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Fathers as Caregivers: Peer Exposure to Household Gender Roles and Girls' Beliefs and Achievement

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Abstract

Gender roles are shaped within families, but whether family gender-role arrangements extend beyond households and influence other children remains unclear. This paper studies whether exposure to peers from father-dominant caregiving households affects students' gender beliefs and educational outcomes. Using nationally representative data from Chinese middle schools and exploiting quasi-random classroom assignment, I show that exposure to a higher share of peers from households in which fathers provide most parental caregiving reduces girls' likelihood of believing that boys are better than girls at mathematics. This exposure also increases girls' mathematics self-beliefs and improves their subsequent mathematics achievement. The effects are concentrated among girls and are accompanied by more positive reported classroom experiences. These findings provide the first causal evidence that the division of caregiving within peers' families can shape girls' gender beliefs and educational outcomes.

Keywords: gender norms, belief formation, peer effects, human capital

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1 Introduction

Gender roles are learned through the environments in which children grow up. The division of responsibilities between mothers and fathers within the household provides children with everyday signals about gender roles, shaping their beliefs about ability, identity, and social expectations (Akerlof & Kranton, 2000; Bisin & Verdier, 2001; Davis & Greenstein, 2009; Jayachandran, 2015). A large literature has shown that families are central to the intergenerational transmission of gender norms: children learn not only from parents' stated beliefs, but also from the behaviors and roles they observe within the household (Bertrand, Kamenica, & Pan, 2015; Bisin & Verdier, 2001; Farré & Vella, 2013; Fernández & Fogli, 2009; Fernández, Fogli, & Olivetti, 2004; Johnston, Schurer, & Shields, 2014). Existing research, however, has primarily emphasized mothers' education, labor-market behavior, and gender-role attitudes as sources of transmission (Fernández & Fogli, 2009; Fernández et al., 2004; Johnston et al., 2014; Olivetti, Patacchini, & Zenou, 2020). Much less is known about whether fathers' roles within the household, particularly their participation in caregiving, shape children's beliefs about gender roles and ability. Although research has documented the importance of paternal involvement for children's development (Cabrera, Tamis-LeMonda, Bradley, Hofferth, & Lamb, 2000; Hsin & Felfe, 2014; Lamb, 2010), less is known about whether fathers' caregiving roles generate broader social effects beyond their own children.

Gender beliefs matter because they influence how children evaluate their own abilities and educational opportunities. In mathematics, beliefs that boys are naturally better suited for quantitative fields can shape students' self-confidence, engagement, and future choices, contributing to persistent gender gaps in STEM (Bian, Leslie, & Cimpian, 2017; Bordalo, Coffman, Gennaioli, & Shleifer, 2019; Carlana, 2019; Fortin, 2005; Guiso, Monte, Sapienza, & Zingales, 2008). Such beliefs can also influence educational choices and competitive preferences in settings where boys and girls face different expectations (Niederle & Vesterlund, 2010). Adolescents' gender attitudes also respond to school-based interventions (Dhar, Jain, & Jayachandran, 2022). However, children do not develop such beliefs exclusively within

households. Social learning through observed behaviors and role models can shape individuals’ beliefs about what roles and abilities are possible (Bandura, 1977; Beaman, Chattopadhyay, Duflo, Pande, & Topalova, 2009; Beaman, Duflo, Pande, & Topalova, 2012). When children enter school, peers become an important social environment through which behaviors, expectations, and beliefs can spread (Eble & Hu, 2022; Feld & Zölitz, 2017; Sacerdote, 2011). Yet little is known about whether family practices themselves, such as how mothers and fathers divide caregiving responsibilities, can extend beyond households through peer networks.

This paper studies whether exposure to peers from father-dominant caregiving households affects students’ gender beliefs, mathematics beliefs, classroom experiences, and academic outcomes. I provide the first causal evidence that the division of caregiving within peers’ families can shape girls’ gender beliefs and educational outcomes. I show that exposure to peers from father-dominant caregiving households changes students’ beliefs about gender and academic ability. These effects are particularly pronounced among girls: exposure to peers from households where fathers take a larger role in caregiving reduces girls’ endorsement of male-typed beliefs about mathematics and improves their own perceptions of mathematical ability. These changes in beliefs are accompanied by improvements in girls’ mathematics achievement and more supportive classroom experiences. The findings demonstrate that family gender-role arrangements can shape children’s beliefs and educational outcomes through social environments outside the household.

I study this question using data from the China Education Panel Survey (CEPS), a nationally representative survey of Chinese middle school students. The research design exploits random variation in peer exposure generated by random classroom assignment in Chinese middle schools (Eble & Hu, 2020,2; Gong, Lu, & Song, 2018; Hu, 2015). Specifically, among schools that assign students to classrooms using random assignment rules, I compare students within the same school who are exposed to different shares of peers from father-dominant caregiving households. This approach allows me to isolate the effect of peers’

family gender-role environments from differences across schools, neighborhoods, and other characteristics that may shape children’s beliefs and educational outcomes.

This paper has three main findings. First, I show that exposure to peers from father-dominant caregiving households shapes students’ gender beliefs about mathematical ability. Among girls, a one-standard-deviation increase in exposure to peers from father-dominant caregiving households reduces the likelihood of believing that boys are better at mathematics by 4.5 percentage points. The corresponding estimate for boys is small and statistically indistinguishable from zero. These results provide evidence that family gender-role practices can extend beyond the household and influence children’s gender beliefs through peer networks.

Second, I show that these changes in gender beliefs are accompanied by broader improvements in girls’ educational experiences and outcomes. Exposure to father-dominant caregiving peers increases girls’ mathematics beliefs by 0.071 standard deviations and raises their mathematics achievement by 0.043 standard deviations. It is also associated with more positive reported classroom experiences, including greater perceived mathematics teacher engagement and recognition. These findings suggest that exposure to counter-stereotypical family gender roles influences not only what students believe about gender differences, but also how they evaluate their own academic ability and experience the classroom environment.

Third, I examine heterogeneity in the transmission of family gender-role environments. The effects on girls’ gender beliefs are larger among girls with more educated mothers. Each additional year of mothers’ schooling makes the estimated effect of a one-standard-deviation increase in peer father-dominant caregiving exposure on girls’ gender beliefs 0.57 percentage points more negative. The corresponding interaction for boys is small and statistically insignificant. This heterogeneity suggests that girls from more educated families may be more responsive to gender-role information conveyed through their social environments.

This paper makes three contributions. First, it contributes to research on the intergenerational transmission of gender norms by examining whether the division of caregiving between

mothers and fathers generates effects beyond the household. Existing research links parental behavior and family environments to the formation and persistence of gender norms (Bisin & Verdier, 2001; Fernández & Fogli, 2009; Fernández et al., 2004), while research on fathers' involvement emphasizes its implications for their own children's development (Cabrera et al., 2000; Lamb, 2010). Eble and Hu (2022) show that parental gender beliefs can affect other children through peers. I extend this analysis to the division of caregiving within peers' households, showing that exposure to classmates from father-dominant caregiving households affects girls' gender beliefs about mathematical ability.

Second, this paper contributes to research on gender beliefs and educational inequality. Previous studies show that gender stereotypes shape children's interests, self-beliefs, and educational outcomes (Bian et al., 2017; Bordalo et al., 2019; Carlana, 2019). Related work finds that exposure to female instructors affects female students' performance and subsequent STEM choices (Carrell, Page, & West, 2010), and that female top scorers improve girls' subsequent academic performance (Qin, Wang, & Zhang, 2026). I show that counter-stereotypical gender-role exposure can also originate in peers' families. Exposure to father-dominant caregiving peers improves girls' mathematics self-beliefs, achievement, and reported classroom experiences.

Third, this paper contributes to research on peer effects by examining parental caregiving arrangements as a dimension of peer family backgrounds. Studies using random assignment identify peer effects on educational outcomes (Duflo, Dupas, & Kremer, 2011; Sacerdote, 2001), while other work examines peers' gender composition and parental education (Fruehwirth & Gagate-Miranda, 2019; Lavy & Schlosser, 2011). Reviews discuss the magnitude and channels of these effects (Sacerdote, 2011). More closely related studies examine peers' parental beliefs and maternal employment (Chen, Chung, & Wang, 2025; Eble & Hu, 2022; Olivetti et al., 2020). I extend this literature to the division of caregiving between mothers and fathers, estimating how exposure to peers from households with different caregiving arrangements affects students' beliefs and educational outcomes.

2 Background

This section describes the institutional setting, data, and construction of the peer father-dominant caregiving measure. I first explain why Chinese middle schools provide a useful setting for studying the social transmission of gender roles. I then describe the two-wave CEPS data, the estimation sample, and the main outcomes. Finally, I define father-dominant caregiving and the corresponding leave-one-out classroom peer measure that forms the key explanatory variable in the analysis.

2.1 Setting

My analysis takes place in Chinese middle schools. This setting has three features that make it useful for studying whether gender roles originating in families extend beyond the household and shape other children’s beliefs and educational outcomes.

