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Gender beliefs and planned occupation: high school pupils and their parents

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Abstract

Psychology and sociology literature suggests that the fact that women are less likely to work in STEM occupations may be caused by gender stereotypes related to differences in math and science abilities. In this study we test whether, particularly parents' beliefs are associated with their children's gender beliefs and with their choices of occupation. We show that the correlation between parents' and children's beliefs is strong. We use High School Longitudinal Study data - survey conducted among US 9th graders, their parents and teachers. Finally, we also test to what extend gender beliefs (parents' and own) correlate with planning to work in STEM fields by high-school pupils. We find that girls are discouraged (and boys encouraged) by parents believing that boys are better in math and science, and that the effect of parent's beliefs are stronger than the effect of pupils' school achievements in math and science.

Keywords:

gender beliefs, choice of occupation, family, STEM, gender occupational segregation

JEL Classification

J16, I24, J13, J24

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1 Introduction

Psychology literature suggests that all choices, apart from being based on the cost-benefit analyses, are determined by beliefs (Eccles, 1994). These beliefs can be both self-assessment, i.e. opinion on one's own strengths and weaknesses, or general convictions about some features of social groups that one is a part of. Rational choice theory (Scott, 2000) does not include own beliefs as a part of decision making process. Following simple cost-benefit analysis does not lead to different final choice if own beliefs are consistent with objective image of own skills. But often, what we believe can distort perception of our own abilities and affect our decisions in unexpected way.

Attitudes towards the roles of women and men in the labor market and at home changed at the same time as participation of women in employment increased and gender occupational segregation declined. In the context of beliefs on gender roles, similarly to the changes in the labor market activity of women, we cannot talk about full convergence to common and widespread belief on equality of opportunities and duties of women and men in the society. In this article we test whether this persistence in gender beliefs can be attributed to the fact that parents share gender views with their children. We also test whether these beliefs can be linked to plans about future occupation.

Between large set of stereotypical views on gender differences, one of the most recognized is associated with mathematics and science abilities. For many years, the stereotype on biological predisposition of men to outperform women in these disciplines was supported by differences in high-school achievements (Hyde et al., 1990) and women underrepresentation in STEM (Science, Technology, Engineering and Mathematics) occupations requiring high technical skills (Beede et al., 2011). While, the gender gap in math tests scores closed some time ago (Hyde et al., 2008), women still tend to choose mathematic courses and pursue careers in STEM occupations less often than men (Jacobs, 2005; Eccles, 2007).

Some evidence on harmful effect of gender beliefs about math abilities can be directly recognized in studies on so-called *stereotype threat*.[1] Experimental studies in which members of a social group associated with a negative stereotype are exposed to a task in which they should perform worse (according to the stereotype), show that they achieve worse results when the stereotype is highlighted before solving the test than when they are unaware of facing it. In Spencer et al. (1999) experiment participants were solving several math tests on exactly the same level of difficulty. Before one of the tests participants were warned that women tend to perform worse on this type of very difficult mathematical test that they are just going to solve. Exposing female participants to *stereotype threat* resulted with significantly worse performance than when the test was not preceded by the information of men outperformaning women in these type of tasks.

Especially persistent and large gender gap in employment and salaries in STEM in USA (Beede et al., 2011) pushed research into seeking sources of this phenomenon. Literature

[1] The phrase *stereotype threat* was introduced by Steele and Aronson (1995) in the context of the experiment in which African American was exposed to stereotype associated with the performance in intellectual tests.

suggests that what might matter for the gender differences in STEM is, among others - culture, beliefs and role models (Hyde and Mertz, 2009; Cheryan et al., 2011; Shapiro and Williams, 2012). Guiso et al. (2008) find that countries with more gender-equal culture do not face a problem of a gender gap in math tests scores. However, positive relationship between differences in math tests and orientation of the culture does not apply to Muslim countries (Fryer and Levitt, 2010). Bharadwaj et al. (2012) highlight the role of differences in self-assessment of own math abilities between girls and boys. Carrell et al. (2009) pay attention to the crucial role of other people's example - they find that gender of the mathematics/science teacher has a powerful effect on female students' grades in math and science.

