One of the first convincing studies was done by Price (2008), who used data from the American Time Use Survey to examine the relationship between parental time with children and birth order. He finds that parental quality time with children is declining with birth order. Unfortunately, he is limited in that he does not observe time spent with each child and is unable to look within families. Monfardini and See (2012) also find significant birth order effects in parental time, although these differences cannot explain the

[48] To separate social and biological birth order we use families where either a child has died before 3 months of age or where a child was put up for adoption. For most adopted children we unfortunately cannot observe the exact date for when they were given up. However, for children born in 1960, 87 (94) percent of adopted children were given up before they were 3 (6) months old. Families receiving an adopted child are excluded from the analysis. Stillborns are not included in the analysis as they never enter the population registers. However, children born alive but who die short after delivery – possibly the same day – are included in the analysis. About 2.5 percent of the families in our sample have either lost a child or given one up for adoption.

[49] The results for both cognitive and non-cognitive abilities are reported in Appendix Table A10.

differences in cognitive abilities across birth order. Hotz and Pantano (2015) document that later-born children are treated differently in that parents are more strict with first-borns, and the authors provide a model of reputation in which strict rules for earlier born children spill over into the behavior of later-born children. In the same vein Avarett, Argys and Rees (2011) find that later born children receive less adult supervision. Most recently, work by Lehmann, Nuevo-Chiquero and Vidal-Fernandez (forthcoming) uses data from the Children of the National Longitudinal Survey of Youth 1979 (NLSY79) and document differences in parental behavior and home environment that they argue can explain a substantial fraction of the early birth order effects they document.

We examine the issue of parental investment behavior in the Swedish context using the ETF-survey, which is a substantially larger dataset than earlier studies used. The ETF-survey samples one individual from each household, which makes it impossible to estimate our preferred specification that includes family fixed effects. However, as discussed above, we can still obtain balance in family background by birth order by including fixed effects for all possible combinations of the sibling's year of birth. For example, if a particular family has children born in 1993, 1995, and 1997, we would create an indicator equal to one if there were three children in the family and those three children were born in 1993, 1995, and 1997. Although we are not looking within families, we are still comparing children of different birth order but whose family birth composition, including children's ages and child spacing, is exactly the same.[50]

The results on children's effort and parental investments are presented in Table 8. Not surprising, given our results on non-cognitive abilities and the existing literature on the effects of

[50] To verify that this is equivalent to family fixed effects specifications, Appendix Table A11 presents the results when we estimate the relationship between birth order and non-cognitive abilities using the two specifications: the first panel presents our preferred specification with family fixed effects and the second panel uses the family type fixed effects described above. Because we are so precisely controlling for family type, the results are identical, suggesting that this approach is sufficient to avoid concerns about omitted variable bias. We have also verified that covariates are balanced when we run the alternative specification.

birth order on education, earnings and cognitive abilities, we find that the number of hours per week doing homework is declining significantly with birth order, with later born children spending almost an hour less per week on homework. They are also much less likely to read books, and they spend substantially more time watching TV or playing on the computer. Interestingly, parents report that they spend less time discussing school work with later-born children, suggesting that parental investment falls by birth order. We find no consistent difference in whether or not parents help with homework or in parental expectations by birth order.

Taken together, we think these results suggest that parents invest less in later borns; e.g. being less strict and providing less parental supervision, as suggested by Hotz and Pantano (2015) and Avarett, Argys and Rees (2011). However, an alternative interpretation is that birth order affects children's personality through sibling rivalry, and that parents adapt and treat children differently.

VI. Conclusion

Popular press is replete with articles and books touting the relationship between birth order and personality. However, due to data limitations, there is very little convincing evidence documenting these relationships. Using unique registry data from Sweden on a large sample of men, we are able to estimate the relationship between birth order and measures of non-cognitive ability and occupational characteristics, all of which serve as reasonable proxies for individual personalities.

Consistent with the existing literature on earnings and IQ, we find evidence that non-cognitive abilities are declining with birth order. This is true across a variety of measures of abilities, including the Big Five dimensions of personality. These results are somewhat at odds with the psychology literature, where later borns are expected to be more emotionally stable, open to experience and social. We also find systematic differences in occupational sorting by birth order—

first-born children are more likely to be managers, while later-born children are more likely to be self-employed. This occupational sorting is consistent with predictions from evolutionary psychology where first borns are suggested to dominate younger siblings, whereas later borns are assumed to use more unorthodox strategies to attract attention.

The patterns vary by the sex composition of the children—later born boys are particularly affected when their older siblings are brothers. For non-cognitive ability, the effects of birth order are more than twice as large if one is later born with older brothers. However, when we consider creative occupations, later-born boys are less likely to enter these occupations if they have older sisters while later-born boys are *more* likely to enter these occupations if they have older brothers.

When we examine possible mechanisms underlying the observed birth order patterns, we find support for post-birth environmental factors driving the negative birth order effects, while biological factors go in the other direction. Additionally, we find that study behaviors vary by birth order; teenagers are more likely to read books, spend more time on homework, and less time watching TV if they are first-born. We also find that some parental investments decline by birth order, which could partly explain the negative effects of birth order on non-cognitive abilities. However, this does not rule out that other factors—including parental resources or sibling competition—can help to explain these patterns.