The first feature is the coexistence of traditional caregiving arrangements and gendered beliefs about mathematical ability. The division of caregiving between mothers and fathers provides an observable measure of gender-role behavior within the household. Among households with valid caregiving information, fathers’ average share of parental caregiving is 29.4 percent, and 5.9 percent of households have fathers providing at least 75 percent. These father-dominant arrangements depart substantially from the conventional division in which mothers assume the primary caregiving role. They may provide information that family responsibilities need not follow traditional gender roles. Students may convey this information to classmates through their attitudes, conversations, and behavior, potentially influencing how other children interpret gender differences in roles and abilities, including mathematical ability. This interpretation is consistent with research on the transmission of gender norms across generations and through social environments (Bisin & Verdier, 2001,1; Eble & Hu, 2022; Olivetti et al., 2020), and with evidence that peers’ family backgrounds affect other students’ beliefs and educational outcomes (Chen et al., 2025; Fruehwirth & Gagete-Miranda,

2019).

The second feature is the developmental stage I study. Students enter middle school in Grade 7 after completing primary school and encounter a substantially more demanding mathematics curriculum. This transition provides an important period during which students may update beliefs about their own mathematical ability and about who is likely to succeed in mathematics (Eble & Hu, 2020,2). In my sample, girls outperform boys in mathematics but report weaker mathematics beliefs. Before entering middle school, girls' average math-belief measure is 2.75, compared with 3.03 among boys. In Grade 7, the corresponding averages are 2.36 and 2.52. Girls are also 16 percentage points less likely than boys to endorse the belief that boys are better than girls at mathematics. These patterns make the transition to middle school a useful setting for studying beliefs.

The third feature is the institutional assignment of students to classrooms. Chinese middle schools generally avoid ability tracking and assign entering students across classrooms using random assignment procedures. Students are typically assigned to classrooms when they enter Grade 7 and remain with the same classmates throughout middle school. Previous studies using CEPS have exploited this institutional feature to study peer and teacher effects (Eble & Hu, 2020,2; Gong et al., 2018; Hu, 2015). I follow this literature by restricting the analysis to schools that report random classroom assignment and do not subsequently resort students across classrooms. Conditional on school fixed effects, this design compares students within the same school who are exposed to different peer caregiving environments because of classroom assignment rather than differences in academic ability, school choice, and family background.

2.2 Data

This paper combines the first two waves of the China Education Panel Survey (CEPS), a nationally representative longitudinal survey of middle school students in mainland China conducted by the National Survey Research Center at Renmin University of China. The

baseline survey was administered during the 2013–2014 academic year and sampled approximately 20,000 students in Grades 7 and 9 using a multistage probability-proportional-to-size sampling design. Within sampled schools, classes were randomly selected and all students in selected classes were surveyed. The CEPS links student questionnaires to information from parents, homeroom teachers, subject teachers, and school administrators, as well as administrative records on academic performance.

I focus on students who entered the CEPS in Grade 7 and were followed into Grade 8 in the 2014–2015 academic year. This restriction serves two purposes. First, it allows me to observe students during the transition into middle school and again after an additional year of exposure to their assigned peers. Second, the follow-up survey contains the parental caregiving information used to characterize the family gender-role environments of students' peers. After restricting the sample to schools that retain the classroom-assignment conditions described above, the analysis sample contains 5,472 students in 120 classrooms across 72 schools. Because the primary question concerns how counter-stereotypical family gender roles affect girls, the main outcome analysis focuses on female students, while results for boys provide an important comparison.

The CEPS provides several measures of students' beliefs and educational outcomes. The first is a measure of gender belief. Students are asked whether they agree that boys are better than girls at mathematics. I construct an indicator equal to one for students who endorse this statement and zero otherwise. This outcome captures a gendered belief about mathematical ability rather than students' assessments of their own performance.

The second outcome is students' belief about their own mathematical ability. The CEPS asks students how difficult they find learning mathematics, with responses ranging from 1 to 4. I code this measure so that higher values indicate stronger perceived mathematical ability.

The third main outcome is mathematics achievement. The CEPS obtains students' midterm mathematics scores directly from school administrative records. Students within

a given school and grade take the same examination, making scores comparable within the relevant comparison group. I use achievement in both Grades 7 and 8. When studying Grade 8 achievement, I condition on Grade 7 mathematics performance to account for students’ prior achievement.

I retain the gender-belief indicator in its original 0/1 form and standardize all other outcome variables in the regression analysis. Effects on gender beliefs are therefore reported in percentage points, while effects on other outcomes are reported in standard deviations.

I also examine outcomes that help characterize students’ educational experiences following exposure to different peer family environments. These include educational expectations and students’ interactions with their mathematics teachers, including how frequently they report being called on and praised by the teacher. These outcomes are useful for assessing whether the effects associated with peer family gender roles extend beyond stated beliefs to the classroom experiences and investments that accompany subsequent achievement.

Table 1 reports descriptive statistics for the analysis sample. Several patterns motivate the analysis. Girls perform better than boys in mathematics but report weaker beliefs about their own mathematical ability. They are also less likely to endorse male superiority in mathematics. The combination of stronger observed performance and weaker self-beliefs mirrors a broader literature documenting gender differences in mathematical confidence, stereotypes, and educational choices (Bordalo et al., 2019; Carlana, 2019; Niederle & Vesterlund, 2010).

2.3 Measure of Peer Father-Dominant Caregiving

The key explanatory variable is the share of peers from households in which fathers provide most parental caregiving. The follow-up CEPS parent questionnaire separately records daily-life caregiving provided by the student’s father and mother. I define the father’s share of total parental caregiving as

$$FatherShare_i = \frac{FatherCare_i}{FatherCare_i + MotherCare_i}, \quad (1)$$

Table 1: Summary Statistics

Variable	(1) All Students	(2) Girls	(3) Boys	(4) Girls – Boys	(5) N
<i>Panel A. Student and family characteristics</i>					
Age	13.252 (0.009)	13.187 (0.013)	13.312 (0.013)	−0.125	5333
Ethnic minority	0.119 (0.004)	0.123 (0.006)	0.116 (0.006)	0.007	5456
Mother’s education (years)	10.037 (0.050)	10.158 (0.071)	9.925 (0.070)	0.233	5459
Father’s education (years)	10.763 (0.045)	10.842 (0.065)	10.689 (0.063)	0.153	5459
Agricultural <i>hukou</i>	0.448 (0.007)	0.437 (0.010)	0.459 (0.010)	−0.022	5079
Household economic status	2.873 (0.008)	2.882 (0.011)	2.864 (0.011)	0.018	5450
Only child	0.489 (0.007)	0.463 (0.010)	0.513 (0.009)	−0.050	5472
Attended preschool	0.828 (0.005)	0.830 (0.007)	0.826 (0.007)	0.004	5423
Repeated a grade	0.120 (0.004)	0.108 (0.006)	0.132 (0.006)	−0.024	5461
<i>Panel B. Academic beliefs and achievement</i>					
Grade 7 math score	70.173 (0.135)	71.030 (0.189)	69.369 (0.192)	1.661	5327
Grade 6 math belief	2.895 (0.014)	2.749 (0.019)	3.032 (0.019)	−0.282	5431
Parent gendered math belief	0.401 (0.007)	0.365 (0.010)	0.435 (0.010)	−0.070	4895
<i>Panel C. Caregiving environments</i>					
Father caregiving hours	1.684 (0.052)	1.667 (0.075)	1.701 (0.071)	−0.035	4747
Mother caregiving hours	3.380 (0.068)	3.611 (0.103)	3.161 (0.090)	0.450	4638
Father share of parental caregiving	0.294 (0.005)	0.277 (0.006)	0.310 (0.006)	−0.033	3773
Father-dominant caregiving	0.059 (0.004)	0.052 (0.005)	0.067 (0.006)	−0.015	3773
Peer father-dominant caregiving	0.063 (0.001)	0.061 (0.001)	0.064 (0.001)	−0.003	5472

Notes: This table reports summary statistics. Columns (1)–(3) report means for all students, girls, and boys, with standard errors in parentheses. Column (4) reports the girls-minus-boys difference, and column (5) reports the number of non-missing observations. All indicator variables are coded as 0 = No and 1 = Yes. Father caregiving share is the father’s share of total parental caregiving. Father-dominant caregiving equals one if the father provides at least 75 percent of total parental caregiving. Peer father-dominant caregiving is the leave-one-out classroom share of peers from such households.

for households in which at least one parent provides positive caregiving time. I classify a household as father-dominant if the father provides at least 75 percent of total parental caregiving. Approximately 6 percent of households with valid caregiving information satisfy this definition. The 75 percent threshold is intended to capture a clear departure from the traditional gender division of caregiving rather than small differences in care provided by mothers and fathers. In robustness checks, I use alternative thresholds of 70, 80, and 85 percent.

I use this household measure to construct a student-level measure of exposure to father-dominant caregiving among randomly assigned peers. Specifically, for each student I calculate the leave-one-out share of peers from father-dominant households,

$$PeerFatherDominant_{ic} = \frac{\sum_{j \in c, j \neq i} FatherDominant_j}{\sum_{j \in c, j \neq i} \mathbf{1}\{FatherDominant_j \text{ observed}\}}. \quad (2)$$

The leave-one-out construction ensures that a student’s own household arrangement does not mechanically enter the peer measure. I standardize this variable throughout the regression analysis, so that coefficients correspond to a one-standard-deviation increase in exposure to peers from father-dominant caregiving households.

Because parental daily-life caregiving is observed after classroom assignment, two potential sources of feedback warrant consideration. First, fathers may assume greater responsibility for their children’s daily care in response to academic difficulties. Appendix Table A1 compares father-dominant caregiving households with other households. The reported differences in mothers’ and fathers’ education, children’s mathematics achievement, and mathematics self-beliefs are not statistically significant.

