IZA Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 12156

Born in the Family: Preferences for Boys and the Gender Gap in Math

Gaia Dossi
David Figlio
Paola Giuliano
Paola Sapienza

FEBRUARY 2019

I Z A Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 12156

Born in the Family: Preferences for Boys and the Gender Gap in Math

Gaia Dossi
London School of Economics

David Figlio
Northwestern University and NBER

Paola Giuliano
UCLA, NBER and IZA

Paola Sapienza
Northwestern University and NBER

FEBRUARY 2019

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Born in the Family: Preferences for Boys and the Gender Gap in Math[1]

We study the correlation between parental gender attitudes and the performance in mathematics of girls using two different approaches and data. First, we identify families with a preference for boys by using fertility stopping rules in a population of households whose children attend public schools in Florida. Girls growing up in a boy-biased family score 3 percentage points lower on math tests when compared to girls raised in other families. Second, we find similar strong effects when we study the correlations between girls' performance in mathematics and maternal gender role attitudes, using evidence from the National Longitudinal Survey of Youth. We conclude that socialization at home can explain a non-trivial part of the observed gender disparities in mathematics performance and document that maternal gender attitudes correlate with those of their children, supporting the hypothesis that preferences transmitted through the family impact children behavior.

JEL Classification: A13, I20, J16, Z1

Keywords: gender Differences, cultural transmission, math performance

Corresponding author:
Paola Giuliano
Anderson School of Management
University of California, Los Angeles
Los Angeles, CA 90095
USA
E-mail: paola.giuliano@anderson.ucla.edu

[1] We thank Alice Eagly for suggestions. We are especially grateful to the Florida Department of Education and Health for providing the linked population-level administrative data that permitted this analysis to take place. Luisa Cefalà provided excellent research assistantship. All errors and opinions are those of the authors and do not reflect those of the Florida Departments of Education and Health.

Introduction

In the U.S. and around the world, the gender gap in mathematics is strongly correlated with women's emancipation and societal norms regarding women's role in society (Guiso et al., 2008, Pope and Sydnor, 2010). While several mechanisms might contribute to explain this correlation, the literature has so far been silent on them due to lack of data. In this paper, we focus on one potential mechanism and study whether socialization within the family can partially explain the gender gap in mathematics in the U.S., following the theoretical contribution of Bisin and Verdier (2001).

We exploit two different empirical strategies and datasets in order to investigate the link between family attitudes and girls' math performance. First, we measure gender biases inside the family by exploiting fertility patterns. Bharadwaj et al. (2015) and Dahl and Moretti (2008) found evidence of parental preferences for boys over girls by showing that the number of children in the U.S. is significantly higher in families when the firstborn is a girl. Following this literature, we investigate whether different fertility patterns correlate with girls' math performance.[2] Using a unique dataset matching administrative data for public schools in Florida (FLDOE) with birth certificates, we first define "boy-biased" families (those families with a fertility stopping rule biased towards sons) and then test whether performance in mathematics is indeed lower for girls raised in these families. We find that girls raised in gender-biased families have a three percentage point lower performance in standardized math tests than girls raised in other families.[3] We find that the effect is concentrated among families with higher socio-economic status as measured by mother's education and non-eligibility to reduced or free lunch.

Fertility stopping rules could be a noisy proxy for gender roles attitudes inside the family, as a specific fertility pattern could simply be a reflection of randomness. To limit this concern, our second strategy uses the National Longitudinal Survey of Youth 1979 (NLSY79) to test the existence of a correlation between test scores in mathematics and maternal measures of attitudes towards gender roles. The advantage of the NLSY is that preferences on gender roles are measured explicitly, unlike the FLDOE, the disadvantage is that we have far fewer observations than in the FLDOE. We show

[2] While we are the first to compare girls' mathematics performance across families with different fertility patterns, our paper is related to several papers that study how differences in family composition correlate with educational outcomes. Brenoe (2017) investigates the correlation between sibling gender composition and participation in STEM education. She finds that having a younger sibling of the opposite sex increases the probability of enrolling in a gender-stereotypical field in education. The author's interpretation is that parents with mixed gender children encourage their children to specialize by gender. Deaton (1989) and Bharadwaj and Nelson (2012) also find evidence that parents invest differentially in their children, depending on the gender.

[3] The presence of a gender gap has been documented in Florida public schools by the National Assessment of Educational Progress (NAEP), a nation-wide assessment program which gives results on subject-matter achievement, instructional experiences, and school environment for students in grades 4, 8 and 12, and by the Florida Department of Education for the case of SAT scores.

that maternal attitudes regarding the role of women in society correlate with girls' test scores in mathematics but do not correlate with boys' performance in mathematics. We also document that maternal attitudes toward gender equality correlate with children's attitudes, an indication that gender role attitudes are transmitted inside the family from parents to children at an early age.[4]

1. Data and outcomes of interest

1.1. Florida Department of Education Data

For our first set of results, we employ a unique dataset containing demographic and school information on the universe of students born in Florida. The Florida Departments of Health and Education merged individual-level information from the Florida Bureau of Vital Statistics birth certificates with individual level public school records from the Florida Education Data Warehouse for the purpose of this paper. Birth certificate data include all children born in Florida between 1994 and 2002, while the school data contain information on every K-12 student who attended Florida public schools between the academic year 2002-2003 and 2011-2012.[5] Overall, our sample contains information for nine birth cohorts born between 1994 and 2002 and attending public schools between 2002-2003 and 2011-2012.

The Florida birth certificate data permit us to measure a household's fertility structure and to obtain information on a large set of socio-economic characteristics of the mother (such as level of education, marital status, year and month of birth, and the zip code at the time of birth).[6] The FLDOE data contain information on standardized test scores in mathematics (the Florida Comprehensive Assessment Test, or FCAT) from third through tenth grade[7], in addition to children's individual and family characteristics including age in month and gender, receipt of reduced or free lunch, and whether

[4] Intergenerational transmission of gender attitudes has also been documented by Farre and Vella (2013) for a sample of young adults age 15-22 in the US, and Dhar et al. (2015) for the case of 6th and 7th graders in India.

[5] The match between the school records and the birth certificates was implemented by the Florida agencies based on three dimensions: the first and last name, the date of birth, and the social security number; the agencies removed individual identifiers before providing the data for research purposes. The sample of birth records of children born in Florida from 1994 to 2002 consists of 2,047,633 observations. Of these individuals, 1,652,333 were present in Florida public school data. The match rate of 81% is consistent with the percentage of children who are born in Florida, reside there until school age, and attend public school, as calculated from the Census and the American Community Survey for the corresponding years. More details on the match are provided in Figlio et al. (2014). We further restrict the sample to children who were in the Florida public school system between 2002 and 2011. This leaves us with 1,596,753 observations.

[6] Birth certificates contain information on the number of older siblings (but not their gender) and a unique identifier for the mother, which allows us to reconstruct the household siblings' composition.

[7] The FCAT (Florida Comprehensive Assessment Test) is the state's high-stakes criterion-referenced test. Students enrolled in public school in grades 3 through 10 are required to take the math portion every year. Students are also tested in reading, but we focus on math because of the broad-based public discussion of women and STEM.

the child participates in a special education program.[8] More details about each variable are contained in the Online Appendix.

We conduct two sets of analyses using the Florida data. First, using observations at the family level, we replicate in our sample the fertility results of Dahl and Moretti (2008) and confirm that in Florida, like in the rest of the U.S., fertility is higher conditional on having a girl as a first child. Second, having classified families according to their gender preferences as implied by fertility patterns, we use student-year level observations to test whether girls' test scores in mathematics vary based on these family parental preferences for boys versus girls.

Sample for fertility regressions. We estimate the fertility relationship at the family level. For the purpose of our analysis, we compare similar households whose fertility decisions proxy for gender preferences toward boys (Dahl and Moretti, 2008).[9] We restrict our sample to those families for which the first child was born after 1994, the first year for which we have access to birth certificate data that permits sibling identification. This restriction is necessary because birth certificates report the number of older siblings, but not their gender, therefore the only way to have the gender composition of the entire family is to have the birth certificate for each child.[10]

The main challenge for the reconstruction of the completed fertility is due to the fact that we can observe the maternal fertility history only up to 2002 (the last year of our birth certificates data). Thus, we cannot rule out that the mothers in our sample have additional children born after 2002. To address this issue, we use a probabilistic methodology based on national fertility patterns estimated from data of the American Community Survey (ACS) and we attribute to each woman in our sample a probability that she has completed her fertility by 2002.

More specifically, our methodology is the following: We attribute to each mother in the Florida dataset a probability that her fertility is completed. We calculate this probability empirically using

[8] Categories for special education include mentally handicapped, orthopedically, speech, language, or visually impaired, deaf or hard of hearing. It also includes students with emotional or behavioral disabilities, with autistic spectrum disorder and other forms of serious disabilities (such as students with traumatic brain injuries).

[9] Given that fertility decisions are different for first generation immigrants (Blau, 1992) and that gender preferences differ across countries (Guiso et al., 2008), we eliminate from our sample families that have an international background (families whose mothers are born outside the United States and families where at least one child does not speak English at home). This reduces the likelihood that our results are driven by families engaging in selective abortion in favor of sons, as Almond and Edlund (2008) find evidence of sex-selection among certain groups of migrants to the U.S., but not among natives. However, our results are robust if we did not exclude students with an international background (see Appendix, Table A3). We also drop from our sample mothers who had their first child when they were still teenagers (younger than 15 years old): at that age fertility is likely to be unplanned; in addition, it is likely that these mothers will complete their fertility outside of our time window. Finally, we drop from the sample families with twins (it is difficult to define birth order) and those observations for which the birth order is not reported or for which there is an inconsistency between the reported birth order and the year of birth of the child based on the birth certificate. More details on the data construction are provided in the Appendix.

[10] We also eliminate all the families for which we cannot reconstruct the fertility history and the gender of all children due to missing birth certificates.

information on completed fertility of mothers with similar characteristics (number of children and age at which she had each child) in the ACS.[11] We then keep only those observations for which the probability that the mother has completed her fertility exceeds 90 percent. The details of the procedure with some examples of corresponding probabilities are reported in the Online Appendix (Table A1). Using these restrictions, the number of families left in the sample is 129,686. Descriptive statistics at the family level are reported in Table 1, Panel A.[12]

Sample for test score regressions. The test score regressions are estimated at the student-year level. We start with all students belonging to one of the families in our sample. We then limit our attention to children/years for which we observe a math score and who attended sixth grade or higher, as the literature shows that the gender gap in mathematics starts appearing during junior high school (Fryer and Levitt, 2010).[13]

Since our goal is to identify biases in the family using the "differential stopping" fertility behavior, we follow the approach of Bharadwaj et al. (2015) and create a dummy variable for "boy biased" families equal to 1 if all children are girls except for the last born, and equal to 0 for all the other families.

Since our main objective is to compare the performance of girls who are raised in gender-biased families and those who do not, we drop the last born from our sample.[14] (By construction, the last born in a "boy biased" family is a boy, therefore there are no last-born girls in these families.) Finally, in order to perform a placebo test on the sample of boys, we construct a dummy variable "girl-biased", symmetric to "boy-biased", equal to 1 if all children are boys with exception of the last born, and equal to 0 for all the other families. The corresponding sample statistics for the "boy" and "girl biased" families are in Panels B and C of Table 1. Note that for the same reasons outlined above, we drop the last born also in the sample of boys.

1.2 National Longitudinal Survey of Youth (NLSY79)

[11] The ACS contains the number of all the children living in the household and their gender and age. Note that, given the structure of the ACS, we cannot be certain that the youngest child in the household is indeed the firstborn. If something, this implies that we are underestimating the probability of completed fertility. We use the 2001-2009 period in the ACS. Mothers are matched based on the age at which they had each of their children, and on the number of years elapsed since the last child was born. The Appendix describes this methodology in details.

[12] In Table A2 of the Appendix, we report alternative results using different probability thresholds for completed fertility.

[13] Because the math tests has changed over time, we standardize test scores to zero mean and unit variance at the grade/year level based on our sample of native students who took the mathematics test at the level corresponding to the grade they were enrolled in. If a student repeated a grade, we consider only the first time s/he was enrolled in a given grade (we drop subsequent scores taken for the same grade). We also exclude students who attend grades ahead of their age.

[14] Note that by eliminating the last born we automatically drop also all "only child" students, as by definition they are the last. However, our results are robust to the inclusion of the last born (Table A4 in the online Appendix.)

We use the 1979 National Longitudinal Survey of Youth (NLSY) to expand our analysis and test directly the importance of cultural transmission. As discussed above, fertility stopping rules have some limitations when used as a proxy for gender role attitudes. The NLSY contains survey-based information on gender role attitudes for all the mothers and children in the sample, as well as performance in mathematics for the children.[15] We therefore use the NLSY79 to study whether maternal attitudes about gender roles correlate with performance in mathematics for boys and girls.[16] The NLSY also contains survey-based information about children's and young adults' gender attitudes. As evidence of cultural transmission, we correlate maternal gender roles attitudes and those of their children.[17] We only examine the importance of maternal (and not paternal) gender roles on performance in mathematics because the NLSY79 follows the offspring of women, but not the ones of men.

