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Kim, Jun Hyung; Wang, Shaoda

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Birth Order Effects, Parenting Style, and Son Preference

Jun Hyung Kim and Shaoda Wang^{*}

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Abstract

While it is well known that there are systematic birth order effects on life cycle outcomes, there is less consensus about underlying channels and mechanisms of birth order effects. We find negative birth order effects among Chinese adolescents, favoring earlier-born children within household in academic achievement and cognitive skill measures. We highlight harsh parenting as a novel channel of birth order effects, in which earlier-born children are less likely to be physically punished by their parents. Focusing on son preference as a potential mechanism generating birth order effects, our tests show limited support for the existence of son preference among Chinese siblings. These findings are in contrast to positive birth order effects and strong evidence of son preference among earlier generations of Chinese siblings reported in the literature, suggesting weakened role of son preference within families in contemporary China.

Keyword: birth order effect, parenting style, academic achievement, cognitive skill, son preference JEL: I20 J10 J13

^{*}Kim: Institute for Economic and Social Research, Jinan University, Guangzhou, China. kimjunhyung@jnu.edu.cn. Corresponding author. Wang: School of Economics, Jinan University, Guangzhou, China. wangsd0110@stu2020.jnu.edu.cn. We thank Xi Wang, Yang Zhe, Yu Zhang and the participants at the 13th International Symposium on Human Capital and Labor Markets for helpful comments and suggestions.

Understanding birth order effects, where children systematically out-perform or under-perform their siblings within a household by their birth order, may advance our understanding of the nature of quantity-quality trade-off at home (Becker, 1960), and can facilitate more targeted development of policies that affect families. A large body of evidence shows negative birth order effects (better outcomes for earlier-born children) in developed countries (Behrman and Taubman, 1986; Black et al., 2005), wherease the evidence is mixed for developing countries (positive birth order effects in Ejrnæs and Pörtner, 2004; Khanam and Rahman, 2007; Patrinos and Psacharopoulos, 1997; negative birth order effects in Behrman, 1988; Horton, 1988; Jayachandran and Pande, 2017). There is even less understanding of the channels and mechanisms that generate birth order effects. Studies point to the allocation of household resources and parenting behavior as likely channels of birth order effects (Behrman and Taubman, 1986; Price, 2008). But these studies do not always explain underlying mechanisms, i.e. why parents would choose to differentiate resource allocation or parenting behavior by the birth order of their children. Some of the explanations proposed to explain birth order effects include resource dilution (Lafortune and Lee, 2014), parent learning (Cho, 2019), reputation concern (Hao et al., 2008; Hotz and Pantano, 2015), response to unwanted fertility (Lin et al., 2020), and son preference (Jayachandran and Pande, 2017).

In this study, we investigate birth order effects, their channels, and mechanisms, among adolescents in contemporary China. We focus on academic achievement and cognitive skill measures as outcomes. We also consider parenting styles which is relatively unexplored in the literature as potential channels generating birth order effects. Finally, we ask whether son preference is one of the underlying mechanisms that could have generated the birth order effects. The role of son preference in birth order effect has not been examined in Chinese context, even as studies found evidence of its importance in explaining birth order effects in other countries such as India and Pakistan (Hafeez and Quintana-Domeque, 2018; Jayachandran and Pande, 2017). Son preference in China is mainly due to patrilineal family system, similar to those in East and South Asia (Murphy et al., 2011), but may not generalize to countries that do not share such cultural elements. Therefore, to place empirical evidence from China in international context, it is important to understand to what extent son preference can expain birth order effects in China.

We find evidence of negative birth order effects (favoring earlier-born children) among Chinese children on academic achievement and cognitive skill. We also find negative birth order effects on the parents' use of parenting styles such as the use of corporal punishment and checking the child's homework. The effects were stronger for first-born sons and for those in low-income households, although the effects on supervising homework was stronger for first-born daughters. Evidence of birth order effects on parent's use of harsh parenting such as corporal punishment is new in economics literature. Literature shows that harsh parenting has negative effects on child outcomes (Fiorini and Keane, 2014; Kim et al., 2018), suggesting that harsh parenting could be one of the channels generating birth order effects within a household.

To learn about the extent to which son preference could explain birth order effects, we decompose the birth order effect estimates by subgroups consisting of different sibling-gender compositions. We interpret negative birth order effects in families with earlier-born daughters and later-born sons as evidence of weak role of son preference in generating birth order effects. We also replicate tests of son preference in previous studies on China and India, using the gender of elder siblings, younger siblings, proxies of the strength of patrilineal family culture, and fertility restriction policies (Chen, 2020; Lei et al., 2017; Jayachandran and Pande, 2017; Ebenstein, 2010; Zhang, 2019). Our analyses show that son preference plays at best a limited role in explaining birth order effects on child development in contemporary China.

Our results stand in contrast to previous studies which found positive birth order effects in China (Weng et al., 2019) and that son preference was an important feature in explaining the variation in outcomes among siblings (Chen, 2020; Ebenstein, 2010; Lei et al., 2017; Weng et al., 2019; Zhang, 2019). These studies used older generations of Chinese, while our sample consists of children in late childhood and adolescence in contemporary China, likely reflecting the reduced importance of son preference among Chinese families today. These results imply that compared to previous generations, the Chinese home environment may be closer to those found in other, mostly developed countries also showing negative birth order effects.

1 Background

Studies based on data from mostly developed countries show that earlier-born children outperform their younger siblings in academic achievement (Behrman and Taubman, 1986; Black et al., 2005; Booth and Kee, 2009; Hotz and Pantano, 2015; Kantarevic and Mechoulan, 2006; Kim, 2020), cognitive skill (Black et al., 2011; Rohrer et al., 2015), risky behavior (Averett et al., 2011; Breining et al., 2020) earnings (Behrman and Taubman, 1986), and even intergenerational outcomes (Havari and Savegnago, 2020). Interestingly, studies based on developing countries tend to find later-born children outperforming earlier-born children (De Haan et al., 2014; Ejrnæs and Pörtner, 2004; Khanam and Rahman, 2007; Lafortune and Lee, 2014; Tenikue and Verheyden, 2010; Weng et al., 2019), although exceptions exist (Behrman, 1988; Horton, 1988; Jayachandran and Pande, 2017). In China, Weng et al. (2019) found positive birth order effects on academic performance, consistent with the evidence from developing countries. In contrast, negative birth order effects are shown in Shi (2020) and Xiong et al. (2020) on outcomes including subjective well-being and years of schooling, respectively, although these two studies did not account for household-level unobservables.

Proposed channels of birth order effects include household resource allocation (Behrman and Taubman, 1986; De Haan, 2010; Mechoulan and Wolff, 2015; Monfardini and See, 2016), parental investment (Breining

et al., 2020; Black et al., 2018; De Haan et al., 2014; Kim, 2020; Lehmann et al., 2018; Price, 2008), and parental monitoring (Averett et al., 2011; Hao et al., 2008; Hotz and Pantano, 2015). These studies highlight the role of parents in generating birth order effects among siblings. Parenting style, which recently emerged as another important dimension of parenting behavior that has long-run impact on child outcomes (Fiorini and Keane, 2014; Kim et al., 2018), remains relatively unexplored in the literature.