Second, mathematics teachers’ requests may prompt parents to adjust their division of daily-life caregiving. Appendix Table A4 examines whether observable mathematics teacher characteristics predict peer father-dominant caregiving exposure, conditional on school fixed effects. The joint test fails to reject that the coefficients on these characteristics are zero, providing no evidence of systematic differences in observed teacher characteristics across peer

caregiving environments.

These comparisons and balance tests provide indirect checks on the two potential sources of feedback. I regard the underlying division of daily-life caregiving as a relatively persistent household arrangement over the study period. I therefore interpret the measure as capturing household gender roles and a family environment through which gender norms may be transmitted to children (Bisin & Verdier, 2001; Fernández & Fogli, 2009; Fernández et al., 2004). This interpretation assumes that classroom assignment does not systematically alter parents' subsequent caregiving arrangements.

Appendix Figures A1 – A3 describe the variation in this measure. Across the estimation sample, the mean share of peers from father-dominant caregiving households is 0.063, with a standard deviation of 0.052 and a range from 0 to 0.40. Figure A.1 shows substantial variation in exposure to father-dominant caregiving across classrooms. Figures A.2 and A.3 show that meaningful variation remains across classrooms within the same school, which is the variation used in the empirical analysis. Thus, the data provide sufficient within-school variation in peer father-dominant caregiving exposure to estimate the effects of these family environments through peer networks.

3 Estimation Strategy

This section describes the empirical strategy used to estimate the effect of exposure to peers from father-dominant caregiving households. I first describe the classroom assignment restrictions that generate identifying variation and assess balance in the key peer exposure measure. I then introduce the estimating equation and define the coefficient of interest.

3.1 Random Classroom Assignment

The empirical strategy uses variation in classroom peer composition within Chinese middle schools. I restrict the sample to schools in which entering Grade 7 students are assigned

across classrooms using random assignment procedures and are not subsequently re-sorted across classrooms. Students typically remain with the same peers as they progress through middle school. Under these restrictions, differences in classroom composition within a school provide plausibly exogenous variation in the family environments to which students are exposed through their peers.

Identification therefore comes from differences across classrooms within the same school in the share of peers from father-dominant caregiving households. The identifying comparison is between students who enter the same school and face the same institutional environment but are assigned to classrooms with different exposure to peers from these households. This design follows prior work using the CEPS to study peer and teacher effects under plausibly random classroom assignment (Eble & Hu, 2020,2; Gong et al., 2018; Hu, 2015).

The key identifying assumption is that, conditional on school fixed effects and predetermined student and family characteristics, exposure to peers from father-dominant caregiving households is unrelated to unobserved determinants of students' gender beliefs, mathematics beliefs, and educational outcomes. This assumption would be violated if students were systematically sorted across classrooms according to characteristics correlated with both their peers' family caregiving arrangements and their own outcomes. The classroom-assignment restrictions are designed to address this concern.

I assess the plausibility of this assumption in two ways. First, I test whether peer father-dominant caregiving exposure is predicted by predetermined student and family characteristics. Table 2 reports these results. Conditional on school fixed effects, these characteristics have little joint predictive power for peer father-dominant caregiving exposure. The joint test fails to reject that the coefficients are jointly zero ($F = 1.29$, $p = 0.242$), consistent with the identifying variation arising from classroom assignment rather than systematic sorting.

Second, I assess balance using 1,000 permutations of classroom assignment within schools. Appendix Figure A5 compares the estimate under the observed assignment with the distribution generated by these permutations. The permutation test yields a p -value of 0.82,

consistent with classroom assignment being unrelated to predetermined student and family characteristics.

Table 2: Test for Randomization

	(1)	(2)
Age	0.0405 (0.0259)	0.0126 (0.0108)
Female	-0.0291 (0.0285)	0.0004 (0.0077)
Ethnic minority	-0.2488*** (0.0463)	-0.0014 (0.0236)
Agricultural hukou	-0.1115*** (0.0330)	0.0009 (0.0180)
Only child	-0.0458 (0.0326)	0.0249* (0.0138)
Attended preschool	-0.1026*** (0.0389)	-0.0047 (0.0236)
Repeated grade	0.2201*** (0.0497)	0.0063 (0.0199)
Mother's years of schooling	-0.0268*** (0.0057)	-0.0020 (0.0028)
Father's years of schooling	0.0002 (0.0061)	0.0049** (0.0024)
Household economic status	-0.1253*** (0.0264)	-0.0180 (0.0223)
Number of observations	4,897	4,897
School fixed effects		X
Joint test F-statistic	17.96	1.29
Joint test p-value	< 0.001	0.242

Notes: This table tests predetermined student and family characteristics' joint ability to predict peer father-dominant caregiving by regressing the standardized leave-one-out peer measure on the listed covariates. Column (2) adds school fixed effects. The joint F-statistic and its p -value test whether all covariate coefficients are jointly zero. Standard errors are reported in parentheses: conventional in Column (1) and clustered at the classroom level in Column (2). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

3.2 Estimation Framework

I estimate the effect of exposure to peers from father-dominant caregiving households using the following specification:

$$Y_{ics} = \beta_0 + \beta \text{PeerFatherDominant}_{-i,cs} + X'_{is}\gamma + \delta_s + \varepsilon_{ics}, \quad (3)$$

where i indexes students, c classrooms, and s schools. Y_{ics} denotes the outcome of interest, including gender beliefs, math beliefs, mathematics achievement, educational expectations, and classroom experiences. $\text{PeerFatherDominant}_{-i,cs}$ is the standardized leave-one-out share of peers from households in which fathers provide at least 75 percent of total parental caregiving. X_{is} contains predetermined student and family characteristics, and δ_s denotes school fixed effects. Standard errors are clustered at the classroom level.

The coefficient of interest is β . It captures the effect of a one-standard-deviation increase in exposure to peers from father-dominant caregiving households, conditional on school fixed effects and the control set. Because the peer measure excludes student i 's own household, the estimate is not mechanically driven by the student's own family caregiving arrangement. The main analysis focuses on girls, for whom gendered beliefs about mathematics are particularly salient, and reports corresponding estimates for boys as a comparison. These estimates capture the reduced-form effect of exposure to peers' family caregiving environments. They do not separately identify an effect of peers' contemporaneous behavior (Manski, 1993).

The baseline control set includes student age, minority status, mother's and father's years of schooling, agricultural *hukou*, household economic status, only-child status, preschool attendance, and repeated-grade status. For follow-up educational outcomes, I additionally control for prior mathematics achievement where appropriate. School fixed effects absorb common school-level factors, including school resources, admissions environments, and institutional practices shared by students in the same school. Thus, identification comes from differences in peer father-dominant caregiving across classrooms within the same school.

4 Main Results

This section presents the main estimates of the effect of exposure to peers from father-dominant caregiving households. I first study whether peer exposure to these family environments affects students' gender beliefs and mathematics beliefs. I then examine effects on mathematics achievement. Finally, I study classroom experiences, including interactions with mathematics teachers.

The coefficient of interest throughout this section is the effect of a one-standard-deviation increase in the standardized leave-one-out share of peers from father-dominant caregiving households. Because this measure is constructed using peers' household environments, the estimates capture spillovers from peers' family environments rather than the effect of changing a student's own household arrangement.

4.1 Beliefs

I first examine whether exposure to peers from father-dominant caregiving households affects students' beliefs. I study two outcomes: students' beliefs about gender differences in mathematics and their beliefs about their own mathematical ability.

Table 3 reports these results separately for boys and girls. Columns (1)–(2) present estimates for gender beliefs. A one-standard-deviation increase in peer father-dominant caregiving reduces girls' endorsement of gender-stereotypical beliefs about mathematics by 4.5 percentage points. The corresponding estimate for boys is weak and is not statistically distinguishable from zero.

Columns (3)–(4) report estimates for mathematics beliefs. Exposure to peers from father-dominant caregiving households increases students' confidence in mathematics. The estimated effects are 0.084 standard deviations for boys and 0.071 standard deviations for girls. These estimates are statistically significant and indicate that exposure to peers from father-dominant caregiving households is associated with stronger mathematics beliefs.

Taken together, these results show that family gender-role arrangements can extend beyond individual households and shape students’ beliefs in shared social environments. The strongest evidence appears in gender beliefs, where the effect is concentrated among girls. This pattern is consistent with the idea that observing fathers taking a larger role in caregiving provides a counter-stereotypical signal about the relationship between gender and ability, consistent with evidence that children learn gender norms from parental behaviors and roles observed within the household (Bertrand et al., 2015; Fernández et al., 2004).

Table 3: Effects of Peer Father-Dominant Caregiving Exposure on Beliefs

	Gender Beliefs		Mathematics Beliefs	
	(1) Boys	(2) Girls	(3) Boys	(4) Girls
Peer father-dominant caregiving	0.009 (0.014)	-0.045*** (0.017)	0.084*** (0.029)	0.071** (0.030)
Baseline mathematics achievement			X	X
Student and family controls	X	X	X	X
School fixed effects	X	X	X	X
Observations	2,426	2,343	2,231	2,193
R-squared	0.091	0.086	0.328	0.332

Notes: This table reports estimates of the effect of exposure to peers from father-dominant caregiving households on students’ beliefs. Columns (1)–(2) examine gender beliefs measured in Grade 7, and Columns (3)–(4) examine mathematics beliefs measured in Grade 8. Mathematics belief specifications additionally control for baseline mathematics achievement measured in Grade 7. All specifications include school fixed effects and predetermined student and family controls. Standard errors clustered at the classroom level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Performance on Mathematics Examinations

I next examine whether exposure to peers from father-dominant caregiving households affects students’ subsequent mathematics achievement. While beliefs provide more proximal measures of how students perceive gender and ability, mathematics achievement captures a more downstream outcome of whether exposure to different household gender-role environments is associated with differences in educational performance.