Maternal gender role attitudes. The original NLSY79 sample contains data on 12,686 young individuals aged between 14 and 22 interviewed between 1979 and 2014 (yearly interviews until 1994 and biennially after). From the original sample, we focus on the 4,934 women who had at least one child during the survey period. For this sample, we obtain data on maternal gender roles attitudes, measured using the following three questions: 1) A woman's place is in the home, not in the office or shop; 2) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family; 3) Women are much happier if they stay at home and take care of their children. For each statement, respondents were asked if they strongly disagreed, disagreed, agreed, or strongly agreed (on a range from 1 to 4). We consistently coded the questions so that a higher number indicates more biased gender roles. We only keep the women who have non-missing values for all of the three questions in at least 1987 or 2004.[18] We also obtain the following control variables used in our regressions: birth year, age at birth of each child, income, education, race, relationship status and the Census region of residence.[19]

Sample for test score regressions. Starting from 1986, and every two years, two separate surveys, the NLSY Children and the NLSY Young Adults, were administered to the children of the original 1979 NLSY sample for two different age ranges (between the age of 10 and 14, and older than 14). We use

---

[15] This sample is too small to define gender biases using fertility stopping rules.

[16] Performance in mathematics in the NLSY79 is measured using the Peabody Individual Achievement Test (PIAT), a test administered to children aged five and over. It is among the most widely used brief assessments of academic achievement, with demonstrably high test-retest reliability and concurrent validity.

[17] Farre and Vella (2013) find correlations between mothers and children's attitudes towards working women and subsequent labor market participation of their daughters, and their sons' wives.

[18] While some of these questions were asked also in 1979 and 1982, we excluded those years since at that time the youngest women in the sample were, respectively, 15 and 18 years old and we think that at that age gender role preferences may not be completely formed.

[19] North-east dummy, north-central dummy, west dummy, south dummy, and a dummy for missing macro-region.

these surveys to obtain data on test scores in mathematics, along with information on gender, age, birth order, and grade attended, and link these observations to maternal gender roles attitudes. We keep all the student-year observations for which we have scores in mathematics in any grade from 6th to 10th, parallel to the analysis performed with the FLDOE dataset.[20] Our sample consists of 8,328 year-grade observations, corresponding to 6,185 students (3,065 boys and 3,120 girls). The descriptive statistics for this sample are presented in Table 1, Panel D.

Sample for intergenerational transmission in gender roles attitudes. We also use the Children and Young Adults Sample to link maternal gender roles to the gender roles of their children. Gender role attitudes are measured in a different way in the Children and Young Adults Sample[21].

In the Children Sample, gender role attitudes are measured using answers to the following five questions:[22] 1) Girls and boys should be treated the same in school; 2) A girl should not let a boy know she is smarter than he is; 3) Competing with boys in school would make a girl unpopular with boys; 4) If there is not enough money for all the children in a family to go to college, the boys should get to go instead of the girls; 5) It is perfectly okay for a girl to ask a boy for a date, even if he has never asked her.[23] For each statement, the children were asked if they strongly agreed, agreed, disagreed, or strongly disagreed. We recode the questions so that a higher score always means a more gender biased answer. In the Young Adults Sample, gender roles attitudes are measured through the same questions asked to their mothers.

The children sample consists of 8,697 observations (4,257 boys and 4,440 girls) corresponding to 5,846 children (2,724 boys and 2,762 girls). We present the descriptive statistics in Table 1, Panel E. The sample of young adults consists of 13,502 observations (6,536 boys and 6,966 girls), corresponding to 6,644 children (3,335 boys and 3,309 girls). Descriptive statistics for this sub-sample are shown in Table 1, Panel F. The questions on gender roles are asked in multiple waves. We use all the information contained in the survey, clustering at the child level.

2. Results

[20] Since the dataset is an unbalanced panel, some children appear in the sample multiple times.

[21] Starting from 2002, gender role questions were asked also to children between 14 and 16. We drop children older than 14 to be consistent with the earlier sample (in the earlier waves, these questions are asked only to 10-14 year-olds). However, for robustness, we also run regressions with the complete sample.

[22] The only question we excluded among NLSY questions aimed at eliciting gender attitudes is a question asking whether a girl should pay her own way on dates because the descriptive statistics show a suspiciously large difference between boys and girls, where boys are overwhelming in favor of having the girls pay on dates. All the other questions aimed at measuring gender attitudes in the NLSY are included.

[23] For every year in which such questions are asked, we include only observations for which we have non-missing answers on all the questions.

2.1 Florida evidence: Demand for boys

Using Census data, Dahl and Moretti (2008) present evidence consistent with the notion that parents in the U.S. favor boys by observing the ex-post stopping fertility decisions of U.S. families. Before we conduct our main analysis, we want to confirm whether these results hold in the Florida sample. We use the same intuition of Dahl and Moretti (2008) and identify higher preferences for boys by testing whether fertility is higher for those families where the firstborn is a girl.

In Table 2, we investigate the effect of having a girl as a firstborn on various fertility outcomes. In the first column, we regress the total number of children in the household on a dummy variable which is equal to one if the firstborn child is a girl.[24] The coefficient is positive and statistically and economically significant: Compared to a family where the firstborn is a boy, the total number of children in the household increases by 4.2 percent. In columns 2-4, we regress the probability of having, respectively, two or more, three or more, or four or more children on having a firstborn daughter; each probability increases by between 2.5 and 3.4 percent with a firstborn daughter.

2.2 Florida evidence: Family gender bias and girls' performance in mathematics

Given that we confirm a bias for boys in the Florida sample, our next step is to establish whether girls raised in a "boy biased" household have poorer math performance than do other similar girls not raised in such families. Table 3 reports different specifications of girls' performance in mathematics – standardized statewide at the test level-year -- from sixth to tenth grade. As discussed previously, in all columns we drop the last born because we do not have a comparison group for last born girls in boy-biased families (as, by construction, the last born is always a boy in a boy-biased family).

All our regressions contain a large set of controls, including age in months, race dummies, a measure of low-income status (measured by a dummy equal to one if the student is eligible to receive free or reduced lunch or attends a "provision 2" school)[25], the median income of the zip-code at birth and a measure for whether the student has some special educational needs.[26] We also control for

[24] All the models control for a vector of households' characteristics: race dummies (including a dummy for whether the family is a mixed race family), a dummy for whether any child in the household is enrolled in a special education program, two proxies for family income (whether the children in the household receive free or reduced lunch, and median income in zip code of residence at birth*10,000 averaged across all children in the household), dummies for maternal education (whether the mother has graduated from high school, has attended some college, has graduated from college), maternal age at first birth (in addition to the linear term, we include a squared and a cubic term for maternal age), a dummy for whether the mother was married when she had her first child.

[25] To qualify for free or reduced lunch, the family income has to be respectively below 185% and 130% of the federal income poverty. For details on provision 2 schools see http://www.fns.usda.gov/school-meals/provisions-1-2-and-3.

[26] Categories for special education include mentally handicapped, orthopedically, speech, language, or visually impaired, deaf or hard of hearing. It also includes students with emotional or behavioral disabilities, with autistic spectrum disorder and other forms of serious disabilities (such as students with traumatic brain injuries).

maternal characteristics (educational attainment, marital status at time of birth, age at time of birth), birth order, grade, school and year fixed effects. [27]

In column (1) of Table 3, we use the largest sample. We then split the sample by family income (columns 2 and 3) and maternal education (columns 4 and 5). To proxy for income, we distinguish between families with children enrolled in the free or reduced lunch program for at least one year (column 2) and families where no child is ever enrolled in the free or reduced lunch program (column 3). For the maternal education sub-samples, we focus on those families where the mother at most obtained a high school diploma (column 4), or attended at least one year of college (column 5). We find that girls in "boy biased" families have around three percent of a standard deviation lower math test scores than do those raised in other families. To put this figure in perspective, this coefficient is around one-fourth the size of the difference between children of high school graduate mothers and those of high school dropout mothers. We furthermore find evidence that the effect of "boy bias" is larger for relatively advantaged families, measured based on income (column 3) or maternal education (column 5).[28]

There are a number of potential reasons why the effects of "boy bias" might be more substantial in relatively advantaged families. First, they might be due to class differences in child rearing practices (Reardon, 2011). Better-educated and higher-income parents are more involved in their children's education and have greater impact on children's educational decisions (Lareau, 2011). Conversely, since disadvantaged families have fewer resources (time and money) to invest in their children's education, the deleterious impact of their gender-biased attitudes on daughters may be more limited. Consistently, Autor et al. (forthcoming) show that boys fare comparatively worse than girls in disadvantaged families—both behaviorally and educationally, while Fryer and Levitt (2010) find that girls fall behind boys in math relatively more in families with higher maternal education.

At least two alternative explanations for our results do not directly link math performance to family gender attitudes. The first possibility is lack of learning: the presence of mostly girls in the family may not allow each of them to learn from boys, who typically do better in mathematics, perhaps due to biases originated in the classroom or society at large.[29] Alternatively, the bias could also arise from "equal treatment, unequal outcomes" behavior: girls might come from larger households on

[27] For maternal education, we define dummies for high school completion, some years of college, and four or more years of college. In the regressions the excluded dummy is high school dropout mothers.

[28] This result is also consistent with Reardon et al. (2018), who find that the gender gap in mathematics is more pronounced in socioeconomically advantaged school districts. The same authors find that socioeconomic variables do not explain the gender gap in reading.

[29] School fixed effects control for the possibility that the biases originate in school.

average, so they are disadvantaged even when the parental inputs are equally allocated among daughters and sons.

To address the possibility that the results are driven by lack of learning[30], in columns (6) to (10) of Table 3 we estimate the same model specifications as in columns (1) to (5), but restrict the sample to only firstborn children, who do not learn from their older siblings. The patterns and magnitudes of findings are very similar regardless of whether we limit to firstborn versus all daughters in the family.

To address the possibility that the outcomes are the result of "equal treatment, unequal outcomes" in Table 4 we run a version of Table 3 which includes family size fixed effects (and exclude birth order fixed effects) for both the overall sample and also limiting the sample to firstborn children. The results are very similar to the ones shown in Table 3.

In Table 5, we perform a parallel analysis in which we compare the math performance of boys raised in "girl-biased" families with those raised in other types of families. Counter to the estimated effects of "boy bias" on girls' math performance, we observe no evidence of "girl bias" on boys' math performance.[31] Importantly, in the relatively-advantaged subgroups for whom the deleterious estimated effect of "boy bias" on girls' math performance is the greatest, the estimated effect of "girl bias" on boys' math performance is especially small in magnitude and statistical significance.

2.3 NLSY evidence: Gender role attitudes and math performance

Our evidence so far shows a correlation between fertility stopping rules and mathematics outcomes. Following Dahl and Moretti (2008), we interpret fertility patterns as proxies of gender roles attitudes inside the family. However, our measures of fertility decisions are noisy, as a specific fertility outcome could simply be a reflection of randomness. The National Longitudinal Survey of Youth 1979 gives us the opportunity to directly test the correlation between mothers' gender role attitudes and children's math performance. We turn now to this analysis.

Table 6 shows the correlation between maternal gender attitudes and children's performance in mathematics for children in sixth through tenth grades. In column (1) we look at the correlation for the overall sample of boys and girls.[32] In this regression, the female dummy is always negative and

[30] Note how all our regressions control for birth order fixed effect, which should reduce partially this concern. A body of evidence in literature also shows how birth order affects educational and life outcomes (for instance, Breining et al., forthcoming).

[31] As explained in the data description, at the family-level we define a dummy "girl bias" which is equal to 1 if all children are boys with exception of the last born.

[32] All regressions include the following controls: log of net family income, dummies for maternal education (whether the mother has graduated from high school, has attended some college, has graduated from college), grade FE, survey year FE, race dummies, macro-region dummies (along with a dummy for missing macro-region), age of the child (in months), age of the mother at time of birth (in years), a dummy for whether the mother was in a relationship at the time of the survey, child's birth order. Columns 1 and 2 also include a female dummy.

significant, indicating the presence of a strong gender gap in mathematics: girls' scores in math are 14 percent lower than the sample standard deviation. More conservative gender role attitudes are associated with lower math performance overall, but the relationship is not statistically significant at conventional levels.[33] That said, as might be expected given our Florida results, conservative gender role attitudes should have different consequences for girls versus boys. Indeed, in column (2) when we interact conservative maternal gender attitudes with gender, we find that the more conservative the maternal gender attitudes are, the worse their daughters' math performance, while the coefficient on gender is reduced by two-thirds and becomes statistically insignificant at conventional levels. On the other hand, boys' average performance is not significantly correlated with maternal attitudes toward gender roles. This result is also apparent if we split the sample by gender (columns 3 and 4): for girls, one standard deviation increase in the conservatism of the mother's gender attitudes leads to a decrease of 3 percent of the sample standard deviation in math scores, but we observe no relationship in the case of boys. The size of this effect is similar to the effect found in the Florida Department of Education data – one-fourth the size of the difference between children of high school graduate mothers and those of high school dropout mothers.

Thus far we have established a correlation between traditional gender roles (measured using fertility stopping rules or subjective measures of gender roles) and girls' math performance. When using the data from the Florida Department of Education we were able to rule out the possibility that the results were driven by learning within the family or competition for resources. The NLSY allows us to test directly the cultural transmission mechanism within the family. If parents transmit traditional gender roles to their children, these differences in beliefs can in turn have an effect on girls' performance in mathematics.