Finally, also the topic of the role of family background, siblings composition and parental influence in educational choices are raised in the literature (Björklund and Salvanes, 2011; Butcher and Case, 1994). Recent study shows that fathers working in STEM occupations raise daughters who are more likely to choose major in college from STEM disciplines, but only when there are no sons in the family (Oguzoglu and Ozbeklik, 2016).

With reference to the literature above, in this study we test whether gender views on abilities to perform well in mathematics and science are common for parents and children. We find that on average if parents believe that boys are better in math and science, the child is more likely to believe the same. The effect is strong for both girls and boys.

Additionally, we test whether plans about future occupation are correlated with own and parental beliefs. We find negative correlation with both own beliefs and parents views' for girls, i.e. stereotypical belief that boys are better in math or science is associated with lower chance of planning to choose a STEM occupation. The magnitude of the effect is stronger in the case of parental beliefs connected to mathematical abilities than science, which may suggest that math stereotype is stronger than the one related to women's predisposition to study science. For boys, there is weak correlation between own beliefs on outperformance of men in math and science and plans of the future occupation. However, we observe strong correlation with parents' beliefs. Finally, we find that planning to work in a STEM occupation is mostly related to whether at least one of the parents works in a STEM occupation.

The results of the study shed more light on the topic of intergenerational transmission of gender-related beliefs and attitudes. First, we confirm the thesis that parents and children tend to share beliefs related to gender roles. Second, we show that for young women own beliefs on boys outperforming girls in math and science can be related to plans of the future occupation. Third, we find that parental beliefs are significant for children's planned occupation, and in most cases the link is stronger than for relation between own beliefs and plans. Finally, we observe a relationship between occupations of the parents and field of the planned occupation of the child.

An article is structured as follows. First, we present data that we utilize to test correlation between parents' and children's views, and between beliefs and planned future occupation. Second, we describe methods used to analyze the topic. Third, we show estimation results and comment on them. Finally, we summarize the study and provide interpretation and implications

of the study.

2 Data

An attempt to link parents and children beliefs and choices requires a very specific type of data. Social studies or surveys that cover both - selection of participants from two generations within the same family and questionnaire on attitudes and beliefs about gender stereotypes or views on gender roles are very rare. Ideally, for the purpose of our study it would be best to utilize data on young adults shortly before choosing direction of the future professional career (e.g. before college) - beliefs of parents and children are measured when they can be the most influential.

To this aim we utilize data from High School Longitudinal Study (HSLS). HSLS is a nationally representative study on over 20 thousand 9th graders - from a sample of 944 high schools. The first wave of the survey was conducted in 2009. The survey is conducted not only among students, but also among their teachers and parents. It is mostly focused on trajectories of students educational and future professional career with a special attention to STEM courses and majors. It includes also algebraic, reasoning and problem solving tests.

Each pupil selected to participate in the study was supposed to fill a questionnaire during in-school, self-administered sessions on the computer. If the child was not present during the day of the session, he or she was interviewed by phone (these cases are rare). One parent or the legal guardian of each pupil participating in the study was asked to complete a 30 minute survey as well. Parental survey was sent to households with a request to fill it by one parent only. The selection of the parent was left to the parents. The HSLS asked about the one who is most knowledgeable about students' school and after school life. Over 75% of guardians who completed the survey were mothers (or female guardians).

Among questions on demographics, school achievements and future plans, survey includes also three questions about beliefs on gender advantages or disadvantages in math, science and English or language arts. Parents and students were asked:

"In general, how would you compare males and females in each of the following subjects:"

A) Math B) Science C) English or language arts?

Participants have to choose answer from the following options: **a) Females are much better, b) Females are somewhat better, c) Females and males are the same, d) Males are somewhat better, e) Males are much better**. This way HSLS data offers a unique opportunity to confront beliefs on gender beliefs of children and their parents. Child and parent surveys are completed in conditions excluding possible influence of parent during the study. Hence, the answers should be as close as possible to the actual opinion.