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Table 1. Descriptive statistics – main data

	Full Sample	First child	Second child	Third child	Fourth child	Fifth child
Outcome variable:						
Non-cognitive ability	0.032	0.124	0.035	-0.065	-0.190	-0.302
	(0.989)	(0.978)	(0.983)	(0.996)	(0.994)	(0.994)
Background variables:						
Family size	2.974	2.708	2.748	3.430	4.265	5.000
	(0.897)	(0.799)	(0.815)	(0.639)	(0.441)	(0.000)
Age, 2010	43.387	45.268	42.444	41.904	42.645	42.642
	(7.853)	(7.460)	(7.985)	(7.827)	(7.427)	(6.661)
Mother's age at first birth	0.063	0.064	0.064	0.062	0.060	0.058
	(0.011)	(0.011)	(0.011)	(0.010)	(0.009)	(0.009)
Mother's years of schooling	10.064	10.303	10.191	9.756	9.039	8.460
	(2.720)	(2.717)	(2.719)	(2.698)	(2.480)	(2.147)
Observations	564,788	205,619	215,913	103,845	31,851	7,560

Notes: The sample is restricted to men in families with at least two males born 1952-82 with valid draft records. Non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Family size is the number of children to whom the mother has given birth. Mother's years of schooling are measured at age 45.

Table 2. Descriptive statistics – employment and occupation data

	Full Sample	First child	Second child	Third child	Fourth child	Fifth child
Employment and occupation:						
Employed	0.825	0.833	0.829	0.816	0.799	0.793
	(0.380)	(0.373)	(0.377)	(0.388)	(0.401)	(0.405)
Self-employed	0.057	0.057	0.057	0.059	0.060	0.057
	(0.233)	(0.232)	(0.232)	(0.236)	(0.237)	(0.232)
Top managers	0.006	0.007	0.005	0.004	0.003	0.002
	(0.068)	(0.077)	(0.066)	(0.059)	(0.052)	(0.035)
Managers	0.085	0.096	0.084	0.074	0.063	0.051
	(0.256)	(0.270)	(0.255)	(0.241)	(0.222)	(0.199)
Creative Occupations	0.006	0.006	0.006	0.007	0.007	0.007
	(0.073)	(0.069)	(0.075)	(0.079)	(0.076)	(0.079)
Job Requirements:						
Social ability	-0.096	-0.036	-0.091	-0.162	-0.261	-0.330
	(0.946)	(0.960)	(0.944)	(0.930)	(0.900)	(0.852)
Leadership ability	0.065	0.118	0.072	0.005	-0.083	-0.123
	(0.990)	(1.010)	(0.983)	(0.971)	(0.960)	(0.893)
Conscientiousness	-0.078	-0.016	-0.069	-0.148	-0.260	-0.325
	(0.969)	(0.978)	(0.964)	(0.961)	(0.943)	(0.899)
Agreeableness	-0.296	-0.248	-0.288	-0.351	-0.432	-0.492
	(0.933)	(0.944)	(0.932)	(0.921)	(0.896)	(0.857)
Emotional Stability	-0.294	-0.245	-0.285	-0.351	-0.439	-0.493
	(0.962)	(0.963)	(0.961)	(0.960)	(0.948)	(0.922)
Extraversion	-0.037	0.025	-0.031	-0.105	-0.208	-0.275
	(0.970)	(0.988)	(0.966)	(0.950)	(0.918)	(0.862)
Openness to experience	0.065	0.129	0.073	-0.007	-0.122	-0.183
	(0.970)	(0.976)	(0.963)	(0.964)	(0.958)	(0.914)
Observations	727,111	267,923	271,373	132,665	44,108	11,042

Notes: The sample is restricted to men in families with at least two males born 1941-74. The information on occupation covers the 1996-2009 period, and we have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual. The information on job requirements is derived from the O*NET occupational descriptions and all measures are standardized in the full sample of workers. The data on employment and occupations covers the full sample (employed and non-employed), while the job requirements are restricted to employed individuals.

Table 3. Effects of birth order on children's non-cognitive ability

	All families	Two-child families	Three-child families	Four-child families	Five-child families	All Families w/control for cognitive ability
			Panel A: Family size FE			
Second child	-0.096***	-0.075***	-0.088***	-0.080***	-0.105***	-0.049***
	(0.004)	(0.007)	(0.006)	(0.009)	(0.018)	(0.003)
Third child	-0.157***		-0.171***	-0.156***	-0.178***	-0.101***
	(0.006)		(0.009)	(0.012)	(0.020)	(0.005)
Fourth child	-0.181***			-0.228***	-0.245***	-0.159***
	(0.010)			(0.017)	(0.024)	(0.008)
Fifth child	-0.196***				-0.314***	-0.215***
	(0.016)				(0.031)	(0.013)
R-squared	0.033	0.016	0.025	0.028	0.022	0.159
			Panel B: Family FE			
Second child	-0.115***	-0.111***	-0.114***	-0.093***	-0.126***	-0.061***
	(0.004)	(0.008)	(0.006)	(0.010)	(0.018)	(0.004)
Third child	-0.199***		-0.224***	-0.194***	-0.193***	-0.109***
	(0.007)		(0.011)	(0.014)	(0.022)	(0.007)
Fourth child	-0.247***			-0.290***	-0.248***	-0.135***
	(0.012)			(0.022)	(0.031)	(0.011)
Fifth child	-0.302***				-0.334***	-0.172***
	(0.019)				(0.043)	(0.018)
R-squared	0.008	0.009	0.010	0.008	0.009	0.091
Observations	564,788	195,852	226,469	103,574	38,893	564,788

Notes: The sample is restricted to men in families with at least two males born 1952-82 with valid draft records. Non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Each column in each panel represents a separate regression. In Panel A all regressions include dummy variables for child's year of birth, mother's year of birth, mother's age at first birth, and mother's educational attainment. In Panel B all regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table 4. Effects of birth order on children's employment and occupation

	Employed	Self-employed	Top Managers	Managers	Creative Occupations
Second child	-0.010***	0.006***	-0.0017***	-0.010***	-0.0002
	(0.002)	(0.001)	(0.0005)	(0.002)	(0.0005)
Third child	-0.017***	0.008***	-0.0020**	-0.015***	-0.0001
	(0.003)	(0.002)	(0.0008)	(0.003)	(0.0008)
Fourth child	-0.020***	0.007***	-0.0018	-0.016***	-0.0003
	(0.004)	(0.003)	(0.0011)	(0.004)	(0.0012)
Fifth child	-0.022***	0.006	-0.0026*	-0.021***	-0.0006
	(0.007)	(0.004)	(0.0015)	(0.007)	(0.0018)
R-squared	0.005	0.001	0.001	0.006	0.001
Observations	727,111	727,111	521,779	521,779	521,779