What can be underlying mechanisms that motivate the parents to differentiate resource allocation and parenting behavior among siblings? One explanation is resource dilution, implying negative birth order effects. First-born child monopolizes parental attention and household resources during early childhood until siblings are born, while later-born children do not enjoy such focused attention during early childhood, a critical period for human development (Heckman and Mosso, 2014).

Another explanation is that parents may gain parenting experience over time, implying positive birth order effects. Evidence of this mechanism is rarely found. An exception is Cho (2019), showing that Korean parents are more likely to optimize birth month beneficial for school schedule for later births.

Hao et al. (2008) proposed a game-theoretic model of reputation building by the parents, implying negative birth order effects. As more children are born, parents wishing to promote good behavior have an incentive to build a reputation to younger children as a "strict" type rather than a "lenient" type parents. This is achieved by setting stricter discipline to earlier-born children, improving their outcomes. Hao et al. (2008) and Hotz and Pantano (2015) present empirical evidence consistent with the implications of thi smodel.

Lin et al. (2020) proposed that later births are more likely to be unplanned, "accidental" births compared to earlier births. Surprised with unplanned fertility, the parents are forced to improvise, providing less than optimal care to later-born children. Changes in unwanted fertility seem to be important determinants of fertility trends and child outcomes among low-SES mothers in the US (Buckles et al., 2019).

A common explanation for positive birth order effects in developing countries is that parents having first children may be severely credit-constrained (Lafortune and Lee, 2014). As credit constraint eases over time, the parents may invest more on later-born children. Initial credit constraint can be so severe that earlierborn children may be asked forego schooling and generate income for the household instead (Edmonds, 2006; Emerson and Souza, 2008; Patrinos and Psacharopoulos, 1997; Tenikue and Verheyden, 2010). Similarly, Coffey and Spears (2021) found that mother's improving health over time could generate positive birth order effects in India.

Studies on India found that son preference can generate negative birth order effects. For example, Jayachandran and Pande (2017) showed that negative birth order effects in height among Indian children were primarily driven by households with characteristics predicting strong son preference based on Hindu culture and religion, and by households with earlier-born sons and later-born daughters. Similarly, Jayachandran and Kuziemko (2011) found that earlier-born daughters tend to receive less breastfeeding than sons or laterborn daughters because parents in need of a son would soon get pregnant again, which hastens weaning of ongoing breastfeeding. These findings were replicated in Egypt and Pakistan (Chakravarty, 2015; Hafeez and Quintana-Domeque, 2018), also known for strong son preference.

Son preference is a prominent feature of Chinese society, driven by patrilineal family system that emphasizes the role of the eldest son to carry on the family name and support the parents in old age (Murphy et al., 2011). This led to serious gender imbalance in favor of more men, aided by fertility restriction policies such as One Child Policy (OCP) and the widespread availability of ultrasound technology that allows *in utero* sex determination (Chen et al., 2013; Ebenstein, 2010; Zhang, 2017). It is therefore possible that son preference and gender imbalance together generate birth order effects in Chinese population. The extent to which son preference explains birth order effects in China has not been examined in the literature.

2 Empirical Strategy

2.1 Data

We use data from China Family Panel Studies (CFPS), which is a comprehensive survey across China, covering a variety of economic and non-economic issues. The CFPS 2010 baseline survey, 2012, 2014, 2016 and 2018 waves all include respondents' cognitive test scores, which is crucial for our analysis. However, do not use the 2012 wave because the cognitive tests in the 2012 wave were taken voluntarily, leading to many missing values. We restrict the sample to children aged 10--15 as outcome measures because parenting measures are available only for children in those ages. Siblings outside this age range are nevertheless accounted for in calculating family size and the number of younger siblings. We also exclude families with twins because the parent-child dynamic and sibling dynamic in twin-households are likely to be significantly different from those in other types of households.

The CFPS child questionnaire provides information on birth year, which enables us to define birth order. We construct the birth order indicators in two different ways. First, we create several dummy variables that equal 1 when the child is the 1st (First Child), 2nd (Second Child) and 3rd (Third Child) born child. Second, we also use the number of younger siblings (NYS) the child has as a proxy of birth order.

The data also allows us to create child outcome variables related to school performance, cognitive skill and parenting styles. School performance is measured by parents' perception of their children's Chinese and Math grades. Parents were asked: "How is the child's Chinese (Math) grade? Is it top, above the median, in the median or below the median in the class?" We constructed two dummy variables Chinese and Math, coded as 1 if the parent believes the child is above class median in the respective subjects.

We use two tests from each wave of CFPS to construct our cognitive skill measure. The 2010, 2014 and 2018 waves of CFPS employ a word test and a math test to measure respondents' cognitive skill. In the word test, respondents were shown 34 Chinese characters, ordered from easy to difficult. The test would terminate if they read three words incorrectly in a row. The score was equal to the sequence of the most difficult character that a respondent read correctly. In the math test, respondents answered 24 math questions, ordered from easy to difficult. Like the word test, the math test also ended when a respondent answered three questions incorrectly in a row. The score was determined by the sequence of the most difficult questions the respondent answered correctly. We use the sum scores of the two tests, normalized to be mean 0 and standard deviation 1 within children's age and survey year.

Unlike the other three waves, the cognitive tests used in the 2016 wave include a memory test and a sequence test. In the memory test, the interviewer read 10 common words (mountain, rice, river, etc.) to the respondent, and the respondent was asked to immediately recall the words after the interviewer finished reading. The total number of words answered correctly was the memory test score. The sequence test contains two stages. In the first stage, a respondent answers three series of questions, thus obtaining the number of correct answers (0 to 3). In the second stage, the interviewer chose one of the four prepared sets of questions to test the respondent based on his/her score of in the first stage. The four sets of questions were of varying difficulty, and respondents who scored higher in the first stage would take the most difficult questions. Given the systematic differences in the difficulty of the tests for different groups of people, we cannot score respondents on the number of correct answers. Therefore, we use the scores calculated by the CFPS official based on Rasch model. Similar to cognitive skill measures in other waves, we construct sum scores as a sum of scores from the memory and the sequence test, which are normalized to be mean 0 and standard deviation 1 within children's age and survey year.

We also create two variables for parenting style: checking homework and corporal punishment use. For checking homework, the parent was asked: "How often do you check the child's homework?" The responses include: 6-7 times per week; 2-3 times per week; once per week; once per month; or never. The variable equals 1 if the parent checked the child's homework once a week or more. For corporal punishment, the parent was asked: "What would you do if the child fails to perform as expected at school?" The responses include: contacting the child's teacher; scolding the child; punishing the child physically; telling the child to work harder; limiting the child's activities; helping the child more; and doing nothing. Parents could choose one or more of these options. The variable is coded as 1 if the parent chose "punishing the child physically" and 0 otherwise.