In Table 7, we further investigate the potential importance of cultural transmission by estimating the relationship between maternal gender role attitudes and gender role attitudes among children aged 10 to 14 (columns 1 and 2) and among children older than 14 (columns 3 and 4). The results suggest an intergenerational transmission mechanism. After controlling for a number of family characteristics,[34] we find a positive and strongly statistically significant relationship between maternal gender role attitudes and children's gender role attitudes, of similar magnitudes for both boys and girls. Moreover, this correlation apparently strengthens as children age: Among younger children, a

[33] Note how in the NLSY sample the female dummy is always negative and significant, indicating the presence of a strong gender gap in mathematics: girls' scores in math are 14 percent lower than the sample standard deviation.
[34] In all regression specification, we control for log of net family income, dummies for maternal education (whether the mother has graduated from high school, has attended some college, has graduated from college), a dummy for whether the mother was in a relationship at the time of the survey, mother birth year FE, survey year FE, race FE, macro-region FE, age of child (in years) FE.

one standard deviation increase in the conservatism of mother's attitudes corresponds to 8.6 percent of a standard deviation more conservative daughters' attitudes and 9.4 percent of a standard deviation more conservative sons' attitudes. Among older children, these relationships grow to 15.5 percent and 17.7 percent of a standard deviation, respectively. In sum, it appears that both sons and daughters of mothers with conservative gender role attitudes maintain those gender role attitudes in childhood and especially later in adolescence.

3. Conclusions

Several papers have established a link between cultural norms and gender gap in mathematics but have failed to establish precise mechanisms that contribute to these correlations (Guiso et al., 2008, Pope and Sydnor, 2010). Following the theoretical literature on parental transmission of norms and preferences (Bisin and Verdier, 2001; Bisin and Verdier, 2010), we empirically explore one of such mechanisms. While parental transmission could be optimal from the parents' perspective, as it expresses the desire of parents to raise children according to their traditions, it may have impact on perpetuating certain societal biases. We isolate the importance of parental transmission on the gender gap in mathematics using a variety of evidence.

We use nine birth cohorts of Florida-native children to study the correlation of family gender norms and attitudes and girls' performance in mathematics. First, in line with the results of Dahl and Moretti (2008) for the United States, we confirm the existence of a higher preference for sons over girls in the Florida population: parents who desire to have one male child continue having children until a boy is born. Following Bharadwaj et al. (2015) we then identify families with a preference for boys as those who display a fertility stopping behavior in favor of sons. We find that girls born in such families perform worse on average in standardized tests in mathematics, compared to girls from other types of families. On the contrary, boys' performance in math is not significantly correlated with whether the kid lives in a family which display a stopping behavior in favor of daughters. We also find that the negative correlation for girls is especially concentrated among wealthier and more educated families, consistently with Fryer and Levitt's (2010) result that girls fall behind boys in math relatively more in families with higher maternal education and Autor et al.'s (forthcoming) result that boys from disadvantaged families fare worse educationally and behaviorally than their sisters do.

One limitation of our analysis is that, by comparing families based on differential stopping behavior, we might be capturing only a lower bound of the true effect, as we are ignoring other forms of gender biases within the family. For instance, as noted by Bharadwaj et al. (2015), even though some parents may not have a fertility bias for boys, they might decide nonetheless to allocate inputs differentially between daughters and sons (Brenoe, 2017). In addition, our proxy of boys' preferences is noisy generating attenuating biases in our results.

We resort to an alternative sample, data, and model to test more directly for the relevance of gender roles inside the family and to investigate whether cultural transmission could be an important potential mechanism behind our findings. Using NLSY data, we test whether parental gender norms might help explain the differential performance among girls and, more generally, the male-female gap in math. Consistent with this hypothesis, we find evidence that, indeed, gender role attitudes of mothers and children are correlated, and that biased maternal attitudes are associated with worse performance in math of daughters, but not of sons. Taken together, our findings suggest that gender-biased attitudes within the family play a significant role in the origination of the male-female gap.

References

Almond, Douglas, and Lena Edlund (2008). "Son-biased sex ratios in the 2000 United States Census." Proceedings of the National Academy of Sciences, 105(15): 5681-5682.

Autor David, David Figlio, Krzysztof Karbownik, Jeffrey Roth, and Melanie Wasserman (forthcoming). "Family Disadvantage and the Gender Gap in Behavioral and Educational Outcomes." *American Economic Journal: Applied Economics*.

Bharadwaj, Prashant, Gordon B. Dahl, and Ketki Sheth (2015). "Gender Discrimination in the Family," "The Economics of the Family", ABC-Clio Publishers, pp. 237-266.

Bharadwaj, Prashant, and Leah K. Nelson (2012). "Discrimination Begins in the Womb-Evidence of Sex Selective Prenatal Investments." *Journal of Human Resources*, 48: 71-113.

Bisin, A., and T. Verdier (2001). "The Economics of Cultural Transmission and the Dynamics of Preferences," *Journal of Economic Theory*, 97 (2), 298–319.

Bisin, A., and T. Verdier (2010). "The Economics of Cultural Transmission and Socialization." In Handbook of Social Economics, Vol. 1A, ed. by J. Benhabib, A. Bisin, and M. O. Jackson. Amsterdam: Elsevier, Chapter 9.

Blau, Francine D. (1992). "The Fertility of Immigrant Women: Evidence from High Fertility Source Countries." In: Borjas, G.J., Freeman, R. (Eds.), Immigration and the Workforce: Economic Consequences for the United States and Source Areas, University of Chicago Press, Chicago, pp. 93-133.

Breining, Sanni, Joseph Doyle, David Figlio, Krzysztof Karbownik, and Jeffrey Roth (forthcoming). "Birth Order and Delinquency: Evidence from Denmark and Florida." *Journal of Labor Economics*.

Brenoe, Anne A. (2017). "Sibling Gender Composition and Participation in STEM Education." Working paper.

Dahl, Gordon B., and Enrico Moretti (2008). "The Demand for Sons." *Review of Economic Studies*, 75(4): 1085–1120.

Deaton, Angus (1989). "Looking for Boy–Girl Discrimination in Household Expenditures." World Bank Economic Review, 3(1): 1–15.

Dhar, Diva, Jain Tarun, and Seema Jayachandran (2015). "Intergenerational Transmission of Gender Attitudes: Evidence from India." NBER Working Paper No. 21429.

Farre, Lidia, and Francis Vella (2013). "The Intergenerational Transmission of Gender Role Attitudes and its Implications for Female Labor Force Participation." *Economica*, 2013(80): 219-247.

Figlio, David, Jonathan Guryan, Krzysztof Karbownik, and Jeffrey Roth (2014). "The Effects of Poor Neonatal Health on Children's Cognitive Development." *American Economic Review*, 104(12): 3921-55.

Fryer, Roland G., and Steven D. Levitt (2010). "An Empirical Analysis of the Gender Gap in Mathematics." *American Economic Journal: Applied Economics*, 2010(2.2): 210-40.

Guiso, Luigi, Ferdinando Monte, Paola Sapienza, and Luigi Zingales (2008). "Culture, Gender and Math." *Science*, 320(5880): 1164–65.

Lareau, Annette (2011). "*Unequal Childhoods: Class, Race, and Family Life.*" University of California Press Books.

Pope, Devin G., and Justin R. Sydnor (2010). "Geographic Variation in the Gender Differences in Test Scores", *Journal of Economic Perspectives*, 24(2): 95-108.

Reardon, Sean F. (2011). "The widening academic achievement gap between the rich and the poor: New evidence and possible explanations." In R. Murnane and G. Duncan (Eds.), "*Whither Opportunity? Rising Inequality and the Uncertain Life Chances of Low-Income Children.*" New York: Russell Sage Foundation Press.

Reardon, Sean F., Erin Fahle, Demetra Kalogrides, Anne Podolsky, and Rosalía C. Zárate (2018). "Gender Achievement Gaps in U.S. School Districts." CEPA Working Paper No. 18-13.

Table 1: Descriptive Statistics, Panel A

	PANEL A		
	(1)	(2)	(3)
	Mean	Std. Dev.	Obs.
Total number of children	1.424	0.621	129,686
Two or more children	0.362	0.481	129,686
Three or more children	0.055	0.227	129,686
Four or more children	0.007	0.083	129,686
Firstborn is a girl	0.491	0.500	129,686
Median income in zipcode of birth (USD)	46,964	13,384	129,686
Family Free Lunch	0.503	0.500	129,686
Mother married at first birth	0.643	0.469	129,686
Maternal age at first birth	26.800	6.591	129,686
Family Special Education	0.265	0.441	129,686
Mother graduated high school	0.349	0.462	129,686
Mother attended some college	0.267	0.429	129,686
Mother graduated from college	0.235	0.419	129,686
Race: Other	0.040	0.196	129,686
Black	0.184	0.388	129,686
Asian	0.003	0.053	129,686
Hispanic	0.044	0.206	129,686
White	0.743	0.437	129,686
Mixed Race family	0.014	0.118	129,686

Notes. The table reports descriptive statistics for the Florida sample used in Table 2. The unit of observation is a family with children born in Florida between 1994 and 2002, and for whom we were able to reconstruct the fertility history without any gap. "Total number of children" is the number of children in the family. "Two or more children" is a dummy variable equal to 1 if the family has two or more children, equal to zero otherwise. "Three or more children" is a dummy variable equal to 1 if the family has three or more children, equal to zero otherwise. "Four or more children" is a dummy variable equal to 1, if the family has four or more children, equal to zero otherwise. "Firstborn is a girl" is a dummy variable equal to 1 if the firstborn in the family is a girl, equal to zero otherwise. The variable "Median income in zipcode of birth (USD)" is taken from the 1999 US Census, and it was calculated as the average across all children in a given family. "Family Free Lunch" and "Family Special Education" are dummy variables equal to 1, if at least one of the siblings in the family is enrolled in the given program in at least one year (in our data). The dummies for race ("White", "Black", "Asian", "Race: Other") are equal to 1, if at least one of the siblings in the family is of that race. The dummy "Mixed Race family" is equal to 1, if the siblings in the family are of at least two different races.

Table 1: Descriptive Statistics, Panel B

	PANEL B								
	Sample: girls, excluding lastborn children								
	All families			Only families with FRL			Excluding families with FRL		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.
Math score	0.407	0.830	65,114	0.095	0.813	28,997	0.657	0.755	36,117
Boy bias	0.481	0.500	65,114	0.462	0.499	28,997	0.496	0.500	36,117
Median income in zipcode of birth*100,000 (USD)	0.487	0.138	65,114	0.441	0.113	28,997	0.524	0.144	36,117
Free Lunch	0.274	0.446	65,114	0.615	0.487	28,997	0.000	0.000	36,117
Mother married at birth	0.835	0.371	65,114	0.692	0.462	28,997	0.949	0.220	36,117
Maternal age at birth	27.125	5.364	65,114	24.548	5.332	28,997	29.193	4.410	36,117
Special Education	0.060	0.238	65,114	0.083	0.275	28,997	0.042	0.201	36,117
Age (in months)	157.213	15.919	65,114	157.809	15.916	28,997	156.735	15.905	36,117

	Mother attended HS			Mother attended college		
	(10)	(11)	(12)	(13)	(14)	(15)
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.
Math score	0.088	0.807	25,775	0.616	0.776	39,339
Boy bias	0.475	0.499	25,775	0.484	0.500	39,339
Median income in zipcode of birth*100,000 (USD)	0.444	0.112	25,775	0.516	0.146	39,339
Free Lunch	0.478	0.500	25,775	0.140	0.347	39,339
Mother married at birth	0.693	0.461	25,775	0.927	0.260	39,339
Maternal age at birth	24.005	5.245	25,775	29.169	4.365	39,339
Special Education	0.081	0.273	25,775	0.046	0.210	39,339
Age (in months)	158.321	16.054	25,775	156.488	15.787	39,339

Notes. The table reports descriptive statistics for the Florida sample used in Table 3. The unit of observation is a student-year. The sample includes all students born in Florida between 1994 and 2002, from a family where we were able to reconstruct the fertility history without any gap, and for whom we have a score in mathematics. We exclude students from families where at least one of the children has unknown father. Here, we look only at female students, and we exclude the lastborn child in each family (only children are therefore not included, by definition). Columns (4) to (6) show statistics for the subsample of children who come from families where at least one child was enrolled in the Free Lunch program in at least one year. Columns (7) to (9) show statistics for the subsample of children who come from families where no child was ever enrolled in the Free Lunch program in any year. Columns (10) to (12) show statistics for the subsample of children with dummy variable "Mother is a high school dropout"=1, or "Mother high school graduate"=1. Columns (13) to (15) show statistics for the subsample of children with dummy variables "Mother attended some college"=1, or "Mother 4 year college graduate"=1."Math score" measures students' Florida Comprehensive Assessment Test math score in a given grade (standardized with mean 0 and standard deviation 1 over the population for a given grade and year). "Boy bias" is a dummy variable equal to 1 if the last born in the family is a boy, and all the older children are girls, 0 otherwise. "Median income in zipcode of birth (USD)" is taken from the 1999 US Census, and it refers to the time of birth of the child. "Free Lunch" is a dummy equal to 1 if the student is enrolled in the Free lunch program in the given academic year. "Mother married at birth" is a dummy variable equal to 1 if the mother was married when the child was born. "Special Education" is a dummy equal to 1 if the student is enrolled in the special education program in the given academic year.