Notes: The sample is restricted to men in families with at least two males born 1941-74. Columns (3) – (5) are based on occupational data for the 1996-2009 period. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. The data covers both employed and non-employed individuals. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table 5. Effects of birth order on sorting into jobs with different skill requirements

	Social Ability	Leadership Ability	Conscien-tiousness	Agreeableness	Emotional Stability	Extraversion	Openness
Second child	-0.064***	-0.048***	-0.071***	-0.048***	-0.050***	-0.064***	-0.075***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)
Third child	-0.101***	-0.084***	-0.116***	-0.080***	-0.085***	-0.102***	-0.122***
	(0.015)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Fourth child	-0.141***	-0.111***	-0.155***	-0.102***	-0.105***	-0.142***	-0.161***
	(0.022)	(0.025)	(0.023)	(0.023)	(0.024)	(0.023)	(0.023)
Fifth child	-0.141***	-0.086**	-0.145***	-0.095***	-0.090**	-0.137***	-0.155***
	(0.034)	(0.038)	(0.035)	(0.034)	(0.036)	(0.035)	(0.036)
R-squared	0.007	0.008	0.006	0.004	0.003	0.008	0.009
Observations	375,540	375,540	375,540	375,540	375,540	375,540	375,540

Notes: The sample is restricted to men in families with at least two males born 1941-74. The occupational information covers the 1996-2009 period, and have been matched to the O*NET database to obtain job requirements. All measures are standardized in the full sample of workers. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table 6. Effects of birth order and siblings' gender composition on children's abilities, employment and occupation

	Non-Cognitive Ability	Employed	Self-employed	Top Managers	Managers	Creative Occupations
Birth order:						
Second child	-0.052***	-0.001	0.003*	-0.0020**	-0.009***	-0.0025***
	(0.009)	(0.003)	(0.002)	(0.0009)	(0.003)	(0.0009)
Third child	-0.101***	-0.001	0.005	-0.0020	-0.014**	-0.0031**
	(0.014)	(0.005)	(0.003)	(0.0014)	(0.005)	(0.0015)
Fourth child	-0.121***	0.001	0.001	-0.0018	-0.014*	-0.0040*
	(0.020)	(0.007)	(0.004)	(0.0019)	(0.007)	(0.0020)
Fifth child	-0.141***	0.002	-0.002	-0.0026	-0.017*	-0.0049*
	(0.027)	(0.010)	(0.006)	(0.0024)	(0.010)	(0.0026)
Birth order among boys:						
Second boy	-0.071***	-0.010***	0.003	0.0003	-0.001	0.0026***
	(0.009)	(0.003)	(0.002)	(0.0009)	(0.003)	(0.0009)
Third boy	-0.109***	-0.020***	0.004	-0.0005	-0.002	0.0028*
	(0.014)	(0.005)	(0.003)	(0.0015)	(0.006)	(0.0015)
Fourth boy	-0.147***	-0.030***	0.014***	0.0006	-0.004	0.0043*
	(0.023)	(0.008)	(0.005)	(0.0021)	(0.008)	(0.0023)
Fifth boy	-0.257***	-0.009	-0.001	-0.0011	-0.012	0.0058
	(0.052)	(0.019)	(0.011)	(0.0033)	(0.017)	(0.0060)
R-squared	0.009	0.005	0.001	0.001	0.006	0.001
Observations	564,788	727,111	727,111	521,779	521,779	521,779

Notes: The sample in column (1) is restricted to men in families with at least two males born 1952-82 with valid draft records, while the remaining columns are restricted to men in families with at least two males born 1941-74. Columns (4) – (6) are based on occupational data for the 1996-2009 period. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. The data covers both employed and non-employed individuals. Non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table 7. Effects of biological and social birth order on children's non-cognitive abilities, exploiting older siblings' vital and adoption status

	Non-cognitive Ability	
Biological birth order		
Second child	-0.103***	0.065*
	(0.004)	(0.036)
Third child	-0.202***	0.122**
	(0.007)	(0.060)
Fourth child	-0.258***	0.179**
	(0.011)	(0.082)
Fifth child	-0.303***	0.176*
	(0.017)	(0.105)
Social birth order		
Second child		-0.170***
		(0.037)
Third child		-0.327***
		(0.060)
Fourth child		-0.441***
		(0.082)
Fifth child		-0.481***
		(0.106)
R-squared	0.008	0.009
Observations	442,244	442,244

Notes: The analysis is restricted to families with at least two males born 1952-82 with valid draft records, and with a family size of 3-6 children. Non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Social birth order is the birth order of the child excluding older siblings who have been put up for adoption or who died within two months of birth. Each column represents a separate regression. Omitted category is first child. The regressions control for family fixed effects, dummy variables for year of birth and a dummy variable for the sixth biological birth order. All families are weighted to match families where at least one child has died or been put up for adoption with respect to family size, sibling's gender composition, mother's year of birth, mother's age at first birth and mother's highest educational level. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table 8. Effects of birth order on pupil effort and parental investments

