Brothers Increase Women's Gender Conformity*

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Abstract

I examine how one central aspect of the childhood family environment—sibling sex composition—affects women's gender conformity, as measured through their choice of occupation and partner. Using Danish administrative data, I causally estimate the effect of having a second-born brother relative to a sister for first-born women. The results show that first-born women with a second-born brother acquire more traditional gender roles resulting in a stronger response to motherhood in terms of labor supply and earnings. I provide evidence of increased gender-specialized parenting in families with mixed-sex children, suggesting a stronger transmission of traditional gender norms. Finally, I find indications of persistent effects to the next generation of girls.

JEL classification: I2, J1, J2
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1 Introduction

Across most OECD countries, women today attain more education than men and participate almost equally in the labor force (OECD, 2016, 2017). But why do women keep choosing fields of study that lead to substantially lower-paid occupations (Blau and Kahn, 2017)? Although barriers to women's participation in education and the labor force have been removed in an attempt to achieve gender equality, gender norms still play an important role for gender differences in behavior and subsequently, economic outcomes (Akerlof and Kranton, 2000; Bertrand, 2011; Goldin, 2014). In particular, in contrast to men, women still experience a substantial drop in labor earnings upon entering motherhood, in large part due to a decreased labor supply, across developed countries (Kleven et al., 2019). To better understand why women continue to behave in ways that lead to inferior labor market outcomes relative to those of men, it is essential to know more about the origins of women's conformity to traditional gender norms.[1] In this study, I focus on the importance of one key aspect of the childhood family environment—sibling sex composition—for women's socialization and development of gender conformity.

To examine how sibling sex composition affects the development of women's gender conformity, I use high-quality administrative data on the Danish population from 1980 to 2016. With this comprehensive data set, I evaluate women's conformity to traditional gender norms measured through their choice of occupation and partner from the age of 31 to 40 (proxied by the gender share in their own and their partner's occupations, respectively). I further complement these measures of gender conformity with an examination of whether sibling sex differentially affects women's response to motherhood in terms of labor supply and earnings. To provide causal estimates of the impact of sibling sex, I exploit the random assignment of the second child's sex in families with a first-born daughter, conditional on the parents' having a second child. In other words, I compare the gender conformity of first-born women with a second-born brother to those with a second-born sister. While sibling sex composition has a small impact on family size, I show that family size is not a confounding factor for the effect of sibling

[1] In this paper, I define *gender norms* as people's perceptions of how women and men generally should conform within society, based on the definition by United Nations Statistics Division (2018). *Gender roles* reflect the expectations associated with the perception of masculinity and femininity; I will refer to gender norms and gender roles interchangeably. Similarly, I consider *gender conformity* as the act of conforming to the prevailing gender norms in society. While gender norms within a given society are relatively fixed at a given point in time, the degree to which individuals conform to those norms differ.

sex composition on women's gender conformity.

This empirical approach distinguishes itself from most previous studies on sibling sex composition, which generally include all siblings in both the measure of sibling sex composition and the estimation sample. However, as the final sibling sex composition in a sibship is endogenous, including all siblings might lead to biased estimates. By focusing on the second-born child's sex, I avoid selection bias, as parents do not know the sex of their unborn child when deciding to have another child.

My results show that having a second-born brother relative to a sister increases first-born women's conformity to traditional gender norms. Specifically, women with a brother work in more female-dominated occupations during their thirties and choose more traditional partners. I next document that women with a brother experience a larger drop in labor earnings and cumulate less working experience from the time of their first childbirth through nine years after, relative to women with a sister. What is even more striking is that this response to the arrival of the first child is entirely driven by women growing up in traditional families.[2]

Why does sibling sex affect women's conformity to traditional gender roles? The dominating effect of having a brother on women's gender conformity cannot be ascribed to changes in ability or parental resource constraints, as I do not find an effect of sibling sex on school performance or educational attainment. Instead, my findings are consistent with the argument that having an opposite-sex sibling increases girls' exposure to gender-typed behavior and thereby increases their inclination to acquire more traditional gender roles.[3] In support of this hypothesis, some studies have shown indications of more sex-typed activities and interests among girls and more traditional family attitudes among women for those with (more) brothers (Brody and Steelman, 1985; Cools and Patacchini, 2019; Grotevant, 1978; Healy and Malhotra, 2013; McHale, Crouter and Tucker, 1999; Rao and Chatterjee, 2018). These effects could be the result of either child-sibling and/or child-parent interactions. On the one hand, girls might for instance try to differentiate themselves from brothers by exhibiting more gender-stereotypical behaviors and attitudes. On the other hand, parents might invest their time more gender-specifically by having the mother spend more time with the daughter and the father more time with the son.