Table 1: Descriptive Statistics, Panel C

	PANEL C								
	Sample: boys, excluding lastborn children								
	All families			Only families with FRL			Excluding families with FRL		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.
Math score	0.444	0.907	67,505	0.107	0.919	29,325	0.703	0.807	38,180
Girl bias	0.461	0.498	67,505	0.448	0.497	29,325	0.472	0.499	38,180
Median income in zipcode of birth*100,000 (USD)	0.491	0.140	67,505	0.445	0.120	29,325	0.526	0.144	38,180
Free Lunch	0.267	0.442	67,505	0.615	0.487	29,325	0.000	0.000	38,180
Mother married at birth	0.841	0.366	67,505	0.699	0.459	29,325	0.949	0.219	38,180
Maternal age at birth	27.274	5.367	67,505	24.697	5.441	29,325	29.254	4.378	38,180
Special Education	0.123	0.329	67,505	0.168	0.374	29,325	0.089	0.285	38,180
Age (in months)	157.744	15.823	67,505	158.593	15.820	29,325	157.092	15.795	38,180

	Mother attended HS			Mother attended college		
	(10)	(11)	(12)	(13)	(14)	(15)
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.
Math score	0.106	0.899	26,368	0.661	0.844	41,137
Girl bias	0.451	0.498	26,368	0.468	0.499	41,137
Median income in zipcode of birth*100,000 (USD)	0.450	0.117	26,368	0.517	0.147	41,137
Free Lunch	0.469	0.499	26,368	0.138	0.345	41,137
Mother married at birth	0.703	0.457	26,368	0.929	0.257	41,137
Maternal age at birth	24.260	5.376	26,368	29.207	4.380	41,137
Special Education	0.162	0.369	26,368	0.098	0.298	41,137
Age (in months)	159.002	15.959	26,368	156.938	15.683	41,137

Notes. The table reports descriptive statistics for the Florida sample used in Table 4. The unit of observation is a student-year. The sample includes all students born in Florida between 1994 and 2002, in a family where we were able to reconstruct the fertility history without any gap, and for whom we have a score in mathematics. We also exclude students from families where at least one of the children has unknown father. Here, we look only at male students, and we exclude the lastborn child in each family (only children are therefore not included, by definition). Columns (4) to (6) show statistics for the subsample of children who come from families where at least one child was enrolled in the Free Lunch program in at least one year. Columns (7) to (9) show statistics for the subsample of children who come from families where no child was ever enrolled in the Free Lunch program in any year. Columns (10) to (12) show statistics for the subsample of children with dummy variable “Mother is a high school dropout”=1, or “Mother high school graduate”=1. Columns (13) to (15) show statistics for the subsample of children with dummy variables “Mother attended some college”=1, or “Mother 4 year college graduate”=1."Math score" measures students’ Florida Comprehensive Assessment Test math score in a given grade (standardized with mean 0 and standard deviation 1 over the population for a given grade and year). "Girl bias" is a dummy variable equal to 1 if the last born in the family is a girl, and all the older children are boys, 0 otherwise. "Median income in zipcode of birth (USD)" is taken from the 1999 US Census, and it refers to the time of birth of the child. "Free Lunch" is a dummy equal to 1 if the student is enrolled in the Free lunch program in the given academic year. "Mother married at birth" is a dummy variable equal to 1 if the mother was married when the child was born. "Special Education" is a dummy equal to 1 if the student is enrolled in the special education program in the given academic year.

Table 1: Descriptive Statistics, Panel D

	PANEL D		
	(1)	(2)	(3)
	Mean	Std. Dev.	Obs.
Math score (standardized)	-0.205	1.017	8,328
Maternal gender role attitudes	1.970	0.520	8,328
Female	0.508	0.500	8,328
Income, USD	54,085	71,945	8,328
Income (log), USD	10.240	1.704	8,328
Mother in a relationship	0.670	0.470	8,328
Mother high school dropout	0.149	0.356	8,328
Mother high school graduate	0.437	0.496	8,328
Mother attended some college	0.247	0.432	8,328
Mother college graduate	0.167	0.373	8,328
Maternal age at birth	25.850	6.170	8,328
Birth order	1.960	1.150	8,328
Age of child (in months)	157.490	12.770	8,328

Notes. The table reports sample statistics for the NLSY sample used in Table 6. The unit of observation is a child-year. The sample includes children enrolled in grade 6th to 10th, and within the sample, a child may appear in multiple years. The variable "Math score (standardized)" is the child's test score in the math PIAT test, standardized by survey-year and grade to have population mean 0 and population standard deviation 1. The variable "Maternal gender role attitudes" was built based on the answers to the following question, asked to each child's mother in 1987 and 2004: How much do you agree or disagree with the following statements: 1) A woman's place is in the home, not in the office or shop; 2) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family; 3) Women are much happier if they stay at home and take care of their children. The menu of answers to this question was the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. A higher value corresponds to a more gender biased family (we recode the answers to the 2004 survey as in that wave the scale was inverted). If at least one answer was missing in 1987 (2004), and none were missing in 2004 (1987), the resulting variable is equal to the average of the three questions in 2004 (1987). If none of the answers were missing in 1987 nor in 2004, we computed the final variable as the average across the average answers in 1987 and 2004. If both in 1987 and 2004 there is at least one answer that is missing, the final variable was assigned a missing value. "Female" is a dummy variable (NLSY variable CSEX). "Income, USD" corresponds to net family income (NLSY variable TNFI). "Income (log), USD" was calculated as log(1+Income, USD). "Mother in a relationship" refers to the status at the time of the survey (built from NLSY variable RELSPPTR). Maternal education dummies ("Mother high school dropout", "Mother high school graduate", "Mother college dropout", "Mother college graduate") were built starting from NLSY variable HGCREV. "Birth order" corresponds to the NLSY variable BTHORDR. "Age of the child (in months)" corresponds to the NLSY variable CSAGE.

Table 1: Descriptive Statistics, Panel E and Panel F

	PANEL E			PANEL F		
	(1)	(2)	(3)	(4)	(5)	(6)
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.
Maternal gender role attitudes	1.965	0.526	8,697	1.984	0.523	13,502
Gender role attitudes (10 to 14 yrs old)	1.933	0.451	8,697	-	-	-
Gender role attitudes (over 14 yrs old)	-	-	-	1.988	0.552	13,502
Female	0.511	0.500	8,697	0.516	0.500	13,502
Income, USD	56,959	70,689	8,697	55,156	60,536	13,502
Income (log), USD	10.315	1.747	8,697	10.117	2.190	13,502
Mother in a relationship	0.689	0.463	8,697	0.607	0.488	13,502
Mother high school dropout	0.121	0.327	8,697	0.144	0.351	13,502
Mother high school graduate	0.424	0.494	8,697	0.460	0.498	13,502
Mother attended some college	0.265	0.442	8,697	0.262	0.404	13,502
Mother college graduate	0.190	0.392	8,697	0.133	0.340	13,502

Notes. The table reports sample statistics for the NLSY sample used in Table 7. The unit of observation is a child-year. The sample in columns (1) to (3) includes children aged 10 to 14 years old. The sample used in columns (4) to (6) includes children older than 14 years old. Within a given sample, some children may appear in multiple years. This happens if they were asked the corresponding survey question more than once, in different years. "Gender role attitudes (10 to 14 yrs old)" is a categorical variable constructed from a set of questions asked to children aged 10 to 14 years old, in survey waves from 1994 until 2014 (over this period the surveys were administered once every 2 years). It is an average of the answers to the following questions: How much do you agree or disagree with the following statements? 1) Girls and boys should be treated the same in school; 2) A girl should not let a boy know she is smarter than he is; 3) Competing with boys in school would make a girl unpopular with boys; 4) If there is not enough money for all the children in a family to go to college the boys should get to go instead of the girls; 5) It is perfectly okay for a girl to ask a boy for a date, even if he has never asked her. The menu of answers to this question was the following: 1: strongly agree, 2: agree, 3: disagree, 4: strongly disagree. For questions 2, 3 and 4 we inverted the scale. The final value was calculated as an average across the questions of interests in a given year. A higher value corresponds to higher bias. "Gender role attitudes (over 14 years old)" is a categorical variable constructed from a set of questions asked to young adults once every 2 years, from 1994 to 2010. It is an average of the answers to the following question: How much do you agree or disagree with the following statements? 1) A woman's place is in the home, not the office or shop; 2) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family; 3) Women are much happier if they stay at home and take care of their children. The menu of answers to this question included the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. A higher value of the variable corresponds to higher bias. The final value was calculated as an average between the questions of interests in a given year. The remaining variables are described in Table 1 Panel D.

Table 2
Fertility Regressions
Florida Department of Education

	(1) Total number of children	(2) Two or more children	(3) Three or more children	(4) Four or more children
Firstborn is a girl	0.026***	0.016***	0.008***	0.002***
	(0.003)	(0.003)	(0.001)	(0.000)
Firstborn girl (beta)	0.021	0.016	0.017	0.014
Observations	129,686	129,686	129,686	129,686
R-squared	0.136	0.139	0.058	0.026
Firstborn is a girl (mean)	0.491	0.491	0.491	0.491
Firstborn is a girl (sd)	0.500	0.500	0.500	0.500
Dep. Variable (mean)	1.424	0.362	0.055	0.007

Notes. This table reports OLS estimates, with robust standard errors. The unit of observation is a family. Descriptive statistics for this sample are shown in Table 1, panel A. In column (1), the dependent variable is the total number of children in a given family. In column (2), the dependent variable is a dummy equal to 1 if the family had two children or more, 0 otherwise. The dependent variables in columns (3) and (4) are dummy variables defined similarly. In all columns, the set of controls includes “Family Special Education”, “Family Free Lunch”, “Median income in zipcode of birth, USD” (averaged across the children in the family), mother education dummies (“Mother high school graduate”, “Mother attended some college”, “Mother high school graduate”, “Mother high school dropout” is the omitted category), “Maternal age at first birth” (with quadratic and cubic term), "Mother married at time of first birth", family race dummies ("White", "Black", "Asian", "Race: Other", "Mixed Race Family"). Here there is no excluded group because we allow for overlap in the case of families with children of different ethnicities. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 3
Performance in mathematics of girls in families with preferences for boys
Florida Department of Education

						Only firstborns				
	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Math score					Math score		
Boy bias	-0.025**	-0.017	-0.035**	-0.018	-0.030**	-0.027***	-0.012	-0.039***	-0.014	-0.034**
	(0.010)	(0.016)	(0.014)	(0.016)	(0.013)	(0.010)	(0.016)	(0.014)	(0.017)	(0.014)
Median income in zipcode	0.256***	0.209***	0.232***	0.297***	0.220***	0.249***	0.210**	0.218***	0.287***	0.209***
of birth*100,000 (USD)	(0.045)	(0.078)	(0.054)	(0.084)	(0.052)	(0.047)	(0.084)	(0.057)	(0.088)	(0.054)
Free Lunch	-0.163***	-0.084***		-0.117***	-0.200***	-0.161***	-0.083***		-0.114***	-0.202***
	(0.012)	(0.013)		(0.016)	(0.019)	(0.012)	(0.014)		(0.016)	(0.020)
Mother high school grad	0.118***	0.100***	0.160***	0.104***		0.114***	0.091***	0.161***	0.099***	
	(0.021)	(0.023)	(0.049)	(0.022)		(0.022)	(0.025)	(0.050)	(0.023)	
Mother college dropout	0.230***	0.214***	0.247***		-0.234***	0.230***	0.203***	0.256***		-0.234***
	(0.022)	(0.027)	(0.049)		(0.014)	(0.024)	(0.029)	(0.050)		(0.014)
Mother college graduate	0.457***	0.414***	0.466***			0.456***	0.405***	0.476***		
	(0.024)	(0.034)	(0.049)			(0.025)	(0.037)	(0.050)		
Mother married at birth	0.025	0.001	0.072**	0.020	0.030	0.022	-0.007	0.076**	0.012	0.037
	(0.015)	(0.019)	(0.031)	(0.020)	(0.027)	(0.016)	(0.020)	(0.031)	(0.021)	(0.028)
Maternal age at birth	0.008***	0.006***	0.007***	0.010***	0.006***	0.007***	0.006***	0.006***	0.010***	0.004**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Special Education	-0.759***	-0.734***	-0.772***	-0.749***	-0.758***	-0.757***	-0.719***	-0.784***	-0.738***	-0.767***
	(0.024)	(0.033)	(0.035)	(0.035)	(0.034)	(0.025)	(0.034)	(0.035)	(0.037)	(0.036)
Age (in months)	-0.017***	-0.022***	-0.009***	-0.022***	-0.010***	-0.017***	-0.023***	-0.009***	-0.023***	-0.010***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Birth order FE	YES	YES	YES	YES	YES	-	-	-	-	-
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
School FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Race FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Boy bias (standardized beta)	-0.015	-0.010	-0.023	-0.011	-0.020	-0.017	-0.007	-0.026	-0.009	-0.022
Observations	65,114	28,997	36,117	25,775	39,339	59,592	25,856	33,736	23,445	36,147
R-squared	0.330	0.319	0.238	0.330	0.260	0.328	0.324	0.242	0.336	0.261