	Homework (hours/week)	Read books (std)	Watch TV or play computer (hours/week)	Parents help with homework (incidence)	Parents talk about school (std)	Parents' Expectations (std)
Second child	-0.132	-0.353***	0.193**	0.011	-0.178**	-0.082
	(0.085)	(0.069)	(0.085)	(0.022)	(0.083)	(0.170)
Third child	-0.282**	-0.500***	0.418***	0.013	-0.326**	0.076
	(0.133)	(0.111)	(0.133)	(0.036)	(0.136)	(0.279)
Fourth child	-0.482**	-0.513***	0.287	0.015	-0.509**	-0.033
	(0.205)	(0.172)	(0.213)	(0.054)	(0.205)	(0.432)
Fifth child	-0.996***	-0.769***	1.025***	-0.077	-0.689**	-0.300
	(0.318)	(0.285)	(0.353)	(0.091)	(0.290)	(0.618)
R-squared	0.048	0.147	0.095	0.024	0.027	0.029
p-value of F-test	0.033	0.000	0.003	0.660	0.121	0.395
Observations	31,908	26,145	30,799	32,636	23,034	11,829

Notes: The sample is restricted to individuals born 1967, 1972, 1977, 1982, 1987 or 1992 in the ETF-data. Each column represents a separate regression. Omitted category is first child. All regressions control for the full interaction between all siblings' year of birth, and dummy variables for child's year of birth and gender. Robust standard errors are in parentheses. The p-value reported at the bottom of the columns is for an F-test of the joint significance of the birth order dummy variables. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Supplementary material to
Born to Lead? The Effect of Birth Order on Non-Cognitive Abilities
By Sandra E Black, Erik Grönqvist and Björn Öckert

This appendix has three sections. Appendix A shows supporting results; Appendix B shows results on occupational sorting for women; and Appendix C describe how we use O*NET to obtain information on personal characteristics.

Appendix A. Supporting results

Table A1. Average non-cognitive and cognitive abilities, by occupational status

	Non-cognitive Ability	Cognitive Ability
Employed	0.077	0.090
[n=823,466]	(0.962)	(0.964)
whereof:		
- Top managers	0.815	0.752
[n=5,296]	(0.854)	(0.733)
- Managers	0.545	0.527
[n=83,297]	(0.875)	(0.799)
- Creative occupations	0.120	0.624
[n=8,903]	(1.007)	(0.779)
Self-employed	0.011	-0.038
[n=52,775]	(0.944)	(0.922)
Not employed	-0.425	-0.301
[n=105,624]	(1.104)	(1.078)
Observations	981,865	981,865

Notes: The table shows mean (standard deviation) non-cognitive and cognitive abilities for men with different occupations. The sample is restricted to men born 1952-74 with valid draft records. The occupational data covers the 1996-2009 period. We have taken the observation closest to age 45 (but within ages 35-55) for each individual, weighted by the inverse of the sampling probability. The number of observations (sum of weights) for each occupation is given in squared parentheses. Cognitive and non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees.

Table A2. Descriptive statistics in full sample and analysis sample

	Full sample	Analysis sample
Outcome variables:		
Non-cognitive ability	0.040	0.032
	(0.985)	(0.989)
Employed	0.829	0.825
	(0.377)	(0.380)
Self-employed	0.056	0.057
	(0.230)	(0.233)
Top managers	0.006	0.006
	(0.069)	(0.069)
Managers	0.070	0.069
	(0.238)	(0.236)
Creative Occupations	0.006	0.006
	(0.074)	(0.070)
Background variables:		
Family size	2.759	2.974
	(0.859)	(0.897)
Age, 2010	43.204	43.387
	(8.440)	(7.853)
Mother's age at first birth	23.410	23.180
	(3.936)	(3.898)
Mother's years of schooling	10.103	10.064
	(2.726)	(2.720)
Observations	1,102,497	564,788

Notes: The full sample consists of all males born 1952-82 with valid draft records, while the analysis sample is restricted to families with at least two males born 1952-82 with valid draft records. The employment and occupation data are restricted to men born 1952-74. Non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. The occupation information covers the 1996-2009 period, and we have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual. Family size is the number of children to whom the mother has given birth. Mother's years of schooling are measured at age 45.

Table A3. Wage premiums for individual abilities and job requirements

	(1)	(2)	(3)	(4)	(5)
Individual abilities:					
Cognitive ability	0.124***			0.063***	0.058***
	(0.000)			(0.000)	(0.000)
Non-cognitive ability	0.083***			0.050***	0.046***
	(0.000)			(0.000)	(0.000)
Job requirements:					
Cognitive ability		0.183***	0.116***	0.140***	0.082***
		(0.001)	(0.001)	(0.001)	(0.001)
Social ability		0.053***		0.044***	
		(0.001)		(0.001)	
Conscientiousness			0.177***		0.156***
			(0.002)		(0.002)
Agreeableness			-0.268***		-0.265***
			(0.002)		(0.002)
Emotional Stability			-0.010***		0.000
			(0.001)		(0.001)
Extraversion			0.225***		0.221***
			(0.001)		(0.001)
Openness to experience			-0.046***		-0.048***
			(0.001)		(0.001)
R^2	0.266	0.360	0.427	0.410	0.469
Observations	518,159	518,159	518,159	518,159	518,159

Notes: The table shows estimates of the association between log-wages and different individual abilities and job requirements. The sample is restricted to employed men born 1952-74 with valid draft records. Cognitive and non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. The wage and occupation data covers the 1996-2009 period, and have been matched to the O*NET database to obtain job requirements. The job requirements are standardized in the full sample of workers. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. Each column represents a separate regression. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table A4a. Correlation matrix for ability measures obtained from the military draft records

	Non-cognitive Ability	Cognitive Ability
Non-cognitive ability	1.0000	
Cognitive ability	0.3756	1.0000

Notes: The sample is restricted to men in families with at least two males born 1952-82 with valid draft records (n=564,788). Cognitive and non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees.