We use two from three presented questions: related to math and science abilities. Analyses for English and language arts is available in the Appendix. Student answer is our dependent

Table 1: High school pupils and their parents beliefs on who is better in math, science and English

	MATH				SCIENCE			
	STUDENTS		PARENTS		STUDENTS		PARENTS	
	Boys	Girls	Fathers	Mothers	Boys	Girls	Fathers	Mothers
Males:	934	270	225	761	918	313	137	446
much better	8.95%	2.63%	6.59%	6.70%	8.82%	3.05%	4.02%	3.94%
Males:	1607	1281	840	2616	1577	1372	641	1946
better	15.39%	12.46%	24.62 %	23.04%	15.15%	13.39%	18.81%	17.17%
The same	5868	6,467	1985	6899	6404	6922	2389	8223
	56.21%	62.91%	58.18%	60.76%	61.52%	67.55%	70.12%	72.56%
Females:	1125	1339	227	661	794	946	141	441
better	10.78%	13.03%	6.65%	5.82%	7.63%	9.23%	4.14%	3.89%
Females:	906	923	135	417	716	694	99	277
much better	8.68%	8.98%	3.96%	3.67%	6.88%	6.77%	2.91%	2.44%

Notes: Shares of responders among pupils and their parents who answered on the questions of who is better in Math, and who is better in Science according to them - women or men. Distribution by sex of pupils and parents participating in the survey. Source: High School Longitudinal Study, National Center for Education Statistics.

variable while parent answer the independent variable. These variables are going to be treated as a proxy of beliefs on gender roles.

Instead of using original 5-levels scale, we slightly change it. The aggregation allows to simplify the comparison (lower variation) without losing important information. "Much better" and "better" answers both imply the same attitude towards stereotypical belief of men outperforming women in math and science. Differentiation seems to be to subtle and it is not necessary from the perspective of our study. In three specifications we aggregated answers creating following dependent (and independent) variables:

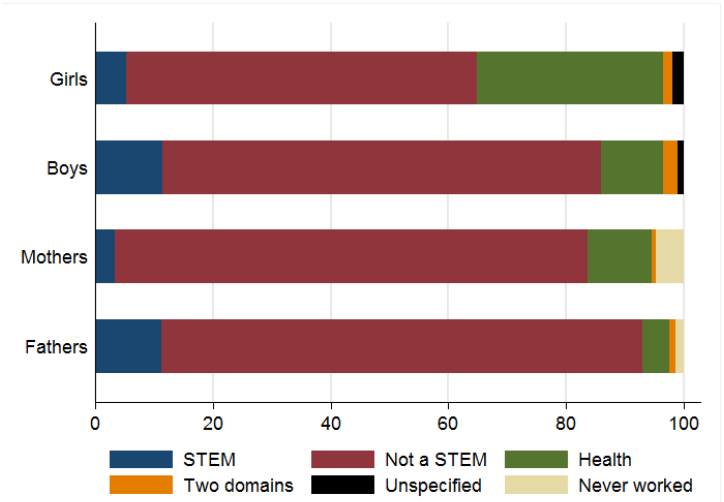
- dummy "boys are better vs. other" - that is equal to one when responder choose option "Males are somewhat better" or "... much better", and zero in any other case,
- dummy "boys are better vs. equal" - that is equal to one when responder choose option "Males are somewhat better" or "... much better", and zero - when responder choose option that females and males are the same (naturally, in this specification those responders who believe that females are better in math/science are excluded) - this specification focus only on differences between stereotypical vs. equality beliefs,
- three levels variable "boys/ equal/ girls" - that is equal to zero when responder claim that girls are better (much, somewhat), one - females and males are the same, and two - boys are better (much or somewhat).

Most of the participants, both among parents and pupils believe that there are no gender differences in math and science abilities. However, there is significantly more of those who believe that men have some natural advantage in math and science among those who do not believe in equality. Women believe more often in equality or female advantage. Mathematics stereotype seems to be stronger than beliefs on gender difference in science. The distribution of children and parents answers is presented in Table 1.

In the analyses we control for pupils and their families features: individual characteristics (race, gender), parents characteristics (race, income category, mother and father education levels and occupations), school localization (big city, suburbs, town or rural) and class characteristics (gender of math and science teachers). Finally, we use pupils' school achievements represented by their Grade Point Average (GPA) in math and science to control for objective assessment of student abilities. Each regression is reweighed using pupils level importance weight.[2]

The HSLS data do not allow to test whether gender beliefs affect future occupational decision as pupils are followed only until the end of high school. However, in the survey there is a question on what the pupils believes her or his profession will be at age 30. Based on that we can test whether what pupil claim about their plan of the future occupation is consistent with what he or she believes, and what their parents believe when it comes to gender stereotypes and their professions.