Notes. This table reports OLS estimates, with robust standard errors clustered by student and school. The unit of observation is a student-year. The sample includes all students born in Florida between 1994 and 2002 from a family for whom we were able to reconstruct the fertility history without any gap, and where none of the siblings has unknown father. From these families we keep students enrolled in grades 6th to 10th for whom we have a mathematics score. In this table we look only at female students, and we exclude the lastborn child in each family (only children are therefore not included, by definition). Sample statistics for this sample are reported in Table 1, Panel B. In Columns (6) to (10), we run the same specifications as in columns (1) to (5), but we restrict the sample to the firstborn in each family. In Columns (2) and (7), we restrict the sample to families with at least one child enrolled in the Free Lunch program, in at least one year in our sample. In Columns (3) and (8), we restrict the sample to those students who come from families where no child was ever enrolled in the Free Lunch program in any year. In Columns (4) and (9) we restrict the sample to children for whom "Mother high school dropout" or "Mother high school graduate" is equal to 1. In Columns (5) and (10) we restrict the sample to those children with "Mother attended some college" equal to 1, or "Mother college graduate college" equal to 1. The dependent variable measures students' Florida Comprehensive Assessment Test (FCAT) math score in a given grade (standardized with mean 0 and variance 1 over the population for a given grade and year). "Boy bias" is a dummy variable equal to 1 if the last born in the family is a boy, and all the older children are girls, 0 otherwise. "Median income in zipcode of birth (USD)" is taken from the 1999 US Census, and it refers to the time of birth of the child. "Free Lunch" is a dummy variable equal to 1 if the student is enrolled in the Free lunch program in the given academic year. "Mother married at birth" is a dummy variable equal to 1 if the mother was married when the child was born. "Special Education" is a dummy equal to 1 if the student is enrolled in the special education program in the given academic year. Columns (1) to (5) include birth order FE. All columns include year FE, grade FE, school FE, race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 4
Robustness to the inclusion of family size fixed effects
Florida Department of Education

	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Math score					Math score		
Boy bias	-0.021**	-0.014	-0.029**	-0.014	-0.026**	-0.023**	-0.011	-0.033**	-0.011	-0.029**
	(0.010)	(0.016)	(0.014)	(0.016)	(0.013)	(0.010)	(0.017)	(0.014)	(0.017)	(0.014)
Median income in zipcode	0.254***	0.208***	0.229***	0.296***	0.217***	0.248***	0.209**	0.217***	0.284***	0.209***
of birth*100,000 (USD)	(0.045)	(0.078)	(0.054)	(0.084)	(0.052)	(0.047)	(0.084)	(0.057)	(0.088)	(0.054)
Free Lunch	-0.166***	-0.084***		-0.118***	-0.203***	-0.163***	-0.083***		-0.116***	-0.204***
	(0.011)	(0.013)		(0.016)	(0.019)	(0.012)	(0.014)		(0.016)	(0.020)
Mother married at birth	0.021	-0.004	0.068**	0.018	0.026	0.022	-0.007	0.075**	0.013	0.035
	(0.015)	(0.019)	(0.031)	(0.020)	(0.027)	(0.016)	(0.020)	(0.031)	(0.021)	(0.028)
Maternal age at birth	0.009***	0.006***	0.008***	0.011***	0.006***	0.007***	0.006***	0.006***	0.010***	0.005***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Special Education	-0.760***	-0.734***	-0.772***	-0.748***	-0.759***	-0.757***	-0.719***	-0.783***	-0.736***	-0.767***
	(0.024)	(0.033)	(0.035)	(0.035)	(0.034)	(0.025)	(0.034)	(0.035)	(0.036)	(0.036)
Age (in months)	-0.016***	-0.021***	-0.008***	-0.022***	-0.010***	-0.017***	-0.023***	-0.009***	-0.023***	-0.010***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Family size FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
School FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Maternal Education FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Race FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Boy bias (standardized beta)	-0.013	-0.009	-0.019	-0.009	-0.017	-0.014	-0.007	-0.022	-0.007	-0.019
Observations	65,114	28,997	36,117	25,775	39,339	59,592	25,856	33,736	23,445	36,147
R-squared	0.330	0.319	0.238	0.331	0.260	0.328	0.324	0.243	0.336	0.261

Notes. This table reports OLS estimates, with robust standard errors clustered by student and school. The unit of observation is a student-year. This is the equivalent to Table 3, but it also includes family size fixed effects (i.e., total number of siblings in the family) instead of birth order fixed effects in columns (1) to (10). In Column (1), the sample includes all girls, excluding lastborns. In Columns (6) to (10), we run the same specifications as in columns (1) to (5), but we restrict the sample to the firstborn child in each family. In Columns (2) and (7), we restrict the sample to families with at least one child enrolled in the Free Lunch program, in at least one year in our sample. In Columns (3) and (8), we restrict the sample to those students who come from families where no child was ever enrolled in the Free Lunch program in any year. In Columns (4) and (9) we restrict the sample to children for whom "Mother high school dropout" or "Mother high school graduate" are equal to 1. In Columns (5) and (10) we restrict the sample to those children with "Mother attended some college" equal to 1, or "Mother graduated from college" equal to 1. The dependent variable measures students' Florida Comprehensive Assessment Test Math score in a given grade (standardized with mean 0 and variance 1 by grade-year across the population). "Boy bias" is a dummy variable equal to 1 if the last born in the family is a boy, and all the older children are girls, 0 otherwise. All columns include year FE, grade FE, school FE, maternal education FE, and race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 5
Performance in mathematics of boys in families with preferences for girls
Florida Department of Education

						Only firstborns				
	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Math score					Math score		
Girl bias	-0.004	-0.003	-0.009	-0.027	0.009	-0.003	0.004	-0.011	-0.026	0.012
	(0.010)	(0.017)	(0.013)	(0.017)	(0.013)	(0.010)	(0.017)	(0.013)	(0.017)	(0.013)
Median income in zipcode	0.223***	0.241***	0.201***	0.275***	0.196***	0.219***	0.249***	0.197***	0.246***	0.206***
of birth*100,000 (USD)	(0.045)	(0.084)	(0.056)	(0.087)	(0.052)	(0.046)	(0.087)	(0.058)	(0.092)	(0.054)
Free Lunch	-0.136***	-0.064***		-0.113***	-0.156***	-0.131***	-0.062***		-0.106***	-0.159***
	(0.012)	(0.014)		(0.017)	(0.019)	(0.013)	(0.015)		(0.017)	(0.020)
Mother married at birth	0.027	0.020	0.056*	0.023	0.063**	0.031*	0.020	0.064**	0.026	0.059**
	(0.016)	(0.020)	(0.031)	(0.021)	(0.029)	(0.017)	(0.021)	(0.031)	(0.022)	(0.030)
Maternal age at birth	0.005***	0.003	0.005***	0.005**	0.005***	0.004***	0.003	0.005***	0.004**	0.004**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Special Education	-0.674***	-0.678***	-0.660***	-0.660***	-0.679***	-0.683***	-0.684***	-0.669***	-0.665***	-0.689***
	(0.019)	(0.027)	(0.028)	(0.028)	(0.026)	(0.020)	(0.030)	(0.029)	(0.030)	(0.028)
Age (in months)	-0.023***	-0.025***	-0.017***	-0.025***	-0.020***	-0.023***	-0.026***	-0.017***	-0.025***	-0.020***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Birth order FE	YES	YES	YES	YES	YES	-	-	-	-	-
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
School FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Maternal Education FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Race FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Girl bias (standardized beta)	-0.002	-0.001	-0.005	-0.015	0.005	-0.001	0.002	-0.007	-0.014	0.007
Observations	67,505	29,325	38,180	26,368	41,137	61,778	26,016	35,762	24,018	37,760
R-squared	0.361	0.364	0.263	0.362	0.299	0.360	0.370	0.269	0.366	0.302

Notes. This table reports OLS estimates, with robust standard errors clustered by student and school. The unit of observation is a student-year. The sample used in Column (1) is the one presented in Appendix Table 1, Panel C. In Columns (6) to (10), we run the same specifications as in columns (1) to (5), but we restrict the sample to the firstborn child in each family. In Columns (2) and (7), we restrict the sample to families with at least one child enrolled in the Free Lunch program, in at least one year in our sample. In Columns (3) and (8), we restrict the sample to those students who come from families where no child was ever enrolled in the Free Lunch program in any year. In Columns (4) and (9) we restrict the sample to children for whom "Mother high school dropout" or "Mother high school graduate" are equal to 1. In Columns (5) and (10) we restrict the sample to those children with "Mother attended some college" equal to 1, or "Mother graduated from college" equal to 1. The dependent variable measures students' Florida Comprehensive Assessment Test Math score in a given grade (standardized with mean 0 and variance 1 by year-grade across the population). "Girl bias" is a dummy variable equal to 1 if the last born in the family is a girl, and all the older children are boys, 0 otherwise. Columns (1) to (5) include birth order FE. All columns include year FE, grade FE, school FE, maternal education FE, race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 6
Performance in mathematics and maternal gender role attitudes
National Longitudinal Survey of Youth

	All		Girls	Boys
	(1)	(2)	(3)	(4)
	Math score			
Maternal gender role attitudes	-0.024	-0.000	0.004	-0.055**
	(0.018)	(0.016)	(0.020)	(0.025)
Maternal gender role attitudes*Female		-0.047*		
		(0.027)		
Female	-0.147***	-0.055		
	(0.019)	(0.055)		
Income (log)	0.034***	0.034***	0.029***	0.040***
	(0.007)	(0.007)	(0.004)	(0.014)
Mother in a relationship	0.096***	0.096***	0.083***	0.108***
	(0.018)	(0.018)	(0.028)	(0.024)
Mother high school graduate	0.248***	0.248***	0.260***	0.240***
	(0.028)	(0.028)	(0.054)	(0.030)
Mother attended some college	0.398***	0.398***	0.426***	0.369***
	(0.029)	(0.030)	(0.069)	(0.035)
Mother college graduate	0.676***	0.675***	0.684***	0.658***
	(0.038)	(0.038)	(0.101)	(0.081)
Maternal age at birth	0.019***	0.019***	0.014***	0.025***
	(0.004)	(0.004)	(0.004)	(0.005)
Birth order	-0.090***	-0.090***	-0.106***	-0.074***
	(0.012)	(0.012)	(0.018)	(0.010)
Age of child (in months)	-0.005*	-0.005*	-0.005	-0.005**
	(0.003)	(0.003)	(0.004)	(0.002)
Survey year FE	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES
Macro-region FE	YES	YES	YES	YES
Race FE	YES	YES	YES	YES
Maternal gender role attitudes (standardized beta)	-0.013	-0.000	0.002	-0.029
Observations	8,328	8,328	4,096	4,232
R-squared	0.182	0.183	0.189	0.177

Notes. The table reports OLS estimates, with robust standard errors double-clustered at the child and grade level. The unit of observation is a child-year. The sample includes children from NLSY enrolled in grade 6th to 10th, and within the sample, a child may appear in multiple years. In Columns (1) and (2), the sample includes both girls and boys. Sample statistic for this sample are presented in Table 1, Panel D. In Columns (3) and (4), the sample is restricted respectively to the subset of girls, and to the subset of boys. The dependent variable "Math score (standardized)" is the child's test score in the math PIAT test, standardized by survey-year and grade to have population mean 0 and population standard deviation 1. The variable "Maternal gender role attitudes" was built based on the answers to the following question, asked to each child's mother in 1987 and 2004: How much do you agree or disagree with the following statements: 1) A woman's place is in the home, not in the office or shop; 2) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family; 3) Women are much happier if they stay at home and take care of their children. The menu of answers to this question was the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. A higher value corresponds to a more gender biased family (we recode the answers to the 2004 survey as in that wave the scale was inverted). If at least one answer was missing in 1987 (2004), and none were missing in 2004 (1987), the resulting variable is equal to the average of the three questions in 2004 (1987). If none of the answers were missing in 1987 nor in 2004, we computed the final variable as the average across the average answers in 1987 and 2004. If both in 1987 and 2004 there is at least one answer that is missing, the final variable was assigned a missing value. "Female" is a dummy variable (NLSY variable CSEX). "Income, USD" corresponds to net family income (NLSY variable TNFI). "Income (log), USD" was calculated as log(1+Income, USD). "Mother in a relationship" refers to the status at the time of the survey (built from NLSY variable RELSPPTR). Maternal education dummies are built from NLSY variable HGCREV. "Birth order" corresponds to the NLSY variable BTHORDR. "Age of the child (in months)" corresponds to the NLSY variable CSAGE. All regressions include survey year FE, grade FE, macro-region FE, race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 7
Cultural transmission of gender role attitudes
National Longitudinal Survey of Youth

	Girls	Boys	Girls	Boys
	(1)	(2)	(3)	(4)
	Gender role attitudes (10 to 14 years old)		Gender role attitudes (over 14 years old)	
Maternal gender role attitudes	0.070***	0.082***	0.162***	0.181***
	(0.014)	(0.015)	(0.017)	(0.017)
Income (log)	-0.007	-0.012**	-0.011***	-0.016***
	(0.005)	(0.005)	(0.004)	(0.004)
Mother in a relationship	0.009	-0.022	0.012	-0.003
	(0.017)	(0.018)	(0.016)	(0.017)
Mother high school graduate	-0.091***	-0.073***	-0.128***	-0.128***
	(0.026)	(0.024)	(0.027)	(0.026)
Mother attended some college	-0.106***	-0.124***	-0.222***	-0.222***
	(0.027)	(0.026)	(0.028)	(0.028)
Mother college graduate	-0.168***	-0.089***	-0.257***	-0.222***
	(0.031)	(0.031)	(0.034)	(0.032)
Child age FE	YES	YES	YES	YES
Survey year FE	YES	YES	YES	YES
Macro-region FE	YES	YES	YES	YES
Maternal birth year FE	YES	YES	YES	YES
Race FE	YES	YES	YES	YES
Maternal gender role attitudes (standardized beta)	0.086	0.094	0.155	0.177
Observations	4,440	4,257	6,966	6,536
R-squared	0.085	0.067	0.080	0.101