We consider three categories of baseline control variables. On the children's level, we control for child

	*		•			
	First	Child	Second	l Child	Third	Child
Variable	Mean	SD	Mean	\mathbf{SD}	Mean	SD
School Performance						
Chinese	0.50	0.50	0.52	0.50	0.39	0.49
Math	0.45	0.50	0.51	0.50	0.49	0.50
Cognitive Skill	0.03	0.98	0.00	1.00	-0.27	1.05
Parenting Behavior						
Checking Homework	0.51	0.50	0.62	0.49	0.48	0.50
Corporal Punishment	0.02	0.13	0.04	0.19	0.10	0.30
Family Controls						
Rural Hukou	0.92	0.27	0.92	0.27	0.95	0.23
Number of Children	2.35	0.68	2.35	0.67	3.37	0.77
Family Income (10,000 RMB)	30.25	34.35	30.19	34.33	26.26	30.74
Child Controls						
Male	0.38	0.49	0.60	0.49	0.59	0.49
Age	13.83	1.16	11.33	1.22	10.69	0.82
Parent Controls						
Father's Education	6.20	4.06	6.190	4.060	6.28	4.08
Mother's Education	4.48	4.21	4.570	4.220	3.71	4.24
Sample Size	1130		1132		112	

Table 1: Descriptive Statistics by Birth Order

Note: Sample is drawn from 2010, 2014, 2016, and 2018 waves of CFPS. Income is deflated to 2010 values in units of 10,000 RMB. Math and Chinese variables equal 1 if the parent believes the child is above class median in the respective subjects. Parents' education variables are coded as 0 = illiterate, 6 = primary school, 9 = middle school, 12 = high school, 14 = junior college and 16 = bachelor. Checking Homework variable equals 1 if the parent checks the child's homework once a week or more. Corporal Punishment variable equals 1 if the parent shows intention to use coporal punishment if the child performs poorly at school.

age and gender. On the parents' level, we control for both father and mother's years of schooling. On the family level, we control for the number of children, rural hukou status, and family income. Family income is adjusted for inflation with 2010 as the base.

Table 1 presents the descriptive statistics based on the analysis sample. The average outcomes are lower for the third children than for the first and the second children, but the difference between the first and the second children are not pronounced. Similarly, the average values of household income and mother's education level are lower for the third children than for the first and the second children, while the latter two have similar average values. About 60% of the second and the third children are male while only 38% of the first children are male, suggesting that sex selection is more likely to occur at later births than earlier births. This pattern is consistent with the evidence in the literature showing stronger evidence of sex selection at higher birth parities (Chen et al., 2013; Egan et al., 2011).

	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	$\cos.$ Skill	Corp . Punish	Check HW
BirthOrder2	-0.061	0.001	-0.227**	0.041**	-0.047
	(0.054)	(0.057)	(0.110)	(0.020)	(0.046)
BirthOrder3	-0.234**	-0.015	-0.529***	0.122^{**}	-0.212**
	(0.110)	(0.110)	(0.199)	(0.050)	(0.084)
N	2028	2028	1936	2042	2029
BO2 = BO3	0.035	0.839	0.033	0.044	0.005
adj. R^2	0.274	0.206	0.399	0.122	0.409
	Chinese	Math	$\cos.$ Skill	$\operatorname{Corp.Punish}$	Check HW
NYS	0.093^{*}	0.002	0.250***	-0.053**	0.085**
	(0.051)	(0.051)	(0.096)	(0.021)	(0.040)
N	2028	2028	1936	2042	2029
adj. R^2	0.272	0.206	0.399	0.120	0.408

Table 2: Effects of Birth Order on Academic Achievement and Parenting Style

Note: ***/**/*: significant at the 1/5/10% level. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects. BO2=BO3 row presents *p*-values from testing the equality of coefficients for BirthOrder2 and BirthOrder3 variables.

2.2 Empirical Model

We estimate the following models using OLS:

$$Y_{iht} = \alpha + \sum_{k=2}^{3} \beta_k BirthOrder_{kiht} + \gamma X_{iht} + \lambda_t + \lambda_h + \epsilon_{iht}$$
(1)

$$Y_{iht} = \alpha + \beta_{nys} NYS_{iht} + \gamma X_{iht} + \lambda_t + \lambda_h + \epsilon_{iht}$$
⁽²⁾

 Y_{iht} is the dependent variable, for child *i* in family *h* at time *t*; *BirthOrder_{kiht}* is the indicator variable for the child of birth order *k*; NYS_{iht} is the number of younger siblings; X_{iht} is a vector of family characteristics including child's age, gender, mother's education, father's education, family size (number of children), *hukou* status of the survey respondent, and household income; λ_t and λ_h represent year and family fixed effects, respectively. ϵ_{iht} is clustered at household level.

Outcome variables include indicators for whether the parent thinks the child's performance in Chinese and math is above median in class; cognitive skill measures normalized to be mean 0 and standard deviation 1 within child's age and survey year; indicator for whether the parent intends to use corporal punishment for poor academic performance; and indicator for whether the parent supervises homework more than once a week.

3 Results

Table 2 shows evidence of negative birth order effects on children's Chinese grade and cognitive skill, but not on Math grade. While the effects on Chinese grade is concentrated on the third birth, the effects on cognitive skill, which are arguably more objectively measured, are observed for both the second birth and the third birth. These results are consistent with a large body of empirical evidence showing negative birth order effects in academic achievement in samples from developed countries (Black et al., 2005). It is however inconsistent with positive birth order effects reported by Weng et al. (2019) in a sample of older cohorts of Chinese.

We also find negative birth order effects in parenting behaviors that favor earlier-born children. Earlier born children are more likely to receive parental supervision in doing homework and are less likely to receive corporal punishment. While previous studies reported negative birth order effects in parental monitoring and supervision (Hotz and Pantano, 2015), the relationship between birth order and the parents' use of harsh punishment remains unknown in the literature. Harsh parenting is commonly practiced around the world and leads to negative child outcomes (Fiorini and Keane, 2014; Kim et al., 2018), suggesting that differential use of harsh parenting by birth order may generate birth order effects on children's academic achievement.

Table 1 showed that outcome differences were smaller between the first-born and the second-born children. In Table A1, we examine birth order effects by restricting the analysis to two-child families, forcing the comparisons to be between the first-born and the second-born. The results are consistent with those found in Table 2, although somewhat less statistically significant.

We then examine heterogeneity in birth order effects. We examine heterogeneity by the gender of the first child, since younger sibling's gender may be endogenous to family size and confounds the estimate with gender composition effect (Weng et al., 2019). We also examine heterogeneity due to household income by dividing the sample at the sample median household income. Finally, we examine heterogeneity by whether the responding parent has rural or urban hukou.

Figures 1 and 2 show that the effects are concentrated on first-born boys, although there is evidence of birth order effects among girls as well, especially on parenting styles. Birth order effects are stronger among low-income households. The effects are more significant among rural residents and somewhat stronger, although non-significance among urban residents may reflect smaller sample size (less than 10% of the sample have urban hukou). Low-income status and rural residence predict stronger son preference in China (Burgess and Zhuang, 2002; Lei and Pals, 2011). Together with stronger effects for first-born boys, the results suggest the possibility that birth order effects in China is driven by son preference. We examine this mechanism more closely in the next section.