Figure 1: Pupils planned occupation at age 30 and their parents actual occupation.



Notes: Figure shows distribution of answers to the question on future occupation (for pupils at age 30) and actual occupation (for their parents). Apart from five occupation categories, parents who never worked for pay also included. The sample includes 10 295 girls and 10 462 boys, and info on 15 619 mothers and 13 060 fathers. The differences come from non responses or lack of one parent present in the household. Source of data: High School Longitudinal Study, National Center for Education Statistics.

Originally, answers to the question on occupation at age 30 are coded in five categories: a) Not a STEM occupation; b) Life and Physical Science, Engineering, Mathematics, and Information Technology Occupations; c) Health Occupations; d) Split across two sub-domains and e) Unspecified sub-domain. Distributions of the planned occupations among students and their parents actual professions are presented in Figure 1. Not STEM occupations dominate by far in all groups. As expected, STEM occupations are more popular among fathers and male students, while for women work in the health sector is much more typical. In comparison to other groups (especially male students) large proportion of female pupils plan to work in this type of profession in the future.

Similarly to the question on beliefs we simplify the picture of occupational plans and recode answers to dummy variables equal to one when student plan to work in STEM (Science,

[2] Applying importance weight provides representativeness of the data on the country level.

Technology, Engineering or Math) occupation ($OccSTEM = 1$) and zero otherwise. The same approach was applied to parents reported occupations.

3 Method

We look at the correlation between children's and parents' gender-related views and plans for future occupation. Using econometric models: logistic regression and ordered logistic regression, we estimate whether a child whose parent has stereotypical beliefs on gender differences in abilities in math and science are more likely to believe that there is inequality in math and science achievements of boys and girls.

First two specifications: "boys are better vs. other" and "boys are better vs. equal" imply dichotomous dependent variable. We will estimate the probability model: $P(Pupil'sView_i = 1|X_i)$ that a pupil believes boys are better than girls in math or science conditional on X - parent belief and set of pupil's characteristics: parents education and occupation, family wealth, GPA in math and science, gender of the math and science teachers. We additionally control for school localization: whether it is a school in the city, on the suburbs, or in the rural areas.

In the first specification we compare those who believe in men outperformance in math and science to the rest of the respondents. In the second specification we focus specifically on the difference between stereotypical thinking and equal-oriented views. The third specification combines characters of two previous specifications - the dependent variable has three levels: middle level responds to participants who believe in equal abilities of men and women in math and science. Apart from the level that corresponds to the stereotypical view that "boys are better", we distinguish also those who are convinced of privileged position of women in STEM majors. From the perspective of the transmission of views which can affect occupational and educational choices it is especially interesting to see if atypical views, not common for the society, are also going to be shared by parents and children? Can parents, even being in opposition to other members of the society, instill attitudes towards gender equality (and vice versa - can they discourage from atypical choice, even though the society moved forward)?

Three level specification requires a different econometric tool. We use ordered logistic regression. Answers "girls are better", "girls and boys are equal" and "boys are better" are ranked in this order - the higher number, the more favoritism towards men. To interpret both logistic regression and ordered logistic regression results we use odds ratios measure:

$$OR = \frac{odds(x_0)}{odds(x_i)} \tag{1}$$

where x_0 is a base level of the independent variable and x_i is the level we are interested in. In this context *odd* is the probability that someone with characteristic x_i believes that boys are better in math or science. Odds ratios give us information whether one level of the characteristic increases the probability more or less than the base level of the characteristic.

Finally, to test correlation between gender-related beliefs and plans of the future occupation field we estimate probabilities using the logistic regression approach. For interpretation we also

calculate odds ratios. Since we expect different direction of the relationship between stereo typical beliefs and plans of the future occupation we provide a set of interactions with gender of the pupil.

4 Results

First, we analyze patterns of gender beliefs of parents and children. The results of the logistic regressions clearly show that children and parents tend to reveal similar views on who is better in math and science.