Table A4b. Correlation matrix for different ability measures obtained from occupation data

	Social Ability	Leadership Ability	Conscien-tiousness	Agreeableness	Emotional Stability	Extraversion	Openness	Cognitive ability
Social Ability	1.0000							
Leadership Ability	0.8054	1.0000						
Conscientiousness	0.8978	0.8556	1.0000					
Agreeableness	0.9381	0.7921	0.8910	1.0000				
Emotional stability	0.8612	0.7773	0.8914	0.9470	1.0000			
Extraversion	0.9819	0.8853	0.9208	0.9183	0.8519	1.0000		
Openness	0.7899	0.8760	0.9195	0.7319	0.7345	0.8538	1.0000	
Cognitive ability	0.6877	0.7112	0.7614	0.6019	0.6309	0.7140	0.8155	1.0000

Notes: The sample is restricted to men in families with at least two males born 1941-74 (n=727,111). The occupation information covers the 1996-2009 period, and has been matched to the O*NET database to obtain job requirements. All measures are standardized in the full sample of workers. We have taken the observation closest to age 45 (but within ages 35-55) for each individual, weighted by the inverse of the sampling probability.

Table A5. Descriptive statistics – ETF-survey

	Full Sample	First child	Second child	Third child	Fourth child	Fifth child
Outcome variables:						
Homework (hours/week)	2.352	2.410	2.349	2.269	2.21	2.001
	(1.473)	(1.492)	(1.465)	(1.464)	(1.42)	(1.216)
Read books (std)	-0.009	0.112	-0.085	-0.083	-0.081	-0.172
	(0.999)	(1.002)	(0.985)	(0.995)	(1.017)	(1.044)
Watch TV or play computer (hours/week)	2.559	2.481	2.582	2.645	2.700	2.862
	(1.477)	(1.454)	(1.465)	(1.503)	(1.617)	(1.757)
Parents help with homework (incidence)	0.823	0.833	0.824	0.808	0.777	0.755
	(0.382)	(0.373)	(0.381)	(0.394)	(0.416)	(0.431)
Parents talk about school (std)	-0.006	0.033	-0.018	-0.064	-0.052	-0.107
	(0.993)	(0.984)	(0.995)	(1.002)	(1.014)	(1.040)
Parents' expectations (std)	-0.032	-0.023	-0.033	-0.033	-0.100	-0.112
	(0.986)	(0.992)	(0.985)	(0.986)	(0.949)	(0.950)
Observations	36,796	14,332	14,988	5,782	1,387	307

Notes: The sample is restricted to individuals born 1967, 1972, 1977, 1982, 1987 or 1992 in the ETF-data. The number of observations varies for different outcome variables.

Table A6. Effects of birth order on children's abilities, simulating "missing" children

		Simulating missing second-born children under the assumption of no birth order effects	
	Observed data	Simulating all missing children	Simulating children likely to be missing
	Panel A: Non-cognitive Ability		
Second child	-0.109***	-0.076***	-0.084***
	(0.006)	(0.005)	(0.005)
	Panel B: Cognitive Ability		
Second child	-0.167***	-0.123***	-0.133***
	(0.005)	(0.005)	(0.005)
Observations	349,922	436,382	424,908

Notes: The table shows the effects of being second-born in the observed data and then when imputing potentially "missing" second-born children in single-child families. The sample is restricted to first-born and second-born children in all families, irrespective of family size. The first column shows the estimated effect of being second-born in the observed data. In the second and third columns, "missing" second-born children in one-child families have been randomly drawn from the skill distribution of all first-born children, within a given strata defined by the interaction between mother's year of birth (10 classes), mother's age at first birth (30 classes), mother's highest educational level (7 classes) and father's income (20 classes). In the second column all missing second-born children have been simulated, while in the third column the number of missing second-born children has been restricted by the probability of fertility for mothers at different ages. The second and third columns show the average point estimates and standard errors from 1,000 repetitions. Cognitive and non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Each column in each panel represents a separate regression. Omitted category is first child. All regressions control for family fixed effects and dummy variables for year of birth. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table A7. Effects of birth order on children's cognitive ability

	All families	Two-child families	Three-child families	Four-child families	Five-child families
Second child	-0.181***	-0.194***	-0.172***	-0.145***	-0.163***
	(0.003)	(0.007)	(0.005)	(0.008)	(0.015)
Third child	-0.299***		-0.328***	-0.278***	-0.283***
	(0.007)		(0.010)	(0.013)	(0.020)
Fourth child	-0.372***			-0.390***	-0.383***
	(0.010)			(0.019)	(0.027)
Fifth child	-0.422***				-0.469***
	(0.017)				(0.038)
Observations	564,788	195,852	226,469	103,574	38,893

Notes: The sample is restricted to men in families with at least two males born 1952-82 with valid draft records. Cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table A8. Effects of birth order and siblings' gender composition on children's non-cognitive and cognitive abilities

	Non-Cognitive Ability		Cognitive Ability	
Birth order:				
Second child	-0.115***	-0.052***	-0.181***	-0.126***
	(0.004)	(0.009)	(0.003)	(0.007)
Third child	-0.199***	-0.101***	-0.299***	-0.207***
	(0.007)	(0.014)	(0.007)	(0.012)
Fourth child	-0.247***	-0.121***	-0.372***	-0.250***
	(0.012)	(0.020)	(0.010)	(0.017)
Fifth child	-0.302***	-0.141***	-0.422***	-0.277***
	(0.019)	(0.027)	(0.017)	(0.024)
Birth order among boys:				
Second boy		-0.071***		-0.063***
		(0.009)		(0.007)
Third boy		-0.109***		-0.107***
		(0.014)		(0.013)
Fourth boy		-0.147***		-0.149***
		(0.023)		(0.020)
Fifth boy		-0.257***		-0.142***
		(0.052)		(0.044)
R-squared	0.009	0.009	0.017	0.017
Observations	564,788	564,788	564,788	564,788

Notes: The sample is restricted to men in families with at least two males born 1952-82 with valid draft records. Non-cognitive and cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table A9. Effects of birth order and siblings' gender composition on occupation skill requirements