Table 4 reports estimates using standardized mathematics achievement measured in the

follow-up survey. Column (1) presents estimates for all students, while Columns (2) and (3) report estimates separately for boys and girls.

Exposure to peers from father-dominant caregiving households improves girls' mathematics achievement. A one-standard-deviation increase in peer father-dominant caregiving exposure increases girls' mathematics achievement by 0.043 standard deviations. The corresponding estimate for boys is 0.009 and is not statistically distinguishable from zero. Thus, as with the results for gender beliefs, the achievement effects are concentrated among girls.

The pattern of results suggests that exposure to peers from households with different parental caregiving arrangements is associated with differences in both students' beliefs and their subsequent academic performance. These findings provide evidence that family gender-role environments may extend beyond individual households and are reflected in downstream educational outcomes.

Table 4: Effects of Peer Father-Dominant Caregiving Exposure on Mathematics Achievement

	(1) All Students	(2) Boys	(3) Girls
Peer father-dominant caregiving	0.025 (0.016)	0.009 (0.021)	0.043** (0.018)
Baseline mathematics achievement	X	X	X
Student and family controls	X	X	X
School fixed effects	X	X	X
Observations	4,499	2,278	2,220
R-squared	0.548	0.580	0.530

Notes: This table reports estimates of the effect of exposure to peers from father-dominant caregiving households on standardized mathematics achievement. All specifications include school fixed effects, predetermined student and family controls, and baseline mathematics achievement. Standard errors clustered at the classroom level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Classroom Experiences

Finally, I examine whether exposure to peers from father-dominant caregiving households is associated with differences in students' reported classroom experiences. These outcomes

capture students’ perceptions of their interactions with mathematics teachers and provide measures of how peer family environments are related to students’ everyday experiences in school.

Table 5 reports estimates for two measures of reported teacher interactions. Columns (1)–(2) examine whether students report being called on by their mathematics teachers, while Columns (3)–(4) examine whether students report receiving praise from their mathematics teachers.

Exposure to peers from father-dominant caregiving households is associated with more positive reported teacher interactions among girls. A one-standard-deviation increase in peer father-dominant caregiving exposure increases girls’ reported teacher asking by 0.063 standard deviations and reported teacher praise by 0.080 standard deviations. The corresponding estimates for boys are small and statistically indistinguishable from zero.

These patterns are consistent with the broader effects on beliefs and academic outcomes. Exposure to peers from different parental caregiving arrangements is associated with differences not only in students’ beliefs and achievement, but also in how students perceive their classroom experiences. Because these outcomes are student-reported measures, they capture students’ experienced classroom environment rather than directly identifying changes in teachers’ behavior.

5 Robustness and Interpretation

This section examines the robustness of the main findings and investigates whether exposure to father-dominant caregiving captures a distinct dimension of peer family environments. I first show that the results are robust to alternative definitions of father-dominant caregiving. I then examine whether the estimated effects are explained by other observable characteristics of peers, including socioeconomic background, parental beliefs, gender composition, and academic ability.

Table 5: Effects of Peer Father-Dominant Caregiving Exposure on Classroom Experiences

	Mathematics Teacher Asking		Mathematics Teacher Praise	
	(1) Boys	(2) Girls	(3) Boys	(4) Girls
Peer father-dominant caregiving	0.023 (0.022)	0.063** (0.029)	-0.007 (0.035)	0.080*** (0.025)
Student and family controls	X	X	X	X
School fixed effects	X	X	X	X
Observations	2,282	2,228	2,288	2,230
R-squared	0.146	0.171	0.123	0.144

Notes: This table reports estimates of the effect of exposure to peers from father-dominant caregiving households on students' reported classroom experiences. Columns (1)–(2) examine mathematics teacher asking, and Columns (3)–(4) examine mathematics teacher praise. All specifications include school fixed effects and predetermined student and family controls. Standard errors clustered at the classroom level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.1 Alternative Definitions of Father-Dominant Caregiving

The main analysis defines father-dominant caregiving as households in which fathers provide at least 75 percent of total parental caregiving. This threshold captures households in which caregiving responsibilities are substantially shifted away from the traditional maternal-dominant arrangement. Because the choice of any cutoff is inherently discrete, I examine whether the main results are sensitive to alternative definitions of father-dominant caregiving.

Appendix Table A2 reports estimates using alternative thresholds of 70, 80, and 85 percent of total parental caregiving. The estimated effects on girls' gender beliefs are similar across these definitions. The coefficients range from -3.8 to -4.5 percentage points, and all estimates remain statistically significant.

These results indicate that the estimated peer effects are not driven by a specific cutoff used to classify father-dominant caregiving households. Rather, the findings reflect exposure to households with substantially different patterns of parental caregiving responsibilities.

5.2 Stability with Additional Peer Controls

A potential concern is that peer father-dominant caregiving exposure may capture other dimensions of classroom composition rather than the role of parental caregiving arrangements themselves. For example, households in which fathers provide a larger share of caregiving may differ in socioeconomic resources, parental beliefs, or students' academic characteristics, which could independently generate peer effects.

To address this concern, I estimate a series of horse-race specifications that progressively control for additional peer characteristics. Table 6 reports these results. Column (1) presents the baseline specification. Columns (2)–(6) sequentially add controls for peer parental SES, peer parental mathematics beliefs, the share of female peers, peer household registration status, and peer cognitive ability.

The estimated effects of peer father-dominant caregiving remain largely unchanged across specifications. For gender beliefs, the coefficient remains close to the baseline estimate, ranging from -0.045 in the baseline specification to -0.048 in the most saturated specification. These results suggest that peer father-dominant caregiving captures a distinct dimension of family environments brought into classrooms, beyond conventional sources of peer effects such as socioeconomic background, parental education, and academic ability.

6 Heterogeneity by Family Background

The previous results show that exposure to peers from father-dominant caregiving households affects girls' gender beliefs. I next examine whether these effects vary with students' family background. Family environments play an important role in shaping how children acquire and interpret gender norms, and differences in parental resources and attitudes may affect how children respond to exposure to counter-stereotypical gender-role arrangements (Bisin & Verdier, 2001; Fernández & Fogli, 2009; Fernández et al., 2004).

I focus on mother's education as a measure of family background. Mother's education

Table 6: Disentangling the Effects of Exposure to Father-Dominant Caregiving and Other Sources of Peer Effects

	(1)	(2)	(3)	(4)	(5)	(6)
Peer father-dominant caregiving	-0.045*** (0.017)	-0.051*** (0.017)	-0.050*** (0.016)	-0.047*** (0.015)	-0.049*** (0.015)	-0.048*** (0.015)
Baseline controls	X	X	X	X	X	X
Peer SES controls		X	X	X	X	X
Peers' parental mathematics beliefs			X	X	X	X
Proportion of female peers				X	X	X
Peers' hukou status					X	X
Peers' cognitive ability						X
School fixed effects	X	X	X	X	X	X
Observations	2,343	2,343	2,343	2,343	2,343	2,343
Classrooms	120	120	120	120	120	120
R-squared	0.086	0.089	0.090	0.091	0.092	0.092

Notes: This table reports regressions for girls that progressively add controls for other dimensions of peer composition. The dependent variable indicates whether a girl agrees that boys are better than girls at mathematics. The key explanatory variable is the standardized leave-one-out classroom share of peers from households in which fathers provide at least 75% of total parental caregiving time. Peer SES controls include peers' parental education and household economic status, entered jointly from Column (2) onward. All regressions include baseline controls and school fixed effects. Standard errors clustered at the classroom level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

captures differences in the social environments in which children are raised, including parental resources, gender-role expectations, and exposure to alternative views about gender roles (Olivetti et al., 2020). I estimate specifications that interact peer father-dominant caregiving exposure with mother’s years of schooling.