Figure 1: Birth Order Effects Heterogeneity





Figure 2: Birth Order Effects Heterogeneity (number of siblings)

Note: ***/**/*: significant at the 1/5/10% level. Appendix Tables A2, A3, A4, A5, A6, and A7 contain values used to generate the plot.

4 Does Son Preference Explain Birth Order Effects?

It is difficult to learn whether son preference plays an important role in explaining birth order effects from the heterogeneity results we report in the previous section. Low-income status is associated with stronger son preference, but higher income may allow households to act on their son preference, by gaining access to sex-selective abortion or by allocating relatively more resources to sons rather than daughters (Almond et al., 2019). Also, while son preference is generally associated with rural area, One-Child Policy was enforced more strictly in the urban area, increasing the incentive for urban families to act on their son preference (Ebenstein, 2010).

In this section, we implement a series of supplementary analyses to learn whether the negative birth order effects can be explained by son preference. We first decompose the baseline results in Table 2 by gender composition of households. We then implement tests of son preference used in the literature to see whether the observed effects are consistent with the presence of son preference across siblings within each household.

4.1 Decomposition by sibling gender composition

We propose a mechanical decomposition of birth order effects by subgroups of households with different sibling gender composition.¹ Consider coefficient β in equation (2) which captures the effect of the number

 $^{^{1}}$ We do not implement the conventional subsample regression because the sample size for each subsample is too small to make any meaningful statistical inference using our models.

of younger siblings (NYS) on the child outcome. We can write the decomposition as

$$\beta = \sum_{l=1}^{L} w_l \beta_l, \ w_l \ge 0, \ \sum_{l=1}^{L} w_l = 1$$

where each β_l represents the relationship between the dependent variable Y and the independent variable NYS within subgroup l. β is now expressed as a weighted sum of β_l from L subgroups in the sample.

This decomposition can be done as follows. For a subsample l of size n_l and individuals j_l in the subsample l, one can estimate a univariate regression of $Y_{j_l} = \beta_l X_{j_l} + \epsilon_{j_l}$ (without a constant) and obtain an estimate of $\hat{\beta}_l$ as

$$\hat{\beta}_{l} = \frac{\sum_{j_{l}}^{n_{l}} X_{j_{l}} Y_{j_{l}}}{\sum_{j_{l}}^{n_{l}} X_{j_{l}}^{2}}.$$
(3)

From the entire sample, we have

$$\hat{\beta} = \frac{\sum_{i}^{n} X_{i} Y_{i}}{\sum_{i}^{n} X_{i}^{2}}$$
$$= \sum_{l=1}^{L} \hat{w}_{l} \hat{\beta}_{l}.$$
(4)

where $n = \sum_{l=1}^{L} n_l$. Recognizing $\sum_{i}^{n} X_i^2 = \sum_{l}^{L} \sum_{j_l}^{n_l} X_{j_l}^2$ and $\sum_{i}^{n} X_i Y_i = \sum_{l}^{L} \sum_{j_l}^{n_l} X_{j_l} Y_{j_l}$, it is straightforward to show that²

$$\hat{w}_l = \frac{\sum_{j_l}^{n_l} X_{j_l}^2}{\sum_l \sum_{j_l}^{L} \sum_{j_l}^{n_l} X_{j_l}^2}.$$
(5)

This decomposition places a greater weight in larger subsamples with more variation in X_j .

In practice, we use partitioned regression to transform equation (2) into a univariate regression without a constant term. This procedure also ensures that exactly the same set of controls are included in each of the regressions, so that equation (4) mechanically holds. Specifically, we can write

$$Y_{iht} = \alpha + \beta_{nys} NY S_{iht} + \gamma X_{iht} + \lambda_t + \lambda_h + \epsilon_{iht}$$
(6)

$$\rightarrow \tilde{Y}_{iht} = \beta_{nys} \widetilde{NYS}_{iht} + \tilde{\epsilon}_{iht} \tag{7}$$

where we partial out all the independent variables except for NYS_{iht} . By Frisch-Waugh-Lovell theorem, the values of estimated β_{nys} are the same in equation (7) as in equation (2). Weights for each subsample is constructed using \widetilde{NYS}_{iht} and $\hat{\beta}_l$ coefficients are estimated by estimating equation (7) for each subsample. To implement this procedure for equation (1), we partial out all the independent variables and one of the birth order indicators to obtain partitioned variable for the other birth order indicator.

 $^{^{2}}$ We thank Xi Wang for advice on this decomposition.

We decompose the sample into five subgroups (earlier born-later born): boy-boy (N = 307), girl-boy (N = 776), boy-girl (N = 419), girl-girl (N = 392), and other families (N = 134). For example, girl-boy group includes two-child families with elder daughter and younger son, and three-child families with earlier-born daughters and later-born sons (girl-girl-boy, girl-boy-boy). "Other" group includes three-child families with alternating sex compositions (boy-girl-boy, girl-boy-girl). If boy-girl group dominates the decompositions, it would be difficult to reject son preference as an important explanation for the negative birth order effects. If other groups dominate the decompositions, it would be unlikely that son preference drives the observed birth order effects. In particular, considering the steep cost of having additional child under OCP, parents with son preference would strongly favor later-born sons when they have earlier-born daughters. Negative birth order effects on girl-boy subsample would therefore be difficult to reconcile with the presence of strong son preference.

The results of this decomposition is presented in Figure 3. The effects are scaled to sum up to 1 for visibility. For Chinese and cognitive skill outcomes, boy-girl subsamples represent a nontrivial portion of the decompositions, but other subgroups represent a sizable portion of the decompositions as well. In particular, girl-boy subsample is represented in all decompositions, contrary to the implications of strong son-preference mechanism. As for the decomposition of birth order effects for parenting style, boy-girl subgroup represents even smaller part of the decompositions, while girl-boy subgroup component is large. Negative birth order effects shown by girl-boy subsample, boy-boy subsample, and girl-girl subsample are inconsistent with son preference.

4.2 Tests of Son Preference

In this section, we conduct a series of tests to look for the evidence that son preference drives the birth order effects in our sample. If the son preference is the key determinant of birth order effect, then the negative birth order effect would be weaker in daughter-son family than in daughter-daughter family. Another test is to examine whether the negative birth order effect is stronger in son-daughter family than in son-son family. In this case, however, parent's preference over gender diversity may divert some resources to the later-born daughter even if son preference is present. Finally, we use proxies that predict stronger effects of son preference, and examine whether birth order effects are strengthened when such proxies are present.