	Social ability	Leadership ability	Conscien-tiousness	Agreeableness	Emotional Stability	Extraversion	Openness
Birth order:							
Second child	-0.058***	-0.031	-0.056***	-0.046***	-0.050***	-0.054***	-0.053***
	(0.017)	(0.019)	(0.018)	(0.017)	(0.018)	(0.018)	(0.018)
Third child	-0.089***	-0.055*	-0.091***	-0.073***	-0.084***	-0.084***	-0.088***
	(0.028)	(0.031)	(0.029)	(0.028)	(0.029)	(0.029)	(0.029)
Fourth child	-0.127***	-0.078*	-0.128***	-0.098**	-0.112***	-0.122***	-0.123***
	(0.038)	(0.043)	(0.039)	(0.038)	(0.040)	(0.039)	(0.040)
Fifth child	-0.119**	-0.045	-0.109**	-0.086*	-0.096*	-0.107**	-0.104*
	(0.051)	(0.057)	(0.053)	(0.051)	(0.054)	(0.052)	(0.053)
Birth order among boys:							
Second boy	-0.006	-0.020	-0.017	-0.003	-0.001	-0.011	-0.025
	(0.017)	(0.019)	(0.018)	(0.017)	(0.018)	(0.018)	(0.018)
Third boy	-0.018	-0.034	-0.031	-0.011	-0.002	-0.024	-0.037
	(0.028)	(0.032)	(0.029)	(0.029)	(0.030)	(0.029)	(0.029)
Fourth boy	-0.007	-0.022	-0.014	0.012	0.032	-0.012	-0.032
	(0.042)	(0.047)	(0.044)	(0.042)	(0.044)	(0.043)	(0.044)
Fifth boy	-0.073	-0.085	-0.091	-0.064	-0.042	-0.086	-0.118
	(0.084)	(0.093)	(0.088)	(0.084)	(0.091)	(0.086)	(0.090)
R-squared	0.007	0.008	0.006	0.004	0.003	0.008	0.010
Observations	375,540	375,540	375,540	375,540	375,540	375,540	375,540

Notes: The sample is restricted to men in families with at least two males born 1941-74. The occupational information covers the 1996-2009 period, and has been matched to the O*NET database to obtain job requirements. All measures are standardized in the full sample of workers. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table A10. Effects of biological and social birth order on children's non-cognitive and cognitive abilities, exploiting older siblings' vital and adoption status

	Non-Cognitive Ability		Cognitive Ability	
Biological birth order				
Second child	-0.103***	0.065*	-0.160***	0.061*
	(0.004)	(0.036)	(0.004)	(0.032)
Third child	-0.202***	0.122**	-0.299***	0.077
	(0.007)	(0.060)	(0.006)	(0.053)
Fourth child	-0.258***	0.179**	-0.375***	0.118*
	(0.011)	(0.082)	(0.010)	(0.072)
Fifth child	-0.303***	0.176*	-0.421***	0.168*
	(0.017)	(0.105)	(0.015)	(0.093)
Social birth order				
Second child		-0.170***		-0.224***
		(0.037)		(0.032)
Third child		-0.327***		-0.379***
		(0.060)		(0.053)
Fourth child		-0.441***		-0.497***
		(0.082)		(0.072)
Fifth child		-0.481***		-0.594***
		(0.106)		(0.094)
R-squared	0.008	0.009	0.017	0.017
Observations	442,244	442,244	442,244	442,244

Notes: The analysis is restricted to families with at least two males born 1952-82 with valid draft records, and with a family size of 3-6 children. Cognitive and non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Social birth order is the birth order of the child excluding older siblings who have been put up for adoption, who were still born or who died within two months of birth. Each column represents a separate regression. Omitted category is first child. The regressions control for family fixed effects, dummy variables for year of birth and a dummy variable for the sixth biological birth order. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table A11. Effects of birth order on children's non-cognitive ability

	All families	Two-child families	Three-child families	Four-child families	Five-child families
	Panel A: Family FE				
Second child	-0.115***	-0.111***	-0.114***	-0.093***	-0.126***
	(0.005)	(0.009)	(0.007)	(0.011)	(0.019)
Third child	-0.199***		-0.224***	-0.194***	-0.193***
	(0.008)		(0.013)	(0.016)	(0.024)
Fourth child	-0.247***			-0.290***	-0.248***
	(0.013)			(0.024)	(0.032)
Fifth child	-0.302***				-0.334***
	(0.019)				(0.045)
	Panel B: Family type FE				
Second child	-0.115***	-0.111***	-0.114***	-0.093***	-0.126***
	(0.004)	(0.008)	(0.006)	(0.010)	(0.018)
Third child	-0.199***		-0.224***	-0.194***	-0.193***
	(0.007)		(0.011)	(0.014)	(0.022)
Fourth child	-0.247***			-0.290***	-0.248***
	(0.012)			(0.022)	(0.031)
Fifth child	-0.302***				-0.334***
	(0.019)				(0.043)
Observations	564,788	195,852	226,469	103,574	38,893

Notes: The sample is restricted to men in families with at least two males born 1952-82 with valid draft records. Non-cognitive abilities are measured at approximately age 18 and standardized by year of draft in the full sample of draftees. Each column in each panel represents a separate regression. All regressions control for dummy variables for year of birth. Family type FE specifications include dummy variables for the full interaction between all siblings' year of birth. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Appendix B. Results on occupational sorting for women