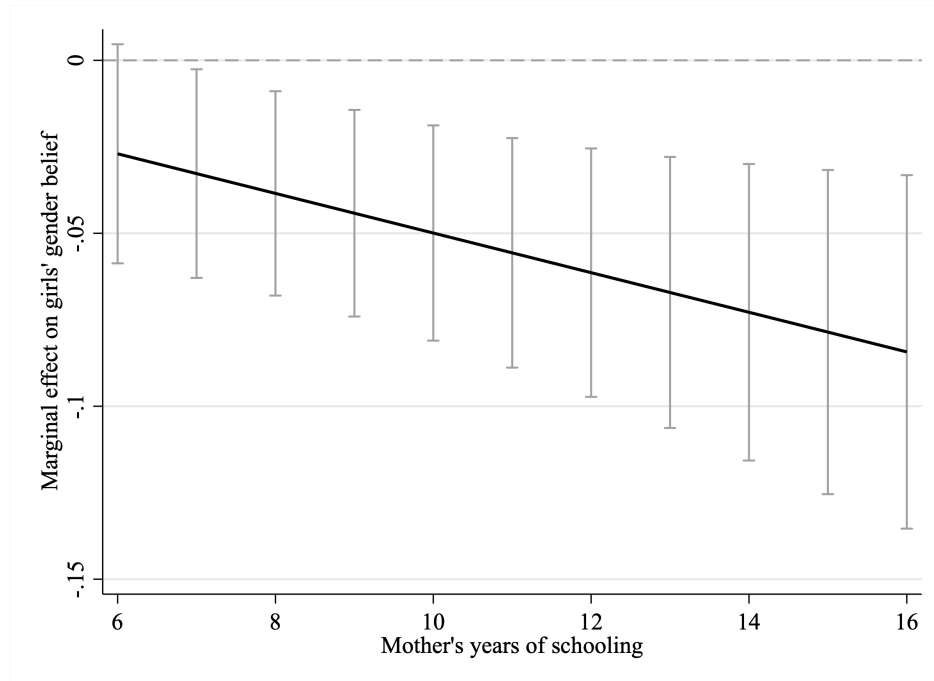


Figure 1: Heterogeneous Effects by Mother’s Years of Schooling

Notes: This figure plots the marginal effect of exposure to peers from father-dominant caregiving households on girls’ gender beliefs across different levels of mother’s years of schooling. Whiskers represent 95% confidence intervals.

Figure 1 presents the marginal effect of exposure to father-dominant caregiving households across levels of mother’s education among girls. The figure plots the estimated effect of a one-standard-deviation increase in peer father-dominant caregiving exposure, together with 95 percent confidence intervals.

The results show that the effect of peer father-dominant caregiving on girls’ gender beliefs varies systematically with mother’s education. The estimated effect becomes more negative as mother’s years of schooling increase. Consistent with the regression estimates reported in Appendix Table A3, the interaction between peer father-dominant caregiving exposure and mother’s education is negative and statistically significant. The magnitude of the interaction

effect is economically meaningful. The estimate implies that the negative effect of peer father-dominant caregiving exposure on girls' gender-stereotypical beliefs becomes larger by 0.57 percentage points for each additional year of mother's schooling.

This pattern suggests that girls from more educated families may respond more strongly to counter-stereotypical caregiving environments. One possible interpretation is that maternal education shapes how children process gender-role signals: children from more educated families may be more likely to encounter egalitarian gender norms or alternative models of family roles, making exposure to fathers' greater involvement in caregiving a more salient signal. This interpretation is consistent with research emphasizing the role of family environments in the intergenerational transmission and formation of gender norms (Bisin & Verdier, 2001; Fernández et al., 2004).

This pattern is not observed among boys. The corresponding interaction between peer father-dominant caregiving exposure and mother's education is small and statistically indistinguishable from zero. Overall, these results suggest that the effects of exposure to father-dominant caregiving households are particularly pronounced among girls from families with higher levels of maternal education, although these heterogeneity patterns should be interpreted as suggestive rather than definitive.

7 Conclusion

This paper studies whether gender-role arrangements within families can extend beyond the household and shape the beliefs and educational outcomes of other children through peer networks. Exploiting quasi-random classroom assignment in Chinese middle schools, I show that exposure to peers from father-dominant caregiving households affects girls' beliefs about gender and ability, with subsequent consequences for their educational experiences and performance.

The main findings provide evidence that family gender-role practices generate social

spillovers beyond the children who directly experience them. Exposure to peers from households in which fathers provide a larger share of caregiving reduces girls' likelihood of endorsing the belief that boys are better at mathematics. The effects are concentrated among girls, consistent with the interpretation that counter-stereotypical household arrangements provide information about the relationship between gender and ability (Beaman et al., 2012; Stout, Dasgupta, Hunsinger, & McManus, 2011). Exposure to father-dominant caregiving peers also increases girls' mathematics self-beliefs and improves their subsequent mathematics achievement. In addition, girls report more positive classroom experiences, including more frequent interactions and recognition from mathematics teachers.

These findings contribute to the literature on the transmission of gender norms by showing that parents' behaviors, not only their stated beliefs, can shape gender-related attitudes beyond the family. Prior research has documented that children acquire gender norms from parental beliefs, behaviors, and household environments (Bertrand et al., 2015; Bisin & Verdier, 2001; Farré & Vella, 2013; Fernández et al., 2004). This paper extends this literature by showing that household gender-role arrangements can be carried into shared social environments and influence children who do not share the same household. More broadly, the findings highlight that peer networks provide an important channel through which family environments may contribute to the persistence or reduction of gender inequality.

The results also contribute to research on fathers' roles in child development. Existing evidence shows that paternal involvement and fathers' caregiving behaviors can shape children's cognitive and socioemotional development (Cabrera et al., 2000; Lamb, 2010). I extend this literature by showing that fathers' caregiving roles may have effects beyond their own children: household gender-role arrangements can generate social spillovers through the peer environments children encounter in schools.

The results also have implications for understanding how gender equality can be promoted in educational settings. Because students learn not only from formal instruction but also from the behaviors and experiences of those around them, increasing the visibility of diverse family

roles may provide students with alternative models of gender and ability. Such exposure may be particularly relevant because gender stereotypes can shape children’s self-concepts, educational choices, and later outcomes (Bian et al., 2017; Carlana, 2019). Future research could examine whether exposure to different family environments has longer-term effects on educational choices, college fields of study, and labor market outcomes (Bertrand et al., 2015; Goldin & Katz, 2008), as well as how these peer spillovers operate across different institutional and cultural contexts.

Declaration of Generative AI

During the preparation of this work, the author used ChatGPT by OpenAI to assist with language editing and clarity of presentation. The author reviewed and edited the output as needed and takes full responsibility for the content of the manuscript.

References

- Akerlof, G. A., & Kranton, R. E. (2000). Economics and identity. *Quarterly Journal of Economics*, 115(3), 715–753. <https://doi.org/10.1162/003355300554881>
- Bandura, A. (1977). *Social Learning Theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Beaman, L., Chattopadhyay, R., Duflo, E., Pande, R., & Topalova, P. (2009). Powerful women: Does exposure reduce bias? *Quarterly Journal of Economics*, 124(4), 1497–1540. <https://doi.org/10.1162/qjec.2009.124.4.1497>
- Beaman, L., Duflo, E., Pande, R., & Topalova, P. (2012). Female leadership raises aspirations and educational attainment for girls: A policy experiment in India. *Science*, 335(6068), 582–586. <https://doi.org/10.1126/science.1212382>
- Bertrand, M., Kamenica, E., & Pan, J. (2015). Gender identity and relative income within households. *Quarterly Journal of Economics*, 130(2), 571–614. <https://doi.org/10.1093/qje/qjv001>
- Bian, L., Leslie, S.-J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children’s interests. *Science*, 355(6323), 389–391. <https://doi.org/10.1126/science.aah6524>
- Bisin, A., & Verdier, T. (2001). The economics of cultural transmission and the dynamics of preferences. *Journal of Economic Theory*, 97(2), 298–319. <https://doi.org/10.1006/jeth.2000.2678>
- Bisin, A., & Verdier, T. (2011). The economics of cultural transmission and socialization. In J. Benhabib, A. Bisin, & M. O. Jackson (Eds.), *Handbook of Social Economics* (Vol. 1A, pp. 339–416). Elsevier. <https://doi.org/10.1016/B978-0-444-53187-2.00009-7>
- Bordalo, P., Coffman, K., Gennaioli, N., & Shleifer, A. (2019). Beliefs about gender. *American Economic Review*, 109(3), 739–773. <https://doi.org/10.1257/aer.20170007>
- Cabrera, N. J., Tamis-LeMonda, C. S., Bradley, R. H., Hofferth, S., & Lamb, M. E. (2000). Fatherhood in the twenty-first century. *Child Development*, 71(1), 127–136. <https://doi.org/10.1111/1467-8624.00126>

- Carlana, M. (2019). Implicit stereotypes: Evidence from teachers' gender bias. *Quarterly Journal of Economics*, 134(3), 1163–1224. <https://doi.org/10.1093/qje/qjz008>
- Carrell, S. E., Page, M. E., & West, J. E. (2010). Sex and science: How professor gender perpetuates the gender gap. *Quarterly Journal of Economics*, 125(3), 1101–1144. <https://doi.org/10.1162/qjec.2010.125.3.1101>
- Chen, L., Chung, B. W., & Wang, G. (2025). Composition of peer mothers and gender norms: Class randomization and short-run effects. *Journal of Economic Behavior & Organization*, 234, 107008. <https://doi.org/10.1016/j.jebo.2025.107008>
- Davis, S. N., & Greenstein, T. N. (2009). Gender ideology: Components, predictors, and consequences. *Annual Review of Sociology*, 35, 87–105. <https://doi.org/10.1146/annurev-soc-070308-115920>
- Dhar, D., Jain, T., & Jayachandran, S. (2022). Reshaping adolescents' gender attitudes: Evidence from a school-based experiment in India. *American Economic Review*, 112(3), 899–927. <https://doi.org/10.1257/aer.20201112>
- Duflo, E., Dupas, P., & Kremer, M. (2011). Peer effects, teacher incentives, and the impact of tracking: Evidence from a randomized evaluation in Kenya. *American Economic Review*, 101(5), 1739–1774. <https://doi.org/10.1257/aer.101.5.1739>
- Eble, A., & Hu, F. (2020). Child beliefs, societal beliefs, and teacher-student identity match. *Economics of Education Review*, 77, 101994. <https://doi.org/10.1016/j.econedurev.2020.101994>
- Eble, A., & Hu, F. (2022). Gendered beliefs about mathematics ability transmit across generations through children's peers. *Nature Human Behaviour*, 6(6), 868–879. <https://doi.org/10.1038/s41562-022-01331-9>
- Farré, L., & Vella, F. (2013). The intergenerational transmission of gender role attitudes and its implications for female labour force participation. *Economica*, 80(318), 219–247. <https://doi.org/10.1111/ecca.12008>
- Feld, J., & Zölitz, U. (2017). Understanding peer effects: On the nature, estimation, and