Notes. The table reports OLS estimates, with robust standard errors clustered at the child level. The unit of observation is a child-year. The sample in columns (1) to (2) includes children aged 10 to 14 years old. The sample used in columns (3) to (4) includes children older than 14 years old. Sample statistics for the two samples are shown respectively in Table 1, Panel E, and in Table 1, Panel F. In Columns (1) and (2), the dependent variable is built from a set of questions asked to children aged 10 to 14 in the survey waves from 1994 until 2014 (over this period the surveys were administered once every 2 years). It is an average of the answers to the following questions: How much do you agree or disagree with the following statements? 1) Girls and boys should be treated the same in school; 2) A girl should not let a boy know she is smarter than he is; 3) Competing with boys in school would make a girl unpopular with boys; 4) If there is not enough money for all the children in a family to go to college the boys should get to go instead of the girls; 5) It is perfectly okay for a girl to ask a boy for a date, even if he has never asked her. The menu of answers included the following: 1: strongly agree, 2: agree, 3: disagree, 4: strongly disagree. For questions 2, 3 and 4 the scale was reversed. The final value was calculated as an average across the questions of interest in a given year. A higher value corresponds to higher bias. In Column (3) and (4), the dependent variable is a categorical variable constructed from a set of questions asked to young adults once every 2 years, from 1994 to 2010. It is an average of the answers to the following question: How much do you agree or disagree with the following statements? 1) A woman's place is in the home, not the office or shop; 2) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family; 3) Women are much happier if they stay at home and take care of their children. The menu of answers to this question was the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. A higher value of the variable corresponds to higher bias. The final value was calculated as an average between the questions of interests in a given year. The variable "Maternal gender role attitudes" was built based on the answers to the following question asked to each child's mother in 1987 and 2004: How much do you agree or disagree with the following statements: 1) A woman's place is in the home, not in the office or shop; 2) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family; 3) Women are much happier if they stay at home and take care of their children. The menu of answers to this question was the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. A higher value corresponds to a more gender biased family (we recode the answers to the 2004 survey as in that wave the scale was inverted). If at least one answer was missing in 1987 (2004), and none were missing in 2004 (1987), the resulting variable is equal to the average of the three questions in 2004 (1987). If none of the answers were missing in 1987 nor in 2004, we computed the final variable as the average across the average answers in 1987 and 2004. If both in 1987 and 2004 there is at least one answer that is missing, the final variable was assigned a missing value. The remaining variables are defined as in Table 6. All regressions include child age FE, survey year FE, macro-region FE, maternal birth year FE, race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Online Appendix

1. Dataset Construction: the Florida dataset

1.1. Florida Department of Education Data and Birth Certificates Data

The individual-level administrative data from the Florida Department of Education (FLDOE) Warehouse contains information on K-12 students who attended Florida public schools between the academic year 2002-2003 and 2011-2012. This data was matched with the universe of birth certificates from the Florida Department of Health, comprising all children born in Florida between 1992 and 2002.[1] For the purpose of our analysis, we restrict the sample to the cohorts born from year 1994 onwards, as information on the birth order is not available for children born in 1992 and 1993. The full sample of children enrolled in Florida public schools from 2002-2003 to 2011-2012, and who were born between 1994 and 2002 contains 2,441,705 individuals. Among them, the sample of children whom we are able to match to a birth certificate consists of 1,320,713 individuals.

To obtain a culturally homogenous sample we exclude the children of immigrants by eliminating all students who do not speak English at home and all those students whose mothers were born outside the United States. In the dataset, we are able to reconstruct the language and the maternal country of birth information for 99.92% of the sample.[2] After dropping these individuals, the final sample (which contains students born in Florida, from mothers born in the U.S., and who speak English at home) contains 909,987 individuals.

In order to reconstruct the full fertility history from the birth certificates, we need to be able to observe all children beginning with the firstborn. Therefore we keep only those families where the first child was born in or after 1994. We also eliminate those households where we do not observe all the children between the firstborn and the lastborn.

Starting from the sample of children present in the FLDOE records and born between 1994 and 2002, in order to recreate household composition we match each of them to their mother. From the initial sample of 909,987 individuals, we are able to match 881,798 individuals (96.90%) to their mother ID (In fact note that the sample of children for whom we have information on the mother

[1] The match between the school records and the birth records was implemented by the Florida agencies based on three dimensions: the first and last name, the date of birth, and the social security number. The sample of birth records of children born in Florida from 1994 to 2002 consists of 2,047,633 observations. Of these individuals, 1,652,333 were present in Florida public school data. As reported in Autor et al. (2016), the match rate (81%) is consistent with the percentage of children born in Florida and who attended public school in the State taken from the ACS and the Census over this period. More details on the match are provided in Figlio et al. (2014).

[2] We lose 993 students because the birth country of the mother is coded as unknown (i.e., recorded as “99”), and 7,398 students because their country of birth and/or language spoken at home is coded as unknown (i.e., recorded as “NULL”).

country of birth is larger than the one who we are able to match to a maternal ID). We further restrict the sample by dropping those students who belong to households where at least one child speaks at home a language different than English. This leads us to dropping 18,406 children (corresponding to 15,063 households). Furthermore, we drop 159 children, for whom the variable indicating birth order is missing, and 12,666 children (4,812 households) who belong to households where two (or sometimes three) children were recorded as having the same birth order.[3] Finally, we drop 513 children where the data on birth order of the children are inconsistent with the birth year recorded in the school data. The final sample contains 849,349 children (626,628 households).

We use this sample to reconstruct the fertility history of the family to approximate gender biases in the family, following Dahl and Moretti (2008). In order to do this, we face two challenges. First, we need to eliminate the households who have older children who were not enrolled in Florida's public schools between 2002-2003 and 2011-2012: for these children the gender is unknown, as the birth certificate of their younger sibling reports the number of older children but not their gender. This cut further restricts the households and students to respectively 352,138 and 501,274. In order to make sure that fertility is (likely) to be completed, we keep only those households where the probability that the mother has other children after the last one is less than or equal to 10%. The construction of this probability is detailed in section 1.3. of this appendix. Since in the Census there is no indication of whether children of the same age in a given households are twins or only siblings, we further drop from our dataset the families where the mother gave birth to one or more children during the same year (the mother has the same age). This leaves us with 345,968 households and 485,871 children.[4] We also drop mothers who had their first child when they were still teenagers (15 years old or younger). This leaves us with 343,639 households (482,447 children). Finally, we drop the children who come from families with twins because we assume that the arrival of twins might modify future fertility choices. This leads us to dropping 646 observations. Among them, 134,310 households (corresponding to 189,909 children) are the ones likely to have completed fertility, according to our definition.

[3] These are likely due to data entry mistakes as in the case of twins, each child is usually recorded with a unique birth order. In fact, among the sample of twins only 2.6% of them are recorded as having the same birth order (instead, in the rest of the sample 1.1% of children are recorded as having the same birth order)

[4] We also drop 12,300 observations where the birth year of the mother differs across children, or the maternal age at birth was unknown.

1.2. Sample for the test scores regressions

In our sample there are 162,329 students enrolled in grade 6 or higher, corresponding to 630,322 grade/year observations. We keep the student/year observations with non-missing scores in mathematics (we are left with 465,928 observations, corresponding to 153,544 children).[5] If a student repeated a grade, we consider only the year she/he was first enrolled in it (we drop subsequent test scores taken for the same grade). This leads us to drop 4,607 observations (while the number of children remains the same). We also exclude observations corresponding to students who took a math test of grade level different than the one that they are enrolled in. As a result, we drop 973 student/year observations, corresponding to 955 children (among these observations, 98 students are entirely dropped from the dataset; for the rest of the students there are observations corresponding to different years which remain in the dataset). We exclude student/year observations corresponding to students attending a grade two or more years ahead of school (245 student/year observations, which implies dropping 63 children). For our baseline regressions, we also drop those households where at least one of the children has an unknown father and drop all the lastborn children in a given family, which leaves us with 139,928 student/year observations (corresponding to 40,177 children). We lose additional 7,102 observations (corresponding to 1,940 children) because we do not have information on median income in zip code of birth; 85 observations (corresponding to 28 children) because we do not have information on the level of education of the mother, 11 observations (4 children) because we do not have information on the marital status of the mother, 111 observations (corresponding to 23 children) because the school id is missing. Our score regression final sample contains 132,619 student/year observations (65,114 girls and 67,505 boys), corresponding to 38,182 unique children (18,512 girls and 19,670 boys). The mathematics scores are standardized to have mean 0 and standard deviation 1 by test grade level/year across the population of children enrolled in public school in Florida. The sample statistics on Table 1 Panel B and on Table 1 Panel C present respectively sample statistics for the sample of girls and boys.

[5] In few cases, a student is reported to have more than one score in the mathematics test in a given year. If the repeated scores are identical, we take only one of them, and drop the repetitions. If they are not identical, we assign the student a missing score as we cannot be sure whether these are mistakes, or if they are due to some other reason (for example, the student changed school during the school year, and was administered the test twice). We also assign a missing score whenever the (absolute) difference between the grade attended by the student and the grade level of the test is greater or equal to 2.

2. Dataset Construction: National Longitudinal Survey of the Youth

We use the 1979 National Longitudinal Survey of Youth (NLSY79) because we are able to observe women's gender role attitudes of mothers in the sample and link them to their children's gender attitudes and performance in math. The original sample includes 12,686 individuals aged between 14 and 22 followed between 1979 and 2014 (yearly interviews until 1994 and biennially after). We focus on the sample of women, which contains 6,283 observations.

Women's gender role attitudes are asked in 1987 and 2004 to all women in the sample.[6] We select three questions:

1) A woman's place is in the home, not in the office or shop;

2) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family;

3) Women are much happier if they stay at home and take care of their children.

For each statement, respondents were asked if they strongly disagreed, disagreed, agreed, or strongly agreed (answers were coded on a scale from 1 to 4). We inverted the answers of the 2004 wave since the scale was reversed. If the respondent has non-missing values both in 1987 and in 2004, we average the answers across years; otherwise, we keep only the average in the year where no value is missing.[7] Finally, we keep only women who have children, for a total of 4,934 mothers. In our final variable, a higher score means a more gender biased answer.

Starting from 1986, and every two years, a separate survey is administered to the children of the original 1979 NLSY sample (NLSY Children and Young Adults database). Each child is interviewed only for few waves and not every child is interviewed every survey year. Over the years (the last available wave is 2014), 11,521 children were interviewed, corresponding to the 4,934 mothers in our 1979 NLSY sample.

The Young Adults database contains children's attitudes toward women's role and their performance in mathematics measured by the attitudinal test PIAT.[8] We use two sets of variables

[6] Some questions were asked also in 1979 and 1982, but we decided to exclude them since at that time the youngest women in the sample were, respectively, 15 and 18 years old. We deem that at this time gender role preferences are not completely formed yet.

[7] In order to rule out the possibility that an individual has a missing value to an answer which is more important than the others, for every year (i.e. 1987 and 2004) we only keep those women who have non missing value for all of the three questions in at least one year. If the questions are asked in more than one year, we take the average response by year and then we average across years.

[8] We standardize math scores by grade-year, with mean 0 and standard deviation 1 across the full sample and applying population weights.

measuring gender roles attitudes in children: the first set of questions is only asked to children between the age of 10 and 14. The second set of questions is asked to young adults older than 14.

For the first group, we use answers to five out of six questions asked every year to a subset of interviewees. We pool together answers asked to children aged 10 to 14[9]. Since the same questions are asked in more than one survey, we exploit the longitudinal nature of our dataset and run panel regressions, clustering at the child-level.

We average the answers to the following questions[10]:

1) Girls and boys should be treated the same in school

2) A girl should not let a boy know she is smarter than he is.

3) Competing with boys in school would make a girl unpopular with boys.

4) If there is not enough money for all the children in a family to go to college, the boys should get to go instead of the girls.

5) It is perfectly okay for a girl to ask a boy for a date, even if he has never asked her.

For each statement, the children were asked if they strongly agreed, agreed, disagreed, or strongly disagreed. The possible answer ranged from 1 to 4. For consistency, we recoded all question in such a way that a higher score means a more gender biased answer. In the sample, 6,193 children answer these questions, and since some children were asked the same questions in multiple years, we have in total 10,407 observations. We lose 161 observations because we do not observe mothers' attitudes, and 1,549 observations because of missing values in the control variables (mother's income, mothers' years of education, mother's birth year, survey year, race, geographical dummy, dummy for being in a relation at the time of the interview, child's age in years).

The final sample counts 8,697 observations (of which 4,257 are boys and 4,440 are girls). This corresponds to 5,486 children (of which 2,724 boys, and 2,762 girls). We present the sample statistics in Table 1, Panel E.

In addition, in the sample there are 7,381 children aged 14 and above (young adults), who answer the same questions on gender attitudes that are asked to their mothers. These young adults are interviewed several times in the survey for a total of 16,761 observations. We lose 333 observations

---

[9] These questions are also asked also to children aged 14 to 16. We dropped children older than 14, to avoid compositional effects. In addition, the NLSY Children asked these question to children between 14 and 16 only starting from 2002. When we use the full sample, our results do not change. Note how, although the survey specifically says that the children are asked this set of questions in age 10-14, in the data we observe some younger or older children. We cut the ones aged less than 9 (4 observations) and those aged more than 15 (13 observations).