Table B1. Descriptive statistics, females

	Full Sample	First child	Second child	Third child	Fourth child	Fifth child
Employment and occupation:						
Employed	0.833	0.844	0.834	0.821	0.810	0.794
	(0.373)	(0.363)	(0.372)	(0.383)	(0.392)	(0.404)
Self-employed	0.030	0.031	0.030	0.029	0.029	0.029
	(0.171)	(0.173)	(0.171)	(0.169)	(0.168)	(0.169)
Top managers	0.001	0.001	0.001	0.001	0.001	0.001
	(0.027)	(0.030)	(0.027)	(0.025)	(0.025)	(0.023)
Managers	0.036	0.039	0.035	0.033	0.029	0.023
	(0.165)	(0.173)	(0.164)	(0.158)	(0.148)	(0.131)
Creative Occupations	0.009	0.008	0.009	0.010	0.008	0.007
	(0.086)	(0.081)	(0.090)	(0.091)	(0.083)	(0.077)
Job Requirements:						
Social ability	0.151	0.207	0.153	0.094	0.012	-0.061
	(0.963)	(0.973)	(0.959)	(0.952)	(0.943)	(0.930)
Leadership ability	-0.004	0.053	-0.001	-0.064	-0.140	-0.210
	(0.919)	(0.931)	(0.915)	(0.909)	(0.879)	(0.863)
Conscientiousness	0.132	0.199	0.136	0.061	-0.031	-0.117
	(0.940)	(0.946)	(0.936)	(0.935)	(0.917)	(0.910)
Agreeableness	0.343	0.392	0.342	0.293	0.232	0.168
	(0.905)	(0.907)	(0.902)	(0.902)	(0.895)	(0.891)
Emotional Stability	0.343	0.388	0.344	0.297	0.239	0.181
	(0.865)	(0.855)	(0.863)	(0.875)	(0.879)	(0.888)
Extraversion	0.094	0.152	0.098	0.035	-0.049	-0.122
	(0.952)	(0.964)	(0.948)	(0.937)	(0.917)	(0.898)
Openness to experience	-0.004	0.058	0.002	-0.073	-0.165	-0.249
	(0.949)	(0.955)	(0.945)	(0.941)	(0.923)	(0.906)
Observations	663,749	243,432	246,801	121,712	41,245	10,559

Notes: The sample is restricted to women in families with at least two females born 1941-74. The occupational information covers the 1996-2009 period, and we have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual. The information on job requirements is derived from the O*NET occupation descriptions and all measures are standardized in the full sample of workers. The data on employment and occupations covers to the full sample (employed and non-employed), while the job requirements are restricted to employed individuals.

Table B2. Effects of birth order on children's employment and occupation, females

	Employed	Self-Employed	Top Managers	Managers	Creative Occupations
Second child	-0.009***	0.003***	-0.0004**	-0.005***	0.0009**
	(0.002)	(0.001)	(0.0002)	(0.001)	(0.0004)
Third child	-0.018***	0.004***	-0.0006**	-0.008***	0.0018**
	(0.003)	(0.001)	(0.0003)	(0.002)	(0.0008)
Fourth child	-0.021***	0.007***	-0.0006	-0.009***	0.0017
	(0.004)	(0.002)	(0.0004)	(0.002)	(0.0011)
Fifth child	-0.032***	0.008**	-0.0003	-0.012***	0.0010
	(0.007)	(0.003)	(0.0006)	(0.003)	(0.0015)
R-squared	0.005	0.001	0.001	0.006	0.001
Observations	663,749	663,749	566,521	566,521	566,521

Notes: The sample is restricted to women in families with at least two females born 1941-74. Columns (3) – (5) are based on occupation data for the 1996-2009 period. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. The data covers both employed and non-employed individuals. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table B3. Effects of birth order on sorting into jobs with different skill requirements, females

	Social Ability	Leadership Ability	Conscien-tiousness	Agree-ableness	Emotional Stability	Extraversion	Openness
Second child	-0.092***	-0.086***	-0.094***	-0.079***	-0.070***	-0.091***	-0.093***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Third child	-0.167***	-0.157***	-0.168***	-0.148***	-0.130***	-0.166***	-0.168***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Fourth child	-0.233***	-0.200***	-0.215***	-0.204***	-0.182***	-0.228***	-0.213***
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Fifth child	-0.273***	-0.229***	-0.249***	-0.239***	-0.212***	-0.264***	-0.255***
	(0.026)	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
R-squared	0.007	0.008	0.006	0.004	0.003	0.008	0.009
Observations	459,846	459,846	459,846	459,846	459,846	459,846	459,846

Notes: The sample is restricted to women in families with at least two females born 1941-74. The occupation information covers the 1996-2009 period and has been matched to the O*NET database to obtain job requirements. All measures are standardized in the full sample of workers. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table B4. Effects of birth order and siblings' gender composition on employment and occupation, females

	Employment	Self-employed	Top managers	Managers	Creative Occupations
Birth order:					
Second child	-0.006**	0.001	-0.0005*	-0.005***	0.0004
	(0.003)	(0.001)	(0.0003)	(0.002)	(0.0009)
Third child	-0.013**	0.001	-0.0007	-0.008***	0.0007
	(0.005)	(0.002)	(0.0005)	(0.003)	(0.0014)
Fourth child	-0.015**	0.002	-0.0006	-0.008**	0.0004
	(0.007)	(0.003)	(0.0006)	(0.004)	(0.0018)
Fifth child	-0.024**	0.003	-0.0003	-0.011**	-0.0003
	(0.010)	(0.004)	(0.0008)	(0.005)	(0.0023)
Birth order among girls:					
Second girl	-0.004	0.002	0.0001	-0.000	0.0006
	(0.003)	(0.001)	(0.0003)	(0.002)	(0.0009)
Third girl	-0.005	0.003	-0.0001	-0.001	0.0018
	(0.005)	(0.002)	(0.0005)	(0.003)	(0.0014)
Fourth girl	-0.008	0.008**	0.0000	-0.003	0.0005
	(0.008)	(0.004)	(0.0008)	(0.004)	(0.0021)
Fifth girl	-0.016	0.005	-0.0007	0.001	0.0010
	(0.021)	(0.010)	(0.0009)	(0.010)	(0.0038)
	(0.019)	(0.010)	(0.0010)	(0.010)	(0.0041)
R-squared	0.009	0.001	0.001	0.006	0.001
Observations	663,749	663,749	566,521	566,521	566,521