- channels of peer effects. *Journal of Labor Economics*, 35(2), 387–428. <https://doi.org/10.1086/689472>
- Fernández, R., & Fogli, A. (2009). Culture: An empirical investigation of beliefs, work, and fertility. *American Economic Journal: Macroeconomics*, 1(1), 146–177. <https://doi.org/10.1257/mac.1.1.146>
- Fernández, R., Fogli, A., & Olivetti, C. (2004). Mothers and sons: Preference formation and female labor force dynamics. *Quarterly Journal of Economics*, 119(4), 1249–1299. <https://doi.org/10.1162/0033553042476224>
- Fortin, N. M. (2005). Gender role attitudes and the labour-market outcomes of women across OECD countries. *Oxford Review of Economic Policy*, 21(3), 416–438. <https://doi.org/10.1093/oxrep/gri024>
- Fruehwirth, J. C., & Gagete-Miranda, J. (2019). Your peers’ parents: Spillovers from parental education. *Economics of Education Review*, 73, 101910. <https://doi.org/10.1016/j.econedurev.2019.101910>
- Goldin, C., & Katz, L. F. (2008). *The Race between Education and Technology*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Gong, J., Lu, Y., & Song, H. (2018). The effect of teacher gender on students’ academic and noncognitive outcomes. *Journal of Labor Economics*, 36(3), 743–778. <https://doi.org/10.1086/696203>
- Guiso, L., Monte, F., Sapienza, P., & Zingales, L. (2008). Culture, gender, and math. *Science*, 320(5880), 1164–1165. <https://doi.org/10.1126/science.1154094>
- Hsin, A., & Felfe, C. (2014). When does time matter? Maternal employment, children’s time with parents, and child development. *Demography*, 51(5), 1867–1894. <https://doi.org/10.1007/s13524-014-0334-5>
- Hu, F. (2015). Do girl peers improve your academic performance? *Economics Letters*, 137, 54–58. <https://doi.org/10.1016/j.econlet.2015.10.025>
- Jayachandran, S. (2015). The roots of gender inequality in developing countries. *An-*

- nual Review of Economics*, 7, 63–88. <https://doi.org/10.1146/annurev-economics-080614-115404>
- Johnston, D. W., Schurer, S., & Shields, M. A. (2014). Maternal gender role attitudes, human capital investment, and labour supply of sons and daughters. *Oxford Economic Papers*, 66(3), 631–659. <https://doi.org/10.1093/oep/gpt039>
- Lamb, M. E. (Ed.). (2010). *The Role of the Father in Child Development* (5th ed.). Hoboken, NJ: John Wiley & Sons.
- Lavy, V., & Schlosser, A. (2011). Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics*, 3(2), 1–33. <https://doi.org/10.1257/app.3.2.1>
- Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *Review of Economic Studies*, 60(3), 531–542. <https://doi.org/10.2307/2298123>
- Niederle, M., & Vesterlund, L. (2010). Explaining the gender gap in math test scores: The role of competition. *Journal of Economic Perspectives*, 24(2), 129–144. <https://doi.org/10.1257/jep.24.2.129>
- Olivetti, C., Patacchini, E., & Zenou, Y. (2020). Mothers, peers, and gender-role identity. *Journal of the European Economic Association*, 18(1), 266–301. <https://doi.org/10.1093/jeea/jvy050>
- Qin, X., Wang, Y., & Zhang, H. (2026). Number one girl: Female top scorers and peer academic performance in junior high schools. *Journal of Development Economics*, 182, 103801. <https://doi.org/10.1016/j.jdeveco.2026.103801>
- Sacerdote, B. (2001). Peer effects with random assignment: Results for Dartmouth roommates. *Quarterly Journal of Economics*, 116(2), 681–704. <https://doi.org/10.1162/00335530151144131>
- Sacerdote, B. (2011). Peer effects in education: How might they work, how big are they and how much do we know thus far? In E. A. Hanushek, S. Machin, & L. Woessmann (Eds.), *Handbook of the Economics of Education* (Vol. 3, pp. 249–277). Elsevier. <https://doi.org/10.1016/B978-0-7623-7328-2.00011-1>

doi.org/10.1016/B978-0-444-53429-3.00004-1

Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: Using ingroup experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality and Social Psychology*, *100*(2), 255–270. <https://doi.org/10.1037/a0021385>

A Appendix

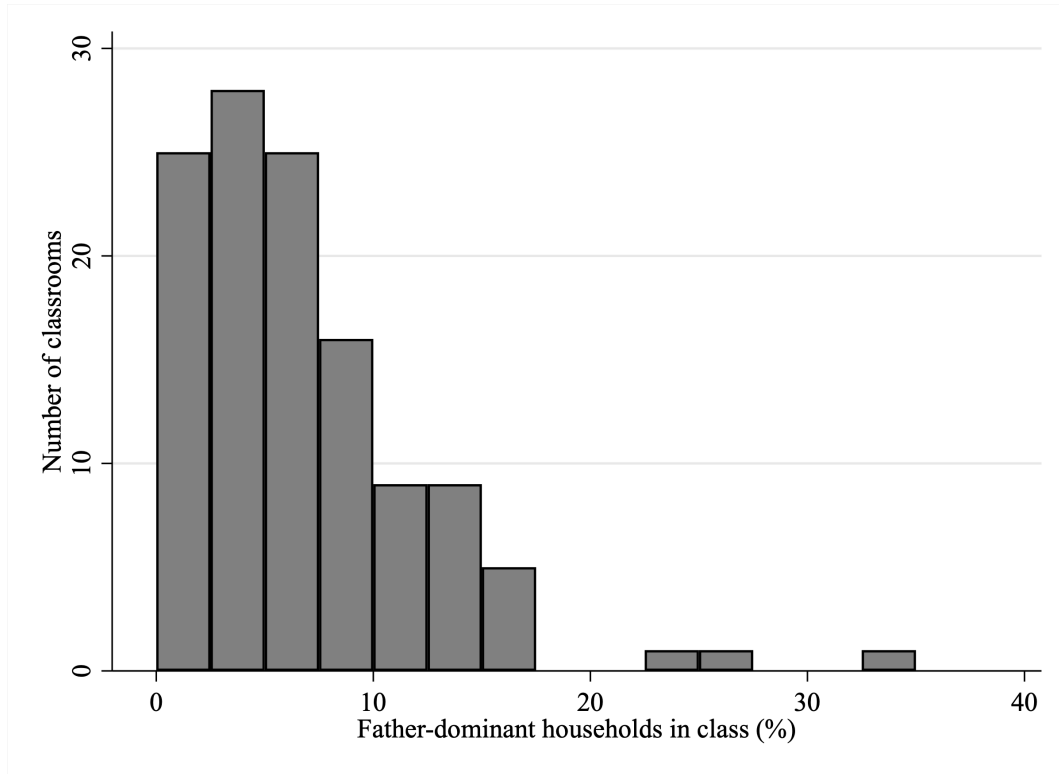


Figure A1: Distribution of Father-Dominant Caregiving Households Across Classrooms

Notes: This figure shows the distribution of the share of father-dominant caregiving households across classrooms in the estimation sample. A household is classified as father-dominant if the father provides at least 75% of total parental caregiving time. Classroom shares are calculated among students with valid caregiving information and are shown without standardization.