Sharing gender beliefs

We find that the probability that a pupil will believe that boys are better than girls in math is around 1.6 times higher when his or her parent belief is the same, and 1.5 when the parent believes that girls and boys have the same abilities in math. Relationship is also positive in the case of science stereotype but the odds ratio is slightly smaller - around 1.3. Regression on three levels dependent variable reveal that also opposite to stereotypical beliefs are systematically shared by parents and children - if parent claim that girls are better in math or science there are lower chances that a pupil says that boys are better or boys and girls are equal. The effects for girls are slightly smaller in the case of math beliefs and stronger in the case of science - most importantly - the relation for girls is also positive. The results are reported in Table 2.

Additionally, we provide interactions between beliefs, pupil's gender and gender of the parent who is closer to the pupil according to self-selection of the parents who fill the survey. If the father was responder in the survey correlation between fathers and daughters views was stronger in the case of math, but smaller in the case of science.

There is no clear effect for female pupils - it seems like the differences between boys and girls come mostly from girls who perform better in math (have higher GPA in math). In the case of science, correlation between grades and beliefs is almost negligible for both boys and girls.

Difference between results from math and science specifications suggests that even though math and science could be classified in one category from the perspective of gender roles, trends in how views are changing are somehow different for these two groups of educational and occupational directions. This is especially interesting if we would like to assess how many generations are needed for gap in math and science gender beliefs to disappear. Taking into account overall effect, and making the strong assumption that beliefs on equality are stable between generations (i.e. if parent believe that there is no difference between boys and girls in math/science achievements than child believe the same), we find that science stereotype should be shared be lower than 1% of the population in fourth generation (starting from our parents sample). In the case of mathematics stereotype we need at least seven successive generations to achieve equality (less than 1% believe that "boys are better in math").

What is worth highlighting is that according to regression results correlation of parent

Table 2: Children and parents beliefs: who is better in math and science - females or males?

ODDS RATIO (Logit model)	MATH			SCIENCE		
	Student's views:					
	boys better vs. other	boys better vs. equal	boys/ equal/ girls	boys better vs. other	boys better equal	boys/ equal/ girls
Parent's views:						
Boys are better	1.641***	1.517***	1.594***	1.371***	1.301***	1.346***
	(0.012)	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)
Girls are better			0.595***			0.622***
			(0.007)			(0.010)
Boys are better#Girl	0.955***	1.034***	0.845***	1.535***	1.657***	1.267***
	(0.011)	(0.012)	(0.008)	(0.019)	(0.021)	(0.014)
Girls are better#Girl			1.416***			1.666***
			(0.021)			(0.034)
Boys are better#Father	0.801***	0.896***	0.753***	0.891***	1.059***	0.676***
	(0.012)	(0.014)	(0.010)	(0.014)	(0.017)	(0.053)
Girls are better#Father			1.690***			1.690***
			(0.039)			(0.053)
Boys are better#Girl#Father	1.441***	1.106***	1.600***	0.852***	0.681***	1.010
	(0.033)	(0.027)	(0.030)	(0.021)	(0.018)	(0.021)
Girls are better#Girl#Father			0.432***			0.549***
			(0.013)			(0.021)
Girls	1.280***	0.982	1.874***	0.698***	0.525***	1.127***
	(0.018)	(0.015)	(0.020)	(0.010)	(0.008)	(0.013)
Father	0.837***	0.828***	0.843***	1.086***	1.038***	1.118***
	(0.008)	(0.008)	(0.006)	(0.009)	(0.009)	(0.008)
Girl#Father	1.112***	1.203***	1.171***	0.679***	0.781***	0.774***
	(0.015)	(0.018)	(0.012)	(0.009)	(0.011)	(0.008)
Income category	1.022***	1.024***	1.012***	0.996***	0.993***	1.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female math/science teacher	0.844***	0.958***	0.763***	1.133***	1.198***	1.065***
	(0.004)	(0.005)	(0.003)	(0.005)	(0.006)	(0.004)
GPA math/science	1.348***	1.202***	1.486***	1.094***	1.072***	1.164***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
GPA math/science # Girl	0.720***	0.789***	0.667***	0.919***	0.948***	0.857***
	(0.004)	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)
Sensitivity	41.11%	42.17%		44.74%	36.77%	
No. of observations	7231	5440	7231	7179	5866	7179