4.2.1 Tests based on the presence of older brother

In Table 3, we restrict the sample to households who had a son as the youngest-born child, and examine the "effect" of having a brother as the eldest sibling. Son preference mechanism predicts that later-born son would receive greater allocation of household resources if the earlier-born siblings are daughters. Then,



Figure 3: Decomposition of Birth Order Effects

(c) Number of Younger Siblings Variable Coefficient

Note: Coefficient size scaled to be 1. See Tables A8, A9, and A10 in the Appendix for the values used to generate the figure. Decomposition for Math outcome is not shown in the figure for visibility but appears in the Appendix tables. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

		0	0		
	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	$\cos.$ Skill	$\operatorname{Corp.Punish}$	Check HW
First-born is a son	0.130*	-0.050	0.062	0.013	-0.061
	(0.075)	(0.083)	(0.150)	(0.030)	(0.064)
Ν	1108	1108	1060	1115	1109
adj. R2	0.258	0.246	0.440	0.098	0.451

Table 3: Outcome of the Youngest Son by the Gender of the First-born Child

Note: *: significant at the 10% level. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, year fixed effects, and family fixed effects.

the indicator for the first-born sibling being a son would have negative coefficient estimates. The results in Table 3 are inconsistent with the strong effects of son preference as the explanation for child outcomes and parenting among siblings. The coefficient estimates are relatively small in magnitude and inconsistent in sign across outcomes. In fact, positive and significant coefficient for the Chinese grade outcome contradicts the implications of son preference. Table A11 in the Appendix further restricts the sample to two-child families, whose results confirm those in Table 3.

4.2.2 Tests based on the presence of younger sisters

In Table 4, we test whether the increase in the fraction of sisters among siblings lead to better outcomes. We follow the strategy of Lei et al. (2017) who found that an increase in the fraction of sisters lead to an increase in the educational attainment of men and women, using a sample of Chinese aged between 25 and 65. Chen (2020) also found that having a younger sister reduces parental educational aspirations and educational expenditures for firstborn daughters but not for firstborn sons. If the negative birth order effects is driven by worse outcomes for later-born daughters, perhaps due to household resource allocation motivated by son preference, we expect positive coefficient estimates on the variable for the proportion of sisters among siblings.

To clarify the interpretation of the results, we apply two sample restrictions: to sons (Panel A), and to children in the households whose first-born child is a son (Panel B). Further sample restriction would greatly reduce statistical power so that meaningful interpretation of results is difficult.³

Estimates in Table 4 are not significantly different from zero in any of the specifications, making it difficult to draw strong conclusions on whether the fraction of sisters among siblings affect children's outcomes of interest. The coefficients for the fraction of sisters for Chinese and Math are positive in both sample restrictions, consistent with the presence of son preference. However, the signs of the coefficients for cognitive skill, corporal punishment, and parents' checking homework do not consistently support the presence of son

 $^{^{3}}$ There are 428 first-born sons in the sample. Estimates on this subsample are imprecise.

	(1)	(2)	(3)	(4)	(5)
Panel A	Chinese	Math	$\cos.$ Skill	$\operatorname{Corp.Punish}$	Check HW
Fraction of sisters	0.394	0.142	-0.468	0.109	-0.048
	(0.305)	(0.292)	(0.531)	(0.163)	(0.276)
NYS	0.127	0.063	0.354	-0.036	0.036
	(0.123)	(0.142)	(0.264)	(0.052)	(0.110)
N	988	988	952	996	987
adj. R^2	0.293	0.211	0.409	-0.172	0.419
Panel B	Chinese	Math	Cog.Skill	Corp.Punish	Check HW
Panel B Fraction of sisters	Chinese 0.455	Math 0.224	Cog.Skill -0.071	Corp.Punish 0.163	Check HW 0.165
Panel B Fraction of sisters	$\begin{array}{r} \text{Chinese} \\ \hline 0.455 \\ (0.295) \end{array}$	$\frac{\text{Math}}{0.224} \\ (0.274)$	Cog.Skill -0.071 (0.414)	Corp.Punish 0.163 (0.198)	Check HW 0.165 (0.346)
Panel B Fraction of sisters Male	Chinese 0.455 (0.295) -0.108	Math 0.224 (0.274) -0.034	Cog.Skill -0.071 (0.414) -0.169	Corp.Punish 0.163 (0.198) -0.015	Check HW 0.165 (0.346) 0.010
Panel B Fraction of sisters Male	$\begin{array}{r} \text{Chinese} \\ 0.455 \\ (0.295) \\ -0.108 \\ (0.072) \end{array}$	$\begin{array}{r} \text{Math} \\ 0.224 \\ (0.274) \\ -0.034 \\ (0.079) \end{array}$	Cog.Skill -0.071 (0.414) -0.169 (0.159)	Corp.Punish 0.163 (0.198) -0.015 (0.029)	Check HW 0.165 (0.346) 0.010 (0.065)
Panel B Fraction of sisters Male NYS	Chinese 0.455 (0.295) -0.108 (0.072) 0.170**	$\begin{array}{r} {\rm Math}\\ \hline 0.224\\ (0.274)\\ -0.034\\ (0.079)\\ 0.117 \end{array}$	$\begin{array}{c} \text{Cog.Skill} \\ \hline -0.071 \\ (0.414) \\ -0.169 \\ (0.159) \\ 0.465^{***} \end{array}$	Corp.Punish 0.163 (0.198) -0.015 (0.029) -0.073**	$\begin{array}{c} {\rm Check\ HW}\\ 0.165\\ (0.346)\\ 0.010\\ (0.065)\\ 0.001 \end{array}$
Panel B Fraction of sisters Male NYS	$\begin{array}{c} \text{Chinese} \\ \hline 0.455 \\ (0.295) \\ -0.108 \\ (0.072) \\ 0.170^{**} \\ (0.084) \end{array}$	$\begin{array}{r} {\rm Math}\\ \hline 0.224\\ (0.274)\\ -0.034\\ (0.079)\\ 0.117\\ (0.087) \end{array}$	$\begin{array}{c} \text{Cog.Skill} \\ \hline -0.071 \\ (0.414) \\ -0.169 \\ (0.159) \\ 0.465^{***} \\ (0.173) \end{array}$	$\begin{array}{c} {\rm Corp.Punish}\\ 0.163\\ (0.198)\\ -0.015\\ (0.029)\\ -0.073^{**}\\ (0.034) \end{array}$	$\begin{array}{c} {\rm Check\ HW}\\ 0.165\\ (0.346)\\ 0.010\\ (0.065)\\ 0.001\\ (0.068) \end{array}$
Panel B Fraction of sisters Male NYS N	$\begin{array}{c} \text{Chinese} \\ \hline 0.455 \\ (0.295) \\ -0.108 \\ (0.072) \\ 0.170^{**} \\ (0.084) \\ 751 \end{array}$	Math 0.224 (0.274) -0.034 (0.079) 0.117 (0.087) 751	$\begin{array}{c} \text{Cog.Skill} \\ \hline -0.071 \\ (0.414) \\ -0.169 \\ (0.159) \\ 0.465^{***} \\ (0.173) \\ 723 \end{array}$	$\begin{array}{c} {\rm Corp.Punish}\\ 0.163\\ (0.198)\\ -0.015\\ (0.029)\\ -0.073^{**}\\ (0.034)\\ 756 \end{array}$	$\begin{array}{c} {\rm Check\ HW}\\ 0.165\\ (0.346)\\ 0.010\\ (0.065)\\ 0.001\\ (0.068)\\ 747 \end{array}$

Table 4: Effects of the Fraction of Sisters Among Siblings

Note: ***/** significant at the 1/5/10% level. Sample for Panel A is restricted to sons. Sample for Panel B is restricted to those in the households whose firstborn child is a son. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, year fixed effects, and family fixed effects.

preference. The magnitudes of the NYS coefficient are not smaller compared to those in Table 2, suggesting that the presence of younger sisters likely does not explain negative birth order effects.