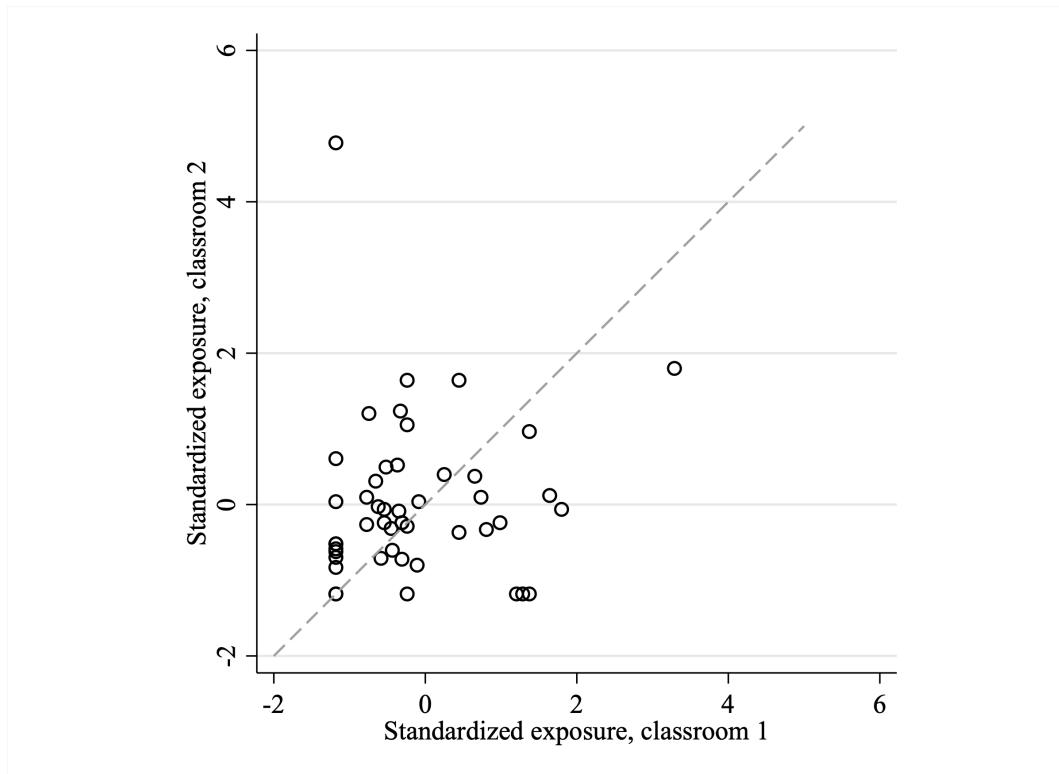


Figure A2: Father-Dominant Caregiving Exposure Across Within-School Classroom Pairs
Notes: This figure plots standardized father-dominant caregiving exposure in one classroom against that in the other classroom for each within-school classroom pair in the same grade. Each point represents a classroom pair. The 45-degree line indicates equal exposure in the two classrooms. Departures from this line show the within-school, between-classroom variation used in the analysis.

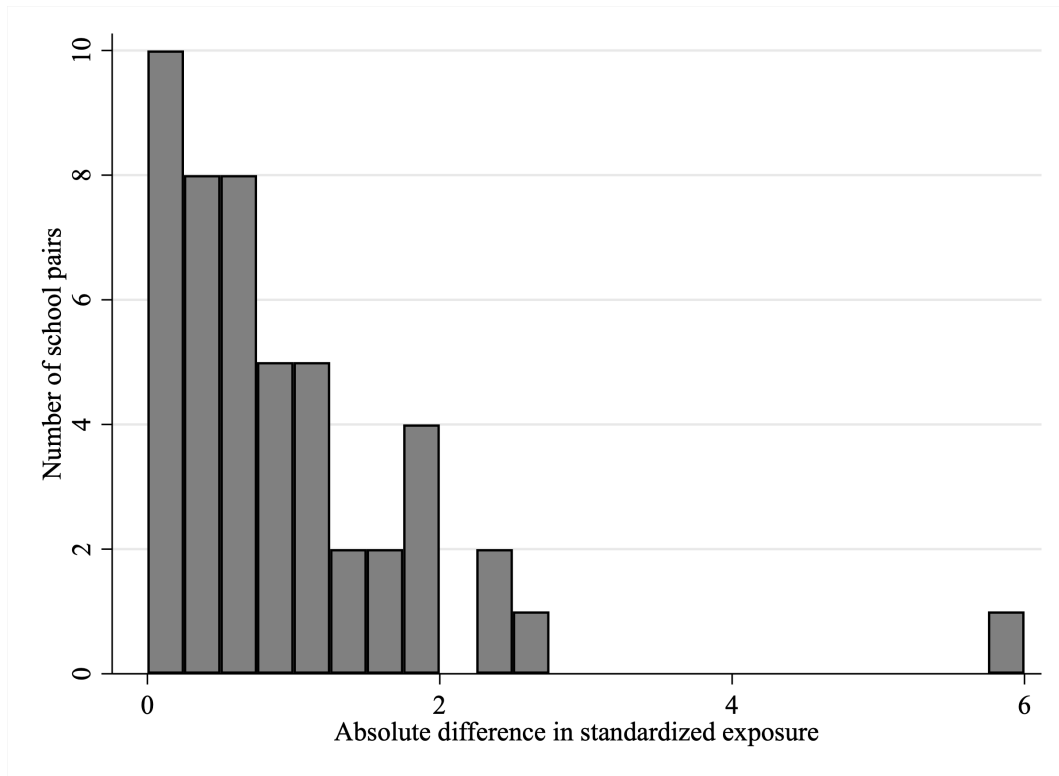


Figure A3: Distribution of Within-School Differences in Father-Dominant Caregiving Exposure

Notes: This figure shows the distribution of absolute differences in standardized father-dominant caregiving exposure between classrooms within the same school and grade. Each observation corresponds to a classroom pair. Larger values indicate greater differences in exposure between the two classrooms.

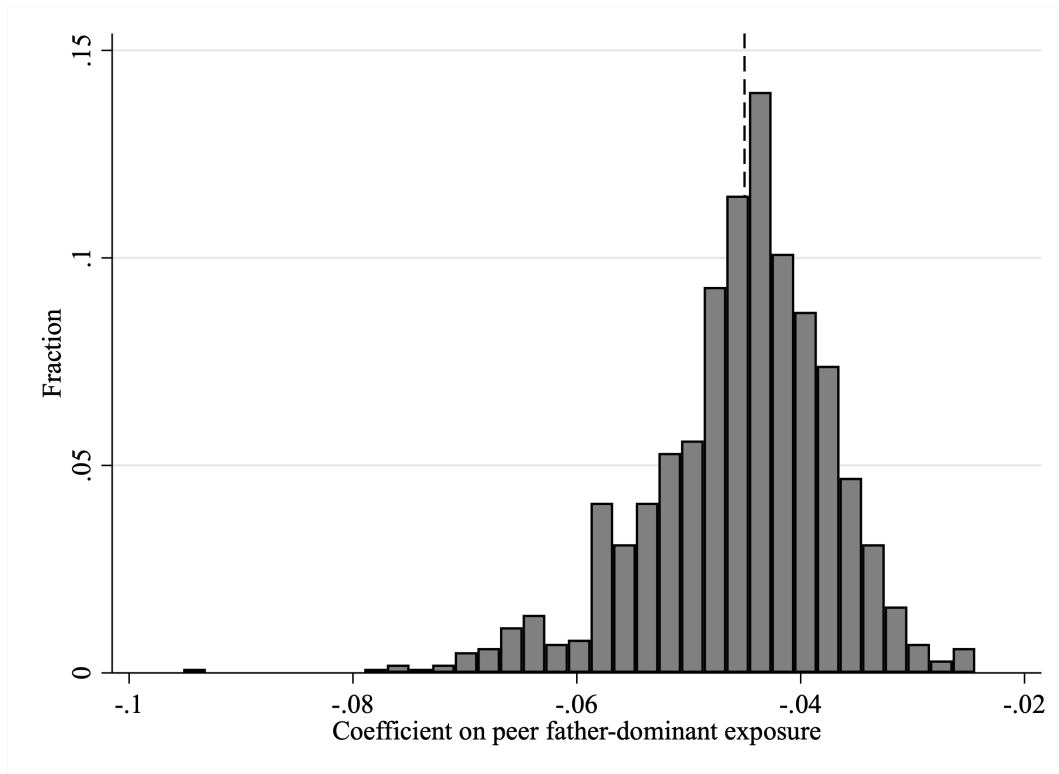


Figure A4: Robustness to Randomly Dropping 10% of Schools

Notes: This figure shows the distribution of estimated coefficients on peer father-dominant caregiving exposure from repeated regressions, each randomly dropping 10% of schools from the estimation sample. The outcome is an indicator for whether a girl agrees that boys are better at mathematics than girls. The vertical line marks the coefficient estimated using the full sample.

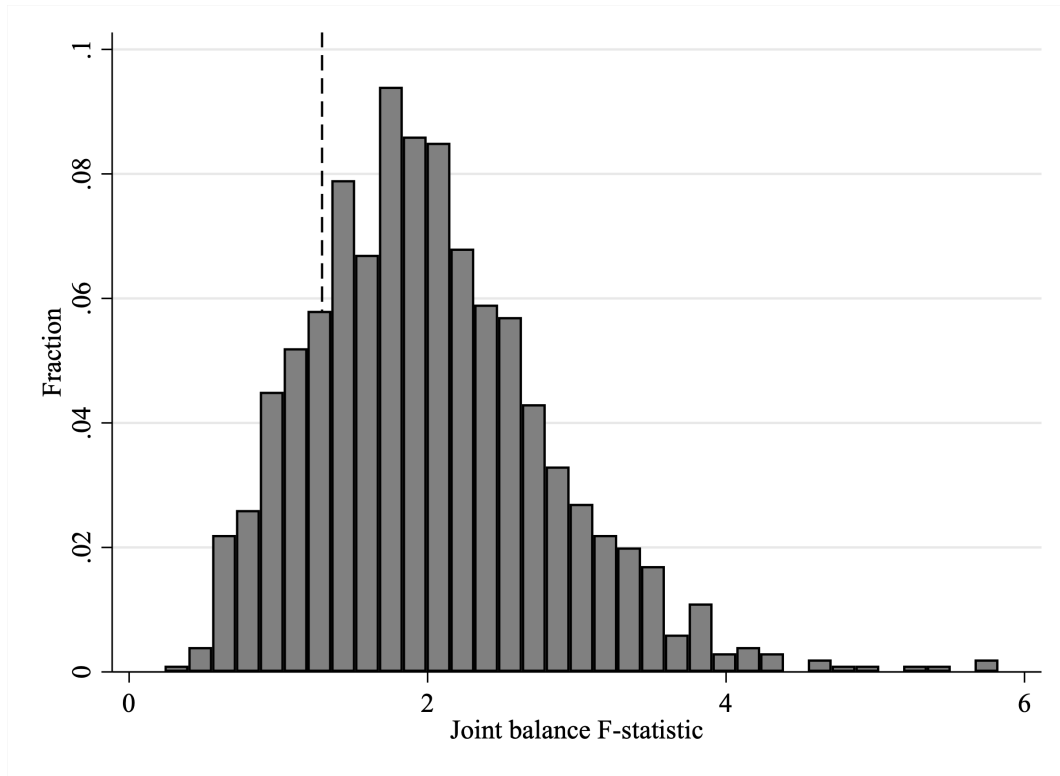


Figure A5: Permutation Distribution of the Joint Balance Test

Notes: This figure reports the permutation distribution of the joint F-statistic from balance tests. The actual assignment yields a joint test statistic corresponding to a p-value of 0.82, suggesting no systematic relationship between classroom assignment and predetermined characteristics.