Notes: Odds ratios from logistic regressions - columns (1)(2)(4)(5) and ordered logistic regressions - columns (3)(6). Dependent variable in the (1) and (4) column is equal to one when pupil claim that males are better in math or science and zero otherwise, in (2) and (5) columns - one - when pupil claim that males are better in math or science, zero - when pupil claim that females and males are the same in math or science - in this specification participants (parents and pupils) who claim that females are better in math or science are excluded. In (3) and (6) column dependent variable is equal to zero when student answered "females are better", one - "females and males are the same", and two - "males are better". All regressions include mother and father race, level of education, pupils race and localization of the school (big city, suburbs, town, rural) - odds ratios not reported in the Table. Standard errors in parentheses. Threshold for sensitivity measure set on the level corresponding to the distribution of the dependent variable. * $p-value<0.1$, ** $p-value<0.05$, ***$p-value<0.01$.

and student views are much stronger than the correlation between gender beliefs and actual achievements in math and science (GPA in math or science).

Gender beliefs and planned future occupation

Finally, we provide analyses on probabilities that a child is planning to work in STEM occupation when he or she will be 30 years old. We expect that belief that boys are better in math and science has a different effect for female and male pupils. Thus, we provide set of interaction terms between independent variables with gender of the pupil. Only two specifications of coding variable of views on math and science abilities: "boys better vs. other" and " boys better vs. equal" are used. The second specification is run as a double check - we make sure that the result is not caused by those who believe that girls are better in math or science.

In Table 3 we show that in both specifications there is a small (around 10%) positive effect of own gender-related beliefs on probability to choose STEM occupation for boys. For girls, the effect is larger and negative - between 20 to 30%. Interestingly, effect of parent's beliefs is larger for both boys and girls than their own views. For girls - there is almost a 50% lower chance to plan STEM occupation when parent believe that girls are worse in math. For boys stereotypical beliefs of parent seems to be additionally encouraging. However, there is one exception - girls seems to be only slightly discouraged (less than 10% drop in probability) by parents stereotypical beliefs about abilities to study science.

The effect of beliefs cannot be compared with the correlation between planned future occupation in STEM and the fact that parents work in STEM occupations. For boys the effect is related mostly to one of the parent working in STEM. The plan to work in STEM occupation is especially strong when mother has a job in STEM comparing when she work in other fields. For girls, the most important comparison is between families where both parents work in STEM and those where they do not.

Finally, we try to explain differences in probabilities by school achievements in math and science (represented by GPA). The effects are small, especially in comparison to beliefs and parents occupations correlations. What should be underlined is that for girls, objective assessment of math and science achievements is almost negligible, while the role of own and parents' gender-related beliefs is largely significant. Parents as occupational role models are also important.