Notes: The sample is restricted to women in families with at least two females born 1941-74. Columns (3) – (5) are based on occupation data for the 1996-2009 period. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Table B5. Effects of birth order and siblings' gender composition on sorting into jobs with different skill requirements, females

	Social ability	Leadership ability	Conscien-tiousness	Agree-ableness	Emotional Stability	Extraversion	Openness
Birth order:							
Second child	-0.064***	-0.062***	-0.067***	-0.051***	-0.042***	-0.064***	-0.070***
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Third child	-0.126***	-0.117***	-0.125***	-0.107***	-0.088***	-0.124***	-0.129***
	(0.021)	(0.019)	(0.020)	(0.020)	(0.019)	(0.020)	(0.020)
Fourth child	-0.180***	-0.145***	-0.154***	-0.152***	-0.126***	-0.173***	-0.159***
	(0.028)	(0.026)	(0.027)	(0.027)	(0.026)	(0.027)	(0.027)
Fifth child	-0.220***	-0.166***	-0.178***	-0.186***	-0.152***	-0.207***	-0.192***
	(0.038)	(0.036)	(0.036)	(0.036)	(0.036)	(0.037)	(0.036)
Birth order Among girls:							
Second girl	-0.032**	-0.028**	-0.031**	-0.032***	-0.032***	-0.031**	-0.027**
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Third girl	-0.044**	-0.047**	-0.050**	-0.045**	-0.046**	-0.046**	-0.046**
	(0.021)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Fourth girl	-0.066**	-0.080***	-0.091***	-0.063**	-0.076**	-0.072**	-0.079**
	(0.032)	(0.030)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Fifth girl	0.021	-0.027	-0.045	0.018	-0.005	0.006	-0.035
	(0.072)	(0.068)	(0.070)	(0.070)	(0.071)	(0.070)	(0.070)
R-squared	0.007	0.008	0.006	0.004	0.003	0.008	0.010
Observations	459,846	459,846	459,846	459,846	459,846	459,846	459,846

Notes: The sample is restricted to women in families with at least two females born 1941-74. The occupation information covers the 1996-2009 period, and have been matched to the O*NET database to obtain job requirements. All measures are standardized in the full sample of workers. We have calculated the weighted average of the five observations closest to age 45 (but within ages 35-55) for each individual, and weighted the regressions by the inverse of the sampling probability. Each column represents a separate regression. All regressions control for family fixed effects and dummy variables for child's year of birth. Omitted category is first child. Robust standard errors are in parentheses. ***/**/*=the estimates are significantly different from zero at the 1/5/10 per cent level of confidence, respectively.

Appendix C. Using O*NET to obtain information on personal characteristics

In order to obtain metrics of personality based of occupation, we use information from the Occupational Information Network (O*NET) database, developed by the U.S. Department of Labor, which classifies and describes occupations based on their skill requirements and on the incumbents' abilities along several dimensions including tasks, work behavior, abilities, skills, and work content. For each occupation, O*NET rates the importance of a large number of personal attributes for success in that occupation (see www.onetcenter.org for more details). With this data, we obtain information on non-cognitive abilities to the extent that they are rated important for job performance in the workers' occupation. In particular, we construct variables capturing the importance of (1) social abilities and (2) leadership abilities in performing the tasks required in occupations. We also categorize the personal attributes into the Big Five domains of personality: Conscientiousness, Agreeableness, Emotional Stability, Extraversion, and Openness.

*Linking O*NET to occupation data*

The job attributes from O*NET are matched to our data on occupations using the following steps. First, we merge the occupational codes (SOC 2000) in O*NET version 14.0 to ISCO88, using a crosswalk table produced by The National Crosswalk Center. Second, we take the employment-weighted average of the job attributes in O*NET, using US Occupational employment statistics. Third, we translate the Swedish occupational classification into the ISCO88 using a crosswalk table from Statistics Sweden. Fourth, we match the data sources together.

Categorizing personal attributes into the Big Five domains of personality

Following Sackett and Walmsley (2014) we categorize the personal attributes into the Big Five domains of personality by adding the intensity of following elements (element id).

Conscientiousness: Social Perceptiveness (2.B.1.a), Service Orientation (2.B.1.f), Instructing

(2.B.1.e), Dependability (1.C.5.a), Integrity (1.C.5.c), Independence (1.C.6), Initiative (1.C.1.c), Persistence (1.C.1.b), Achievement/Effort (1.C.1.a), Attention to Detail (1.C.5.b); Agreeableness: Social Perceptiveness (2.B.1.a), Service Orientation (2.B.1.f), Coordination (2.B.1.b), Negotiation (2.B.1.d), Instructing (2.B.1.e), Integrity (1.C.5.c), Cooperation (1.C.3.a), Concern for Others (1.C.3.b), Social Orientation (1.C.3.c); Emotional Stability: Integrity (1.C.5.c), Self Control (1.C.4.a), Stress Tolerance (1.C.4.b), Adaptability/Flexibility (1.C.4.c); Extraversion: Coordination (2.B.1.b), Persuasion (2.B.1.c), Negotiation (2.B.1.d), Instructing (2.B.1.e), Social Orientation (1.C.3.c), Leadership (1.C.2.b); Openness to Experience: Adaptability/Flexibility (1.C.4.c), Independence (1.C.6), Analytical Thinking (1.C.7.b), Leadership (1.C.2.b), Innovation (1.C.7.a). If the same element is used to build up more than one domain, we deflate the intensity weight for that element with the number of times it is used.

Reference to Appendix C

Sackett, P. R., and P. T. Walmsley, (2014). "Which personality attributes are most important in the workplace?" Perspectives on Psychological Science, 9, 538–551.