Variable Definitions and Caregiving Data Availability

Variable	Definition and Construction
<i>Panel A. Outcome variables</i>	
Gender belief	Grade 7 indicator equal to 1 if the student agrees that boys are better at mathematics than girls, and 0 otherwise.
Math belief	Perceived mathematical ability in Grades 6–8, coded from 1 (“very difficult”) to 4 (“not difficult at all”). Grade 6 beliefs are reported retrospectively in Grade 7; later measures are contemporaneous.
Math achievement	Grade 7 and Grade 8 midterm mathematics scores from school administrative records, standardized within school and grade. Students in the same school and grade take the same examination.
Math future	Perceived usefulness of mathematics for future development in Grades 7–8, measured from 1 to 4, with higher values indicating greater usefulness.
Math teacher ask	Reported frequency of being called on by the mathematics teacher in Grades 7–8, measured from 1 to 4, with higher values indicating greater frequency.
Math teacher praise	Reported frequency of mathematics teacher praise in Grades 7–8, measured from 1 to 4, with higher values indicating greater frequency.
<i>Panel B. Caregiving and peer exposure</i>	
Parental caregiving time	Father’s and mother’s daily-life caregiving hours, reported separately in Grade 8. Nonparticipation is coded as zero; missing participation or hours among participating parents remains missing.
Father caregiving share	Father’s hours divided by total parental caregiving hours, defined when both parents’ hours are observed and their sum is positive.
Father-dominant caregiving	Indicator equal to 1 if the father’s caregiving share is at least 75%, and 0 otherwise. Undefined shares remain missing.
Peer father-dominant caregiving	Standardized leave-one-out classroom share of father-dominant caregiving households among classmates with valid caregiving shares.

Notes: All outcomes except gender belief are standardized. Of 5,472 students, 3,773 have valid caregiving shares. For 865, caregiving information is incomplete: 523 lack both parents’ participation information and 342 lack hours for at least one participating parent. Another 834 are cared for by grandparents or other caregivers with neither parent providing daily-life care, so their parental caregiving shares are undefined. Neither group is coded as non-father-dominant. Peer exposure uses classmates with valid shares. Students with undefined own shares remain eligible for analysis when peer exposure and required regression variables are observed.

Table A1: Characteristics of Father-Dominant Caregiving Households

	(1) All Students	(2) Other	(3) Father-Dominant	(4) Difference
Age	13.252 (0.009)	13.173 (0.010)	13.216 (0.042)	0.043 (0.301)
Ethnic minority	0.119 (0.004)	0.094 (0.005)	0.094 (0.020)	-0.001 (0.977)
Mother's years of schooling	10.037 (0.050)	10.595 (0.059)	10.220 (0.233)	-0.376 (0.120)
Father's years of schooling	10.763 (0.045)	11.225 (0.056)	10.901 (0.216)	-0.324 (0.156)
Agricultural hukou	0.448 (0.007)	0.398 (0.009)	0.371 (0.034)	-0.028 (0.434)
Household economic status	2.873 (0.008)	2.932 (0.009)	2.772 (0.040)	-0.160 (0.000)
Only child	0.489 (0.007)	0.547 (0.008)	0.585 (0.033)	0.038 (0.272)
Preschool attendance	0.828 (0.005)	0.863 (0.006)	0.815 (0.026)	-0.048 (0.045)
Repeated grade	0.120 (0.004)	0.085 (0.005)	0.107 (0.021)	0.022 (0.257)
Mathematics score	70.173 (0.135)	70.762 (0.161)	69.988 (0.746)	-0.774 (0.249)
Mathematics belief	2.895 (0.014)	2.981 (0.016)	2.897 (0.068)	-0.084 (0.209)
Parent gender belief	0.401 (0.007)	0.404 (0.008)	0.453 (0.034)	0.049 (0.160)
Father caregiving	1.684 (0.052)	1.969 (0.064)	4.321 (0.296)	2.352 (0.000)
Mother caregiving	3.380 (0.068)	4.389 (0.082)	0.201 (0.036)	-4.188 (0.000)
Father caregiving share	0.294 (0.005)	0.251 (0.004)	0.967 (0.005)	0.715 (0.000)
Father-dominant caregiving	0.059 (0.004)	0.000 (0.000)	1.000 (0.000)	1.000
Peer father-dominant caregiving	0.063 (0.001)	0.059 (0.001)	0.062 (0.003)	0.002 (0.471)
Observations	5,472	3,549	224	

Notes: This table compares student and household characteristics between father-dominant caregiving and other households. Father-dominant caregiving indicates that fathers provide at least 75 percent of total parental caregiving time. Column (1) includes all 5,472 students. Columns (2)–(3) include 3,773 students with valid caregiving shares: 3,549 in “Other” (father’s share below 75 percent) and 224 in “Father-Dominant”. Columns (2)–(4) exclude 865 students with incomplete caregiving information and 834 cared for by grandparents or other caregivers with neither parent providing daily-life care. Columns (1)–(3) report means with standard errors in parentheses; valid observation counts vary by variable. Column (4) reports father-dominant-minus-other differences, with p -values in parentheses. Caregiving hours are reported in the CEPS follow-up survey. Father caregiving share is the father’s proportion of total parental caregiving time. Peer father-dominant caregiving is the unstandardized leave-one-out classroom share among classmates with valid caregiving shares. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Robustness to Alternative Definitions of Father-Dominant Caregiving

	(1)	(2)	(3)	(4)
	75%	70%	80%	85%
Peer father-dominant caregiving	-0.045*** (0.017)	-0.045*** (0.016)	-0.038** (0.015)	-0.039** (0.016)
Student and family controls	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes
Observations	2,343	2,343	2,343	2,343
R-squared	0.086	0.086	0.085	0.085

Notes: This table examines the sensitivity of the main results to alternative definitions of father-dominant caregiving. The dependent variable is an indicator equal to one if a student agrees that boys are better than girls at mathematics. Each column defines father-dominant caregiving using a different threshold for the father's share of total parental caregiving. The key explanatory variable is the standardized leave-one-out classroom share of peers from households classified as father-dominant under the indicated threshold. All specifications are estimated for girls and include school fixed effects and predetermined student and family controls. Standard errors clustered at the classroom level are reported in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.

Table A3: Heterogeneous Effects by Mother's Education

	(1) Boys	(2) Girls
Peer father-dominant caregiving	0.0219 (0.0353)	0.0073 (0.0268)
Mother's years of schooling	0.0010 (0.0038)	0.0046 (0.0042)
Peer father-dominant caregiving $\times$ Mother's years of schooling	-0.0014 (0.0035)	-0.0057** (0.0027)
Student and family controls	X	X
School fixed effects	X	X
Observations	2,426	2,343
R-squared	0.087	0.091

Notes: This table reports heterogeneous effects of exposure to peers from father-dominant caregiving households by mother's educational attainment. The dependent variable is an indicator equal to one if a student agrees that boys are better than girls at mathematics. The key explanatory variable is the standardized leave-one-out classroom share of peers from households in which fathers provide at least 75 percent of total parental caregiving. Mother's years of schooling is measured in years. All specifications include student and family controls and school fixed effects. Standard errors clustered at the classroom level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Balance Test: Teacher Characteristics

	(1)
Female mathematics teacher	0.043 (0.159)
Mathematics teacher age	0.012 (0.015)
Pedagogical training	-0.024 (0.325)
Teacher belief: student ability is innate	-0.181 (0.204)
Mathematics teacher teaching experience	-0.020 (0.013)
School fixed effects	X
Observations	5,363
Joint test F-statistic	0.82
Joint test p-value	0.535

Notes: This table reports a balance test examining whether observable teacher characteristics predict exposure to peers from father-dominant caregiving households. The dependent variable is standardized peer father-dominant caregiving, defined as the leave-one-out classroom share of peers from households in which fathers provide at least 75 percent of total parental caregiving. Teacher characteristics include mathematics teacher gender, age, pedagogical training, beliefs about student ability, and teaching experience. All specifications include school fixed effects. Standard errors clustered at the classroom level are reported in parentheses. The joint test reports the F-statistic and p-value from a test that all teacher characteristics are jointly equal to zero. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.