Table 3: Planning occupation in STEM and beliefs

ODDS RATIOS (Logit model)	Plan to work in STEM occupation at age 30			
	(Boys are better vs. other)		(Boys are better vs. equal)	
Girl	0.923***	0.858***	1.279***	0.699***
	(0.016)	(0.015)	(0.026)	(0.014)
MATH:				
Pupil's view:				
Boys are better	1.103***		1.145***	
	(0.008)		(0.008)	
Boys are better#Girl	0.628***		0.728***	
	(0.009)		(0.011)	
Parent's view:				
Boys are better	1.329***		1.432***	
	(0.008)		(0.010)	
Boys are better#Girl	0.380***		0.377***	
	(0.005)		(0.005)	
SCIENCE:				
Pupil's view:				
Boys are better		1.117***		1.091***
		(0.008)		(0.008)
Boys are better#Girl		0.629***		0.688***
		(0.009)		(0.010)
Parent's view:				
Boys are better		1.403***		1.352***
		(0.009)		(0.010)
Boys are better#Girl		0.621***		0.732***
		(0.008)		(0.010)
Mother in STEM	2.175***	2.261***	2.440***	2.773***
	(0.038)	(0.039)	(0.047)	(0.050)
Mother in STEM#Girl	0.380***	0.362***	0.249***	0.381***
	(0.012)	(0.011)	(0.010)	(0.013)
Father in STEM	1.727***	1.768***	1.714***	1.800***
	(0.015)	(0.015)	(0.016)	(0.016)
Father in STEM#Girl	0.648***	0.576***	0.664***	0.538***
	(0.010)	(0.009)	(0.012)	(0.010)
Both parents in STEM	0.613***	0.576***	0.570***	0.611***
	(0.018)	(0.017)	(0.018)	(0.019)
Both parents in STEM#Girl	3.530***	3.620***	4.775***	2.769***
	(0.169)	(0.173)	(0.275)	(0.144)
GPA in math	1.095***	1.103***	1.193***	1.089***
	(0.006)	(0.006)	(0.008)	(0.006)
GPA in math#Girl	0.847***	0.885***	0.822***	1.010
	(0.008)	(0.008)	(0.009)	(0.011)
GPA in science	1.204***	1.221***	1.080***	1.225***
	(0.007)	(0.007)	(0.007)	(0.007)
GPA in science#Girl	1.007	0.954***	0.901***	0.861***
	(0.009)	(0.009)	(0.010)	(0.009)
Sensitivity	41.33%	40.15%	39.98%	42.50%
Observations	9,686	9,644	7,277	7,869

Notes: Odds ratios from logistic regressions. Samples includes only female students. Dependent variable is equal to one when student plans working in STEM occupation at age 30, and zero otherwise. Specifications in column (1) and (2) differ by the independent variables: own and parent gender beliefs. The same is for (3) and (4) columns. In the (1) and (3) specification beliefs variables is coded one when someone claim that "boys are better in math/science" and zero otherwise. In the (2) and (4) columns, one is when someone claim that "boys are better in math/science" and zero when believe in gender equality. Race and school controls are included in each regressions, but not reported in the Table. Standard errors in parentheses. * $p-value<0.1$, ** $p-value<0.05$, ***$p-value<0.01$.

5 Discussion

Not only actual choices but also beliefs can reflect changes in the perspective of gender-roles in the labor market. In this article we test whether parents and children share gender-related beliefs. We also look at plans of pupils' future occupation (at age 30) and relate them to own and parents' beliefs. We focus on a gender stereotype that men outperform women in mathematics and science.

We find that in fact there is a strong correlation between parents and children gender-related beliefs. It is observable for both high school female and male pupils. Interestingly, correlation between parents' and children's beliefs are stronger than between pupils beliefs and their actual achievements in math and science (GPA). In this study, we also find that patterns of math stereotypical beliefs are different than in case of science, and science seems to be considered as more fair in a sense of men and women expected achievements.

We test in this study whether gender-related beliefs correlate with pupils planning to work in a STEM occupation at age 30. We find that girls seem to be discouraged to pursue STEM careers by parents who follow stereotypical views on men outperforming women in math and science. The effect of parents' beliefs is stronger than own views. For boys, the relationship is the opposite, i.e. stereotypical beliefs of parents positively relate to plans to work in STEM occupation.

We find significant and persistent correlation between the fact that one of the parents work in STEM field and planned occupation for male pupils. For girls, the effect is significant (and large) when both parents pursue career in a STEM field.

The results presented in this study show several mechanisms important from the perspective of educational plans and choices of occupation. First, children tend to share their parents' gender beliefs. The magnitude of the effect depends on the type of the gender-related views. In the case of belief related to math there is still at least seven generation needed to close the gap (less than 1% of the population believing that women are worse in math than men). In the case of science, progress seems to be much faster - if the pace is not going to change - fourth generation of parents will view genders equally.

Second, it seems that gender views play a role when the decision of the occupation or education field is made (at least in the case of decision between STEM and other fields).

Third, we find that relation between parents' views and future planned occupation is stronger than between own plans and beliefs. It suggests that there is need to popularize information on equal abilities and chances of men and women in STEM field not only among pupils, but also among their parents.

Finally, we find strong effect on the probability to work in STEM occupation if one of the parents or both work in STEM. This result confirm that integenerational transmission of gender norms is observable both in gender views, and choices related to those norms. This topic is worth further analysis in the future.

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