[10] For every year in which such questions are asked, we drop the observations that present at least one missing value to one of the five questions.

because of missing mothers' attitudes and 2,926 observations because of missing controls. In the end, we have 13,502 observations (6,536 boys and 6,966 girls), corresponding to 6,644 children (3,335 boys and 3,309 girls). Sample statistics for this sub-sample of the 1979 NLSY are shown in Table 1, Panel F.

Finally, we use data on mathematics performance of the female students in NLSY. We keep all the student-year observations for which we have scores in mathematics in grades 6th to 10th (using the same rationale used in the FLDOE data).[11] We start from 10,803 child-year observations and after dropping the ones for which the score in that year was missing we lose 829 observations. We further lose 176 observations because of missing values in the variable women gender role attitudes, and 1,470 because of missing controls (1,466 have missing income, and 4 have missing maternal education). Our final sample contains 8,328 year-grade observations, corresponding to 6,186 students (3,066 boys and 3,120 girls). The sample statistics for this sample are presented in Table 1, Panel D.

3. The probability methodology to estimate completion of fertility

In our FLDOE data, we observe the maternal fertility history only up to 2002 (the last year of the birth certificate data provided in the matched dataset). Thus, we cannot rule out with certainty that the mothers in our sample have additional children born after 2002. To address this issue we use a probabilistic methodology, based on data from the American Community Survey and estimate, for each woman in our sample, the probability that she has indeed completed her fertility by 2002.

The ACS contains information on every child living in the household and their year of birth. For this reason, it has the advantage that the fertility cycle of each mother is more precisely estimated because, differently from the Florida data, for every family observed in the period 2001-2009, information on all previous children born in the family (as long as they live at home) are contained in the dataset. For Florida, for children born in 1994-2002, all the previous children are observed too but the date of birth of the sibling and the gender is known only if they attended Florida public school. Thus, ACS allows us to observe more families with a likely complete fertility.

However, the ACS has two potential problems. First, older children who do not live at home anymore are not accounted for in the data. Second, there is always the possibility that the mother has not completed her fertility. For this reason, we make three assumptions. The first one is that that most women do not have any additional child after 8 or more years from the birth of their last child. This

[11] Here too, since the dataset is an unbalanced panel, some children appear in the sample multiple times.

implies that mothers who have children 8 years old, or older, are assumed to have completed fertility. The second one is that we assume that there are no children who have left the households. This is a strong assumption but, if anything, it would imply that we are being too conservative. In fact, by underestimating the number of previous children, we are likely to overestimate the probability that one woman will have more children in the future. The last one is that children leave the household in a sequential way, i.e. older children will leave the household sooner than younger children. We make this assumption to estimate the age of the youngest kid.

In order to construct our probability measures from the ACS, we first eliminate all the families with no children, families where the mother was under 15 at the time of birth of any child (0.41%), and families where the mother was 50 or older at the time of birth of any child (0.04%). Finally, in accordance to our first assumption above, we keep only families for which the youngest observed child is 8 years or older. Note that we identify as "child" those relationships to household head that are "child" and none with any "stepchild", "adopted child", "grandchild", or "foster children".

References

Autor, David, David Figlio, Krzysztof Karbownik, Jeffrey Roth, and Melanie Wasserman (2016). "School Quality and the Gender Gap in Educational Achievement." *American Economic Review*, 106(5): 289-295.

Dahl, Gordon B., and Enrico Moretti (2008). "The Demand for Sons." *Review of Economic Studies*, 75(4): 1085–1120.

Figlio, David, Jonathan Guryan, Krzysztof Karbownik, and Jeffrey Roth (2014). "The Effects of Poor Neonatal Health on Children's Cognitive Development." *American Economic Review*, 104(12): 3921-55.

Variable Description - Main

Name of the variable	*Description*	*Source (and when possible and useful name of the raw variable)*
Firstborn is a girl	A dummy variable equal to 1 if the firstborn child in the household is a girl.	Source: birth certificate, FLDOE Created using raw variables: GENDER_CD
Total number of children	The total number of children had by the child's mother, as reconstructed through the birth certificate.	Source: birth certificate
Two or more children	A dummy variable equal to 1 if the mother had two or more children, equal to 0 otherwise.	Source: birth certificate
Three or more children	A dummy variable equal to 1 if the mother had three or more children, equal to 0 otherwise.	Source: birth certificate
Four or more children	A dummy variable equal to 1 if the mother had four or more children, equal to 0 otherwise.	Source: birth certificate
Family special education	A dummy variable equal to 1 if at least one child was enrolled in the Special education program (excluding the gifted program) in at least one year of our sample.	Source: FLDOE Created using raw variables: PRIMARY_EXCPT_IND
Mother married at first birth	A dummy variable equal to 1 if the mother was married when giving birth to the first child.	Source: birth certificate
Maternal age at first birth	Age of the mother when her first child was born.	Source: birth certificate
Race dummies, family level (Asian, Black, White, Race: Other)	A set of dummy variables equal to 1, if at least one child in the family is of that ethnicity.	Source: FLDOE Created using raw variables: GENDER_CD
Mixed Race Family	A dummy variable equal to 1 if two or more children in a household are of different ethnicity, equal to 0 otherwise.	Source: FLDOE Created using raw variables: GENDER_CD
Median income in zipcode of birth, USD (family level)	Average income in zipcode of birth across children in the family.	Source: birth certificate, Census
Only child	A dummy variable equal to 1 if the child has no siblings.	Source: birth certificate, Census
Math score	Development scale score in the Mathematics section of the FCAT. The scores are standardized by subtracting the mean test score in the sample used for the analysis and by dividing them by the standard deviation in the sample of girl and boys of families for which we observe completed fertility, for each test grade level-year combination.	Source: FLDOE Created using raw variables: DEV_SCALE_SCORE, SUBTEST_ID, TEST_GRADE_LEVEL, CURRENT_ACADEMIC_YEAR
Boy bias	A dummy equal to 1 if the last born in the family is a boy, and all the older children are girls, 0 otherwise.	Source: birth certificate, FLDOE Created using raw variables: GENDER_CD
Girl Bias	A dummy equal to 1 if the last born in the family is a girl, and all the older children are boys, 0 otherwise.	Source: birth certificate, FLDOE Created using raw variables: GENDER_CD
Female	A dummy for whether the student is a boy.	Source: FLDOE Created using raw variables: GENDER_CD

Name of the variable	*Description*	*Source (and when possible and useful name of the raw variable)*
Median income in zip code of birth, (100,000 of $)	The zip code at time of birth (provided by the birth certificates) is matched with zip code income in 1999, obtained from the Census bureau.	Source: birth certificate and Census
Age in months	Assuming the school year starts on September 1st, the variable is calculated as: Academic year*12+8-Student year of birth*12-student month of birth.	Source: FLDOE Created using raw variables: STUDENT_BIRTH_MONTH, STUDENT_BIRTH_YEAR, ENROLLMENT_YEAR
Free or Reduced Priced Lunch	A dummy equal to 1 if the student/year is eligible for free lunch, reduced-price lunch or attends a “provision 2” school and zero otherwise (either the student did not apply or he/she applied but she/he was not eligible).	Source: FLDOE Created using raw variables: LUNCH_STATUS
Mother married at time of birth	A dummy variable equal to 1 if the mother is married at time of giving birth.	Source: birth certificate
Maternal age at birth	Age of the mother when the child was born. The variable was calculated using mother's year and month of birth, and child's year and month of birth.	Source: birth certificate
Special Education	A dummy variable equal to 1 if the variable if the student is enrolled in the special education program and zero otherwise. Gifted students are classified as zero.	Source: FLDOE Created using raw variables: PRIMARY_EXCPT_IND
Mother’s educational dummies	We define three dummies for the maternal level of education: high school graduate (years of education is equal to 12), some college (years of education greater than 12 and strictly smaller than 16) and college graduate (years of education greater than or equal to 16).	Source: birth certificate
Family Free Lunch	A dummy variable equal to 1 if at least one child was enrolled in the Free Lunch program in at least one year of our sample, and zero otherwise.	Source: FLDOE Created using raw variables: LUNCH_STATUS

Name of the variable	*Description*	*Source (and when possible and useful name of the raw variable)*
Maternal gender role attitudes	A categorical variable built starting from a set of questions asked to women in years 1987 and 2004. The variable was constructed using the answers to the following question: How much do you agree or disagree with the following statements?" a) A woman's place is in the home, not the office or shop. f) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family. h) Women are much happier if they stay at home and take care of their children. The menu of answers included the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. For each wave (1987 and 2004) we computed an average across the three answers, and then we averaged these values across the two waves. If at least one answer was missing in 1987 (2004), and none were missing in 2004 (1987), the resulting variable is equal to the average of the three questions in 2004 (1987). If none of the answers were missing in 1987 nor in 2004, the final variable was computed as the average between the average answers in 1987 and 2004. If both in 1987 and 2004 there is at least one answer that is missing, a missing value was assigned.	Source: NLSY Created using raw variables: WOMENS_ROLE_000001_1987, WOMENS_ROLE_000006_1987, WOMENS_ROLE_000008_1987, WOMENS_ROLE_000001_2004, WOMENS_ROLE_000006_2004 and WOMENS_ROLE_000008_2004
Gender role attitudes (10 to 14 yrs old)	A categorical variable constructed from a set of questions asked to children aged 10 to 14 years old, in survey waves from 1994 until 2014 (over this period the surveys were administered once every 2 years). It is an average of the answers to the following questions: How much do you agree or disagree with the following statements? 1) Girls and boys should be treated the same in school; 2) A girl should NOT let a boy know she is smarter than he is; 3) competing with boys in school would make a girl unpopular with boys; 5) If there is not enough money for all the children in a family to go to college, the boys should get to go instead of the girls. 6) It is perfectly okay for a girl to ask a boy for a date, even if he has never asked her. The menu of answers included the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. For questions 2, 3 and 5 the scale was reversed. The final value was calculated as an average across the questions of interests in a given year. A higher value corresponds to higher bias.	Source: NLSY Created using raw variables: CSAS030A, CSAS030B, CSAS030C, CSAS030E, CSAS030F

Name of the variable	*Description*	*Source (and when possible and useful name of the raw variable)*
Gender role attitudes (over 14 yrs old)	A categorical variable constructed from a set of questions asked to young adults once every 2 years, from 1994 to 2010. It is an average of the answers to the following question: How much do you agree or disagree with the following statements?" a) A woman's place is in the home, not the office or shop. f) It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family. h) Women are much happier if they stay at home and take care of their children. The menu of answers to this question was the following: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree. The final value was calculated as an average between the questions of interests in a given year (note that in 2006 question 4) was not asked). For consistency, we had to invert the scale of questions 3), 5) and 7). A higher value of the variable corresponds to higher bias.	Source: NLSY Created using raw variables: Q16_7A, Q16_7B, Q16_7C, Q16_7D, Q16_7E, Q16_7F, Q16_7G, Q16_7H
Female		Source: NLSY Created using raw variables: CSEX
Income, USD	Family income.	Source: NLSY Created using raw variables: TNFI_TRUNC
Income (log), USD	log (1+income)	Source: NLSY Created using raw variables: TNFI_TRUNC
Mother in a relationship	The child's mother is married, has a partner, or is in some other relationship at the time of the survey.	Source: NLSY Created using raw variables: RELSPPTR_YY_XRND (where "YY" stands for the 2-digit code of the year of the survey)
Maternal birth year	Year of birth of the child's mother.	Source: NLSY Created using raw variables: Q1_3_A_Y_1979
Mother's educational dummies	We define three dummies for the maternal level of education: high school graduate (highest grade attended by the mother equal to 12), some college (highest grade attended by the mother greater than 12 and strictly smaller than 16) and college graduate highest grade attended by the mother greater or equal to 16).	Source: NLSY Created using raw variables: HGCREV
Math score	The child's score in the Math PIAT test, standardized by child and grade with mean 0 and standard deviation 1 on the sample used for our analysis.	Source: NLSY Created using raw variables: MATH
Maternal age at birth	Calculated as the difference between the birth year of the child, and the birth year of the mother.	Source: NLSY CYRB, Created using raw variables: Q1_3_A_Y_1979
Birth order	Child's birth order.	Source:NLSY Created using raw variables: BTHORDR
Age of child (in months)	Age of child in months at the time of the survey.	Source:NLSY Created using raw variables: CSAGE