4.2.3 Test based on strong patrilineal culture

Zhang (2019) showed that clan culture in rural China is positively associated with a set of individual values that emphasize the children's duty to support their parents in old age. The author used the presence of ancestral temple as a proxy for strong clan culture and showed that the residents were more likely to agree that the purpose of raising children was to receive help in old age if there was an ancestral temple in the village. Because expectation of old age support is one of the important determinants of son preference in China, son preference may be stronger in places with an ancestral temple. Consistent with this hypothesis, Zhang found that the presence of an ancestral temple predicted more children, higher likelihood of having a son, higher likelihood of parents living with their son, and smaller likelihood of the parents being enrolled in social pension programs. Similarly, Jayachandran and Pande (2017) found shallower negative birth order gradient in subsamples with weaker son preference in India and interpreted them as evidence that the birth order effects were driven by son preference.

In Table 5, we use Zhang's data on the presence of ancestral temples and interacted the presence of temples with birth order indicators or NYS. If the presence of an ancestral temple is associated with stronger son preference and son preference drives negative birth order effects, then we would expect negative birth

	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	Cog.Skill	Corp.Punish	Check HW
BirthOrder2	-0.084	-0.012	-0.214*	0.043**	-0.051
	(0.055)	(0.059)	(0.115)	(0.021)	(0.047)
BirthOrder3	-0.219*	-0.014	-0.565 **	0.123**	-0.227**
	(0.117)	(0.120)	(0.224)	(0.059)	(0.089)
$\mathrm{BO2}{ imes}\mathrm{temple}$	0.094	0.044	-0.102	-0.000	0.025
	(0.062)	(0.069)	(0.115)	(0.017)	(0.056)
${ m BO3{ imes}temple}$	-0.093	-0.033	0.100	0.006	0.083
	(0.151)	(0.165)	(0.283)	(0.080)	(0.139)
Ν	2028	2028	1936	2042	2029
adj. R2	0.275	0.204	0.399	0.121	0.409
	Chinese	Math	$\cos.$ Skill	Corp.Punish	Check HW
NYS	0.104^{**}	0.018	0.241**	-0.057***	0.102**
	(0.051)	(0.054)	(0.101)	(0.022)	(0.042)
$NYS \times temple$	-0.039	-0.054	0.074	0.009	-0.078
	(0.052)	(0.054)	(0.086)	(0.015)	(0.051)
Ν	2028	2028	1936	2042	2029
adj. R2	0.272	0.207	0.400	0.120	0.410

Table 5: Birth Order Effects by the Presence of Ancestral Temples

Note: ***/**/*: significant at the 1/5/10% level. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

order effects to be stronger in areas with ancestral temples. The results, however, shows that the interaction term coefficients are not significantly different from zero and do not share the same signs as the coefficients for the birth order variables. The evidence does not reject the null hypothesis that birth order effects remain the same in areas with ancestral temples and in areas without ancestral temples, which proxy strong local patrilineal culture.

4.2.4 Test based on One Child Policy

Ebenstein (2010) showed that the severity of OCP, as measured by the amount of fine required to pay in case of violating OCP, is associated with higher son-to-daughter ratio and smaller family size. OCP may have provided extra incentive for families with son preference to use sex-selective abortion, or to allocate relatively more resources to sons, because the cost of having more children to have another son would be prohibitively high for many. Then, if son preference drives birth order effects, the effects would be stronger in areas with high OCP fine rate, to the extent that OCP reinforces household behavior based on son preference.

We use the data collected by Ebeinstein on provincial fine rate in units of average worker's annual wages and calculate province-specific fine averages.⁴ Then, we create indicators for being above sample median in the value of average OCP fines, interacted with birth order effects variables. The results in Table 6 does not

 $^{^{4}}$ We do this because the range of years covered by Ebeinstein's data does not fully overlap with the range of years in our sample.

			-		
	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	$\cos.$ Skill	Corp.Punish	Check HW
BirthOrder2	-0.095	0.007	-0.231*	0.053^{**}	-0.059
	(0.063)	(0.064)	(0.122)	(0.023)	(0.050)
BirthOrder3	-0.205	0.064	-0.473^{*}	0.172^{**}	-0.295 * * *
	(0.143)	(0.144)	(0.278)	(0.080)	(0.099)
$\mathrm{BO2}{ imes}\mathrm{high}\ \mathrm{fine}$	0.085*	-0.002	-0.023	-0.024	0.021
	(0.049)	(0.055)	(0.097)	(0.017)	(0.044)
${ m BO3 imes high fine}$	-0.027	-0.119	-0.133	-0.088	0.138
	(0.150)	(0.152)	(0.281)	(0.084)	(0.108)
N	2020	2020	1928	2034	2021
adj. R^2	0.278	0.206	0.400	0.125	0.409
	Chinese	Math	$\cos.$ Skill	Corp.Punish	Check HW
NYS	0.101*	-0.014	0.244 * *	-0.062**	0.099^{**}
	(0.057)	(0.057)	(0.107)	(0.025)	(0.045)
$NYS \times high fine$	-0.031	0.018	0.034	0.017	-0.021
	(0.041)	(0.043)	(0.075)	(0.015)	(0.044)
N	2020	2020	1928	2034	2021
adj. R^2	0.274	0.207	0.401	0.121	0.407

Table 6: Birth Order Effects by One Child Policy

Note: ***/**/*: significant at the 1/5/10% level. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

show stronger birth order effects in areas with high OCP fine rate. The magnitudes of interaction coefficients are generally small and insignificant.

5 Discussion and Conclusion

We use multiple waves of CFPS to investigate birth order effects on children's outcomes, potential channels of birth order effects via parenting styles, and their mechanisms due to son preference. We find negative birth order effects on academic achievement and cognitive skill outcome. We also find negative birth order effects on the parents' use of corporal punishment and supervision of child's homework. We highlight parents' use of harsh parenting as a novel channel that lead to negative birth order effects. Parents were less likely to use corporal punishment to earlier-born children, which has known harmful effects on children's development (Fiorini and Keane, 2014; Kim et al., 2018).

While there may be several mechanisms underlying birth order effects, we focus on one particular mechanism, son preference, that is important in Chinese context. We propose a decomposition of the estimates of birth order effects by different subgroups based on the gender composition of siblings in households. The subsample consisting of households with earlier-born sons and later-born daughters explain a sizable part of birth order effects on achievement outcomes, consistent with the presence of son preference. However, subsample of households with earlier-born daughters and later-born sons also show negative birth order effects, especially on parenting styles. It is difficult to reconcile the effects of son preference with negative birth order effects on such households.

We also implement tests of son preference based on the gender of older siblings, fraction of female siblings, measures of patrilineal family tradition, and the intensity of OCP. The null hypotheses of these tests are consistent with limited to no role of son preference in explaining birth order effects. None of our tests reject the null hypotheses.