Appendix - Tables

Table A1: Probability of having additional children

Probability of having more children

Maternal age at birth			Year of birth of lastborn								
1st child	2nd child		2002	2001	2000	1999	1998	1997	1996	1995	1994
20	22		0.451	0.347	0.225	0.142	0.083	0.045	0.021	0.007	0.000
25	27		0.370	0.301	0.198	0.118	0.067	0.035	0.017	0.007	0.000
30	32		0.274	0.219	0.142	0.071	0.036	0.016	0.006	0.002	0.000
35	37		0.157	0.110	0.061	0.027	0.013	0.007	0.003	0.000	0.000
1st child	2nd child	3rd child									
20	22	23	0.331	0.251	0.161	0.074	0.042	0.021	0.010	0.006	0.000
20	22	24	0.305	0.197	0.107	0.047	0.030	0.016	0.004	0.001	0.000
20	22	25	0.250	0.179	0.115	0.063	0.039	0.022	0.004	0.002	0.000
20	22	26	0.192	0.129	0.067	0.051	0.029	0.020	0.013	0.000	0.000
20	22	27	0.185	0.127	0.097	0.054	0.036	0.019	0.013	0.007	0.000
20	22	28	0.171	0.094	0.047	0.017	0.009	0.009	0.009	0.000	0.000
20	22	29	0.097	0.035	0.024	0.009	0.009	0.009	0.000	0.000	0.000
25	27	28	0.306	0.224	0.124	0.051	0.033	0.018	0.009	0.008	0.000
25	27	29	0.259	0.195	0.092	0.052	0.027	0.015	0.005	0.001	0.000
25	27	30	0.240	0.191	0.109	0.066	0.033	0.017	0.002	0.001	0.000
25	27	31	0.155	0.106	0.058	0.038	0.024	0.006	0.001	0.000	0.000
25	27	32	0.126	0.072	0.045	0.022	0.015	0.005	0.003	0.003	0.000
25	27	33	0.091	0.054	0.029	0.015	0.004	0.000	0.000	0.000	0.000
25	27	34	0.065	0.052	0.027	0.007	0.000	0.000	0.000	0.000	0.000
1st child	2nd child	3rd child									
30	32	33	0.285	0.250	0.082	0.055	0.038	0.022	0.006	0.001	0.000
30	32	34	0.227	0.173	0.081	0.035	0.018	0.004	0.001	0.000	0.000
30	32	35	0.139	0.109	0.057	0.018	0.004	0.002	0.001	0.001	0.000
30	32	36	0.093	0.070	0.046	0.018	0.017	0.014	0.000	0.000	0.000
30	32	37	0.066	0.030	0.006	0.000	0.000	0.000	0.000	0.000	0.000
30	32	38	0.050	0.031	0.015	0.007	0.007	0.007	0.007	0.000	0.000
30	32	39	0.049	0.036	0.015	0.000	0.000	0.000	0.000	0.000	0.000
35	37	38	0.218	0.139	0.043	0.036	0.002	0.000	0.000	0.000	0.000
35	37	39	0.160	0.110	0.049	0.030	0.019	0.017	0.017	0.017	0.000
35	37	40	0.099	0.045	0.016	0.006	0.003	0.000	0.000	0.000	0.000
35	37	41	0.039	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes. The table reports the probability of having an additional child given the number of children already had, the age at which these children we born, and the number of years elapsed since the last birth. In the first Panel, the unit of observation is a mother with a least two children in the American Community Survey, years 2001 to 2009. In the rest of the panels, the unit of observation is a mother with a least three children in the American Community Survey, years 2001 to 2009.

Table A2: Robustness to different thresholds of Pr (Having other children)

	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Math score					Math score		
Pr(Other children) ≤ 0.075										
Boy bias	-0.027**	-0.013	-0.040**	-0.016	-0.034**	-0.028**	-0.008	-0.043**	-0.013	-0.037**
	(0.013)	(0.020)	(0.017)	(0.022)	(0.017)	(0.013)	(0.022)	(0.018)	(0.023)	(0.017)
Boy bias (standardized beta)	-0.014	-0.007	-0.023	-0.009	-0.019	-0.015	-0.005	-0.025	-0.007	-0.021
Observations	53,780	23,151	30,629	20,772	33,008	49,495	20,800	28,695	18,958	30,537
R-squared	0.323	0.315	0.244	0.330	0.263	0.321	0.317	0.249	0.334	0.264
Pr(Other children) ≤ 0.15										
Boy bias	-0.021**	-0.013	-0.030**	-0.008	-0.031***	-0.023***	-0.010	-0.035***	-0.004	-0.037***
	(0.009)	(0.013)	(0.012)	(0.014)	(0.011)	(0.009)	(0.013)	(0.013)	(0.014)	(0.012)
Boy bias (standardized beta)	-0.012	-0.008	-0.020	-0.005	-0.020	-0.014	-0.006	-0.023	-0.002	-0.024
Observations	84,751	39,488	45,263	35,064	49,687	77,080	35,031	42,049	31,766	45,314
R-squared	0.322	0.296	0.229	0.301	0.253	0.319	0.297	0.232	0.304	0.254
Pr(Other children) ≤ 0.20										
Boy bias	-0.015*	-0.008	-0.025**	-0.002	-0.026**	-0.015*	-0.004	-0.029**	0.003	-0.030***
	(0.008)	(0.011)	(0.011)	(0.012)	(0.010)	(0.008)	(0.012)	(0.012)	(0.013)	(0.011)
Boy bias (standardized beta)	-0.009	-0.005	-0.016	-0.001	-0.017	-0.009	-0.002	-0.019	0.002	-0.019
Observations	98,670	47,016	51,654	41,625	57,045	89,599	41,649	47,950	37,582	52,017
R-squared	0.318	0.285	0.224	0.290	0.247	0.316	0.288	0.227	0.294	0.249

Notes. This table reports OLS estimates, with robust standard errors clustered by student and school. The unit of observation is a student-year. Each Panel runs the same specification shown in Table 3, but applying different thresholds to the probability that the student's mother has had other children we do not observe (the default threshold applied in the analysis is 0.10). In Column (1), the sample includes all girls, excluding lastborns. In Columns (6) to (10), we run the same specifications as in columns (1) to (5), but we restrict the sample to the firstborn child in each family. In Columns (2) and (7), we restrict the sample to families with at least one child enrolled in the Free Lunch program, in at least one year in our sample. In Columns (3) and (8), we restrict the sample to those students who come from families where no child was ever enrolled in the Free Lunch program in any year. In Columns (4) and (9) we restrict the sample to children for whom "Mother high school dropout" or "Mother high school graduate" are equal to 1. In Columns (5) and (10) we restrict the sample to those children with "Mother attended some college" equal to 1, or "Mother graduated from college" equal to 1. The dependent variable measures students' Florida Comprehensive Assessment Test Math score in a given grade (standardized with mean 0 and variance 1). "Boy bias" is a dummy variable equal to 1 if the last born in the family is a boy, and all the older children are girls, 0 otherwise. All columns include controls for "Median income in zipcode of birth*100,000 (USD)", "Free Lunch", "Mother married at birth", "Maternal age at birth", "Special Education", "Age (in months)"). Columns (1) to (5) include birth order FE. All columns include year FE, grade FE, school FE, maternal education FE, race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table A3: Robustness check including 2nd generation migrants

	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Math score					Math score		
Boy bias	-0.032***	-0.024*	-0.038***	-0.028**	-0.033***	-0.033***	-0.020	-0.043***	-0.025*	-0.036***
	(0.009)	(0.013)	(0.012)	(0.014)	(0.011)	(0.009)	(0.014)	(0.013)	(0.015)	(0.012)
Median income in zipcode	0.232***	0.177***	0.215***	0.286***	0.204***	0.216***	0.147**	0.205***	0.259***	0.186***
of birth*100,000 (USD)	(0.037)	(0.063)	(0.048)	(0.068)	(0.044)	(0.039)	(0.068)	(0.050)	(0.071)	(0.046)
Free Lunch	-0.164***	-0.087***		-0.115***	-0.202***	-0.158***	-0.084***		-0.110***	-0.197***
	(0.010)	(0.012)		(0.014)	(0.015)	(0.011)	(0.012)		(0.014)	(0.016)
Mother married at birth	0.043***	0.021	0.080***	0.033*	0.039*	0.041***	0.014	0.083***	0.026	0.046*
	(0.014)	(0.016)	(0.029)	(0.018)	(0.023)	(0.014)	(0.017)	(0.030)	(0.018)	(0.024)
Maternal age at birth	0.009***	0.008***	0.008***	0.012***	0.006***	0.008***	0.008***	0.007***	0.012***	0.005***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Special Education	-0.780***	-0.764***	-0.779***	-0.775***	-0.778***	-0.782***	-0.753***	-0.798***	-0.772***	-0.788***
	(0.023)	(0.030)	(0.034)	(0.032)	(0.033)	(0.024)	(0.032)	(0.034)	(0.033)	(0.034)
Age (in months)	-0.016***	-0.021***	-0.009***	-0.021***	-0.010***	-0.016***	-0.021***	-0.009***	-0.022***	-0.010***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Family size FE	YES	YES	YES	YES	YES	-	-	-	-	-
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
School FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Maternal Education FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Race FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Boy bias (standardized beta)	-0.019	-0.015	-0.025	-0.017	-0.021	-0.020	-0.012	-0.028	-0.016	-0.023
Observations	83,778	40,741	43,037	33,819	49,959	76,853	36,565	40,288	30,811	46,042
R-squared	0.314	0.292	0.232	0.309	0.250	0.313	0.295	0.237	0.314	0.252

Notes. This table reports OLS estimates, with robust standard errors clustered by student and school. The unit of observation is a student-year. This is the equivalent to Table 3, but it also includes students who are second generation migrants. In Column (1), the sample includes all girls, excluding lastborns. In Columns (6) to (10), we run the same specifications as in columns (1) to (5), but we restrict the sample to the firstborn child in each family. In Columns (2) and (7), we restrict the sample to families with at least one child enrolled in the Free Lunch program, in at least one year in our sample. In Columns (3) and (8), we restrict the sample to those students who come from families where no child was ever enrolled in the Free Lunch program in any year. In Columns (4) and (9) we restrict the sample to children for whom "Mother high school dropout" or "Mother high school graduate" are equal to 1. In Columns (5) and (10) we restrict the sample to those children with "Mother attended some college" equal to 1, or "Mother graduated from college" equal to 1. The dependent variable measures students' Florida Comprehensive Assessment Test Math score in a given grade (standardized with mean 0 and variance 1 by grade-year across the population). "Boy bias" is a dummy variable equal to 1 if the last born in the family is a boy, and all the older children are girls, 0 otherwise. Columns (1) to (5) include birth order FE. All columns include year FE, grade FE, school FE, maternal education FE, race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table A4: Robustness check including lastborn children

	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college	All families	Only families with FRL	Excluding families with FRL	Mother attended HS	Mother attended college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Math score					Math score		
Boy bias	-0.021**	-0.017	-0.028**	-0.014	-0.025**	-0.027***	-0.016	-0.037***	-0.014	-0.034**
	(0.010)	(0.015)	(0.013)	(0.016)	(0.013)	(0.010)	(0.016)	(0.014)	(0.017)	(0.013)
Only child	-0.087***	-0.060***	-0.112***	-0.062***	-0.105***	-0.091***	-0.061***	-0.119***	-0.061***	-0.112***
	(0.008)	(0.013)	(0.011)	(0.013)	(0.011)	(0.009)	(0.013)	(0.012)	(0.013)	(0.011)
Median income in zipcode	0.235***	0.229***	0.192***	0.280***	0.200***	0.239***	0.215***	0.209***	0.295***	0.194***
of birth*100,000 (USD)	(0.025)	(0.045)	(0.031)	(0.044)	(0.030)	(0.028)	(0.053)	(0.035)	(0.049)	(0.035)
Free Lunch	-0.151***	-0.081***		-0.121***	-0.181***	-0.147***	-0.077***		-0.118***	-0.180***
	(0.007)	(0.008)		(0.009)	(0.011)	(0.007)	(0.009)		(0.009)	(0.012)
Mother married at birth	0.038***	0.024**	0.056***	0.037***	0.049***	0.042***	0.023**	0.063***	0.041***	0.051***
	(0.008)	(0.010)	(0.014)	(0.010)	(0.013)	(0.009)	(0.011)	(0.015)	(0.011)	(0.014)
Maternal age at birth	0.006***	0.002**	0.008***	0.006***	0.006***	0.005***	0.001	0.007***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Special Education	-0.762***	-0.713***	-0.799***	-0.730***	-0.783***	-0.775***	-0.731***	-0.808***	-0.745***	-0.797***
	(0.014)	(0.019)	(0.022)	(0.019)	(0.021)	(0.016)	(0.021)	(0.025)	(0.021)	(0.026)
Age (in months)	-0.017***	-0.022***	-0.010***	-0.022***	-0.011***	-0.019***	-0.023***	-0.012***	-0.023***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Birth order FE	YES	YES	YES	YES	YES	-	-	-	-	-
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
School FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Maternal Education FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Race FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Boy bias (standardized beta)	-0.010	-0.008	-0.014	-0.006	-0.012	-0.013	-0.007	-0.020	-0.007	-0.018
Observations	182,400	83,319	99,081	81,347	101,053	144,805	66,264	78,541	67,181	77,624
R-squared	0.301	0.272	0.217	0.267	0.243	0.305	0.282	0.227	0.275	0.252

Notes. This table reports OLS estimates, with robust standard errors clustered by student and school. The unit of observation is a student-year. This is the equivalent to Table 3, but it also includes the lastborn child in each family. In Column (1), the sample includes all girls. In Columns (6) to (10), we run the same specifications as in columns (1) to (5), but we restrict the sample to the firstborn in each family. In Columns (2) and (7), we restrict the sample to families with at least one child enrolled in the Free Lunch program, in at least one year in our sample. In Columns (3) and (8), we restrict the sample to those students who come from families where no child was ever enrolled in the Free Lunch program in any year. In Columns (4) and (9) we restrict the sample to children for whom "Mother high school dropout" or "Mother high school graduate" are equal to 1. In Columns (5) and (10) we restrict the sample to those children with "Mother attended some college" equal to 1, or "Mother graduated from college" equal to 1. The dependent variable measures students' Florida Comprehensive Assessment Test Math score in a given grade (standardized with mean 0 and variance 1 by grade-year across the population). "Boy bias" is a dummy variable equal to 1 if the last born in the family is a boy, and all the older children are girls, 0 otherwise. Columns (1) to (5) include birth order FE. All columns include year FE, grade FE, school FE, maternal education FE, race FE. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.