Our estimates of birth order effects are in contrast to other findings by Weng et al. (2019). An important difference between our study and theirs may be that ours is based on a sample of adolescents in contemporary China, while the sample in Weng et al. (2019) is from earlier generations of Chinese siblings (average age is 47.55 in 2014; see Table 1 in Weng et al. (2019)). Furthermore, studies showing evidence consistent with strong presence of son preference, such as Lei et al. (2017) and Chen (2020), use sample of Chinese adults, also belonging to earlier generation of Chinese compared to those in our sample. These findings are consistent with projections made by other researchers that the effects of son preference in China would grow weaker over time (Murphy et al. (2011)). Together with the finding of negative birth order effects, these results on son preference suggest that family dynamics in contemporary China is more similar to those found in other countries also showing negative birth order effects.

Statements and Declarations Authors declare no conflict of interest.

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A Appendix

	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	Cog.Skill	Corp . Punish	${\rm Check}~{\rm HW}$
BirthOrder2	-0.018	-0.011	-0.232	0.047^{*}	-0.030
	(0.072)	(0.076)	(0.151)	(0.025)	(0.056)
N	1448	1448	1387	1456	1446
adj. R^2	0.286	0.207	0.380	0.188	0.454
	Chinese	Math	$\cos.$ Skill	Corp.Punish	Check HW
NYS	0.018	0.011	0.232	-0.047*	0.030
	(0.072)	(0.076)	(0.151)	(0.025)	(0.056)
N	1448	1448	1387	1456	1446
adj. R^2	0.286	0.207	0.380	0.188	0.454

 Table A1: Effects of Birth Order on Academic Achievement and Parenting Style

 Restriction: Two-child families

Note: ***/**/*: significant at the 1/5/10% level. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects. The sample is restricted families with two children (regardless of age) at the time of the survey.

	(1)	(2)	(3)	(4)	(5)		
	Chinese	Math	Cognitive Skill	Corp. Punish.	Check HW		
BirthOrder2	-0.108	-0.097	-0.444**	0.037	0.041		
	(0.082)	(0.098)	(0.191)	(0.036)	(0.076)		
BirthOrder3	-0.489***	-0.317*	-0.938**	0.162^{**}	-0.050		
	(0.168)	(0.169)	(0.369)	(0.074)	(0.139)		
Ν	751	751	723	756	747		
adj. R2	0.333	0.169	0.416	0.130	0.452		
	$\mathbf{Chinese}$	Math	Cognitive Skill	Corp. Punish.	Check HW		
nys	0.195^{**}	0.130	0.461***	-0.064**	0.010		
	(0.080)	(0.082)	(0.171)	(0.032)	(0.066)		
Ν	751	751	723	756	747		
adj. R2	0.322	0.167	0.417	0.122	0.451		

Table A2: Birth Order Effects when the First Child is a Son

Note: ***/**/*: significant at the 1/5/10% level. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	Cognitive Skill	Corp. Punish.	Check HW
BirthOrder2	-0.059	0.050	-0.140	0.042	-0.071
	(0.082)	(0.085)	(0.151)	(0.030)	(0.068)
BirthOrder3	-0.114	0.168	-0.282	0.109	-0.258**
	(0.140)	(0.149)	(0.264)	(0.067)	(0.112)
Ν	1277	1277	1213	1286	1282
adj. R2	0.263	0.239	0.390	0.161	0.417
	Chinese	Math	Cognitive Skill	Corp. Punish.	Check HW
nys	0.058	-0.076	0.141	-0.054*	0.115**
	(0.069)	(0.074)	(0.130)	(0.031)	(0.056)
Ν	1277	1277	1213	1286	1282
adj. R2	0.264	0.240	0.391	0.162	0.416

Table A3: Birth Order Effects when the First Child is a Daughter

Note: ***/**: significant at the 1/5/10% level. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

	(1)	(2)	(3)	(4)	(5)		
	Chinese	Math	Cognitive Skill	Corp. Punish.	Check HW		
BirthOrder2	-0.163**	-0.027	-0.211	0.078**	-0.075		
	(0.080)	(0.086)	(0.179)	(0.031)	(0.073)		
BirthOrder3	-0.442***	-0.052	-0.656 * *	0.185 * * *	-0.219		
	(0.147)	(0.158)	(0.328)	(0.071)	(0.138)		
Ν	1000	1000	955	1007	998		
adj. R2	0.315	0.222	0.470	0.164	0.412		
	Chinese	Math	Cognitive Skill	Corp. Punish.	Check HW		
nys	0.203^{***}	0.026	0.293*	-0.089***	0.099		
	(0.072)	(0.077)	(0.160)	(0.031)	(0.066)		
Ν	1000	1000	955	1007	998		
adj. R2	0.314	0.224	0.469	0.164	0.412		

Table A4: Birth Order Effects for Low-Income Households

Note: ***/**: significant at the 1/5/10% level. Households with annual income below sample median are included. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	Cognitive Skill	Corp. Punish.	Check HW
BirthOrder2	0.023	0.005	-0.255*	0.036	-0.027
	(0.077)	(0.081)	(0.152)	(0.025)	(0.065)
BirthOrder3	-0.041	-0.002	-0.354	0.105	-0.207
	(0.160)	(0.165)	(0.272)	(0.065)	(0.130)
Ν	1028	1028	981	1035	1031
adj. R2	0.300	0.185	0.375	0.284	0.482
	Chinese	Math	Cognitive Skill	Corp. Punish.	Check HW
nys	-0.001	-0.006	0.211	-0.043	0.074
	(0.070)	(0.072)	(0.133)	(0.026)	(0.059)
Ν	1028	1028	981	1035	1031
adj. R2	0.300	0.187	0.376	0.283	0.480

Table A5: Birth Order Effects for High-Income Households

Note: ***/*: significant at the 1/5/10% level. Households with annual income above sample median are included. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

(1)	(2)	(3)	(4)	(5)			
Chinese	Math	Cognitive Skill	Corp. Punish.	$\operatorname{Check}\operatorname{HW}$			
-0.027	0.030	-0.251**	0.048**	-0.054			
(0.056)	(0.060)	(0.120)	(0.021)	(0.048)			
-0.220*	0.019	-0.553 * * *	0.136^{***}	-0.208**			
(0.115)	(0.116)	(0.213)	(0.052)	(0.088)			
1875	1875	1787	1887	1876			
0.289	0.213	0.387	0.112	0.431			
Chinese	Math	Cognitive Skill	Corp. Punish.	${ m Check}\;{ m HW}$			
0.076	-0.020	0.267^{**}	-0.060***	0.087**			
(0.053)	(0.054)	(0.104)	(0.022)	(0.042)			
1875	1875	1787	1887	1876			
0.285	0.214	0.387	0.110	0.430			
	$\begin{array}{c} (1)\\ {\rm Chinese}\\ -0.027\\ (0.056)\\ -0.220^*\\ (0.115)\\ 1875\\ 0.289\\ {\rm Chinese}\\ 0.076\\ (0.053)\\ 1875\\ 0.285\\ \end{array}$	$\begin{array}{c cccc} (1) & (2) \\ Chinese & Math \\ \hline -0.027 & 0.030 \\ (0.056) & (0.060) \\ -0.220^* & 0.019 \\ (0.115) & (0.116) \\ 1875 & 1875 \\ 0.289 & 0.213 \\ \hline \\ Chinese & Math \\ \hline 0.076 & -0.020 \\ (0.053) & (0.054) \\ 1875 & 1875 \\ 0.285 & 0.214 \\ \hline \end{array}$	$\begin{array}{c cccccc} (1) & (2) & (3) \\ \hline \\ Chinese & Math & Cognitive Skill \\ \hline & -0.027 & 0.030 & -0.251^{**} \\ (0.056) & (0.060) & (0.120) \\ & -0.220^* & 0.019 & -0.553^{***} \\ (0.115) & (0.116) & (0.213) \\ 1875 & 1875 & 1787 \\ \hline & 0.289 & 0.213 & 0.387 \\ \hline \\ \hline \\ Chinese & Math & Cognitive Skill \\ \hline & 0.076 & -0.020 & 0.267^{**} \\ (0.053) & (0.054) & (0.104) \\ 1875 & 1875 & 1787 \\ \hline & 0.285 & 0.214 & 0.387 \\ \hline \end{array}$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			

Table A6: Birth Order Effects for Rural Households

Note: ***/*: significant at the 1/5/10% level. Respondents hold rural hukou. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

	(1)	(2)	(3)	(4)	(5)
	Chinese	Math	Cognitive Skill	Corp. Punish.	$\operatorname{Check}\operatorname{HW}$
BirthOrder2	-0.261	-0.166	-0.162	-0.053	0.034
	(0.227)	(0.186)	(0.261)	(0.098)	(0.210)
BirthOrder3	-0.130	-0.087	-0.531	-0.126	-0.303
	(0.500)	(0.473)	(0.603)	(0.150)	(0.326)
Ν	153	153	149	155	153
adj. R2	0.126	0.114	0.426	0.128	0.287
	Chinese	Math	Cognitive Skill	Corp. Punish.	$\operatorname{Check}\operatorname{HW}$
nys	0.167	0.107	0.211	0.058	0.057
	(0.205)	(0.185)	(0.262)	(0.085)	(0.167)
Ν	153	153	149	155	153
adj. R2	0.114	0.118	0.432	0.141	0.274

Table A7: Birth Order Effects for Urban Households

Note: ***/** /*: significant at the 1/5/10% level. Respondents hold urban hukou. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects.

Chinese					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.153	0.384	0.206	0.195	0.061
sub-sample coefficient	-0.110	-0.009	-0.041	-0.065	-0.136
weight \times coefficient	-0.017	-0.003	-0.008	-0.013	-0.008
Math					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.153	0.384	0.206	0.195	0.061
sub-sample coefficient	-0.150	0.031	0.012	0.029	0.073
weight \times coefficient	-0.023	0.012	0.002	0.006	0.004
Cognitive Skill					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.159	0.379	0.204	0.195	0.063
sub-sample coefficient	-0.352	-0.145	-0.425	-0.220	0.084
weight \times coefficient	-0.056	-0.055	-0.087	-0.043	0.005
Corporal Punishment					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.155	0.383	0.205	0.196	0.061
sub-sample coefficient	0.076	0.057	0.028	0.035	-0.023
weight \times coefficient	0.012	0.022	0.006	0.007	-0.001
Check HW					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.154	0.383	0.203	0.199	0.061
sub-sample coefficient	-0.043	-0.050	0.019	-0.155	0.015
weight \times coefficient	-0.007	-0.019	0.004	-0.031	0.001

 Table A8: Decomposition for Birth Order 2 Coefficient

	r				
Chinese					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.111	0.364	0.182	0.121	0.222
sub-sample coefficient	-0.136	-0.040	-0.074	-0.095	-0.166
weight \times coefficient	-0.015	-0.015	-0.013	-0.012	-0.037
Math					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.111	0.364	0.182	0.121	0.222
sub-sample coefficient	-0.156	0.024	0.005	0.022	0.066
weight \times coefficient	-0.017	0.009	0.001	0.003	0.015
Cognitive Skill					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.115	0.375	0.177	0.104	0.229
sub-sample coefficient	-0.309	-0.113	-0.399	-0.185	0.118
weight \times coefficient	-0.035	-0.042	-0.071	-0.019	0.027
Corporal Punishment					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.110	0.370	0.180	0.120	0.220
sub-sample coefficient	0.077	0.060	0.033	0.038	-0.015
weight \times coefficient	0.008	0.022	0.006	0.005	-0.003
Check HW					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.110	0.370	0.180	0.120	0.220
sub-sample coefficient	-0.070	-0.083	-0.017	-0.186	-0.017
weight \times coefficient	-0.008	-0.031	-0.003	-0.022	-0.004

Table A9: Decomposition for Birth Order 3 Coefficient

$\operatorname{Chinese}$					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.070	0.224	0.222	0.306	0.178
sub-sample coefficient	0.154	0.024	0.126	0.042	0.174
weight \times coefficient	0.011	0.005	0.028	0.013	0.031
Math					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.070	0.224	0.222	0.306	0.178
sub-sample coefficient	0.179	-0.055	0.055	-0.048	-0.098
weight \times coefficient	0.013	-0.012	0.012	-0.015	-0.017
Cognitive Skill					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.072	0.226	0.218	0.301	0.184
sub-sample coefficient	0.204	0.174	0.511	0.172	0.220
weight \times coefficient	0.015	0.039	0.111	0.052	0.040
Corporal Punishment					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.070	0.225	0.220	0.309	0.176
sub-sample coefficient	-0.085	-0.054	-0.056	-0.055	0.008
weight \times coefficient	-0.006	-0.012	-0.012	-0.017	0.001
Check HW					
$\operatorname{sub-sample}$	boy-boy	girl-boy	boy-girl	girl-girl	other
weight	0.070	0.225	0.217	0.311	0.177
sub-sample coefficient	0.094	0.107	0.013	0.162	0.037
weight \times coefficient	0.007	0.024	0.003	0.050	0.007

Table A10: Decomposition for NYS Coefficient

Table A11: Outcome of the Youngest Son by the Gender of the First-born ChildRestriction: Two-child families

	(1)	(2)	(3)	(4)	(5)		
	Chinese	Math	$\cos.$ Skill	Corp.Punish	Check HW		
First-born is a son	0.165^{**}	-0.039	0.049	0.004	-0.048		
	(0.083)	(0.095)	(0.157)	(0.032)	(0.069)		
Ν	1108	1108	1060	1115	1109		
adj. R2	0.258	0.246	0.440	0.098	0.451		

Note: **: significant at the 5% level. Cog.Skill: Cognitive skill. Corp.Punish: Parent's self-reported intention to use corporal punishment in response to children's low grades at school. NYS: number of younger siblings. Control variables include father's education level, mother's education level, rural hukou status, number of siblings, household income, child's age, gender, year fixed effects, and family fixed effects. The sample is restricted families with two children (regardless of age) at the time of the survey.