Drawing on rich survey data, I examine mothers' and fathers' quality time investment

[2] I measure a *traditional family* as having a father working more than the mother during childhood.

[3] This argument is similar to the one put forward in the same-sex education literature (Booth, Cardona and Nolen, 2013; Schneeweis and Zweimüller, 2012).

in their first-born daughter during childhood. I provide compelling evidence in favor of the child-parent interaction channel by showing that parents of mixed-sex children invest their time more gender-specifically in their first-born daughter compared with parents of same-sex children. This empirical pattern is consistent with a traditional household specialization model with gender-specific parenting human capital (Becker, 1973; Becker and Tomes, 1986). Mothers might have better knowledge of problems facing daughters than fathers and therefore have the comparative advantage of raising daughters and vice versa for fathers and sons. Therefore, it would be optimal for the parents to gender-specialize their parenting in mixed-sex families. This suggests that parents of mixed-sex children more strongly transmit gender-specific human capital and thereby traditional gender norms to their daughters than parents of same-sex children. The results from heterogeneity analyses further indicate that the effect of having a brother is strongest for women from more traditional families.

The key finding that women with a brother acquire more gender-typed human capital and pair with more gender conforming men implies that they end up creating a family environment for their children that is more traditional in terms of gender roles. This motivates an analysis of whether the effects persist into the human capital formation of the next generation. Remarkably, the results show that daughters' comparative advantage in language over math in school is larger for those from more traditional families (i.e. for daughters of mothers with a brother relative to daughters of mothers with a sister). Thus, I find striking evidence of persistent long-run consequences of women's childhood family environment. This demonstrates that women are not only sensitive to the gender role environment shaped in the family after the second child's birth (caused by sibling sex composition and unrelated to parents' human capital), but girls are also sensitive to the degree of gender norms in their family environment shaped already before birth (parents' gendered human capital).

In this paper, I bring in new questions to the literature studying how the social (in particular, the family) environment affects women's conformity to traditional gender norms; importantly, I am able to answer these questions thanks to the rich and extensive data, including administratively reported occupations and family links. This paper makes three central contributions to the existing literature. *First*, I provide a comprehensive analysis of how sibling sex composition causally affects the development of women's gender conformity, using three novel measures (choice of occupation, choice of partner, and the response to motherhood in labor market outcomes).[4] *Second*, I conduct a large quantitative analysis of how sibling sex composition affects child-parent interactions, thereby providing evidence on an important channel through which the effects on gender conformity operate. *Third*, I document lasting effects on the next generation of girls, thereby stressing the persistence of gender norms.[5]

This paper builds on a small literature on sibling sex composition, which has predominantly concerned educational attainment, while a few more recent papers focus on wages. The evidence on educational attainment is mixed overall (Amin, 2009; Bauer and Gang, 2001; Butcher and Case, 1994; Conley, 2000; Hauser and Kuo, 1998; Kaestner, 1997). However, small sample sizes pose a general problem, often resulting in quite imprecise estimates, and these studies include all siblings in the measure of sibling sex composition, raising concerns about potential biases.[6] In contrast, studies on wages reach a more consistent finding that both male and female wages are negatively associated with having an opposite-sex sibling (Cools and Patacchini, 2019; Peter et al., 2018; Rao and Chatterjee, 2018), similar to my findings. The focus of these studies is whether sibling sex composition influences earnings at one specific point in time[7] , while my focus concerns how sibling sex affects women's development of gender conformity, with one aspect being the response to motherhood on labor earnings.To reconcile the existing evidence of a "brother earnings penalty" with my findings on a differential response to motherhood by sibling sex, I show that the negative effect of having a brother on

[4] Only few papers on sibling sex composition have considered occupational choice and have generally not had access to data that could allow for any clearcut conclusion. Cools and Patacchini (2019) and Rao and Chatterjee (2018) consider some occupational outcomes based on self-reported measures of occupation; however, their estimates are too noisy to allow for any clear conclusions due to small sample sizes ($N < 2,900$). Moreover, Peter et al. (2018) consider the female share in women's occupation, but have access to fewer years of data than I do and pool women of very different ages and birth cohorts; overall, they do not find an effect of sibling sex, though they note that they qualitatively find a comparable effect to my results on the probability of working in a STEM field. Moreover, to the best of my knowledge, no previous sibling sex composition paper has examined the gender conformity of the choice of women's partner.

[5] While the main analysis concerns the development of women's gender norms, Appendix B.5 briefly presents the results from a similar analysis for men. In line with the findings for women, the results suggest that having an opposite-sex sibling enhances men's gender conformity.

[6] Sample sizes are in most cases around 3,000–4,000 observations; Hauser and Kuo (1998) analyze slightly larger samples.

[7] Cools and Patacchini (2019) consider earnings around age 30 for cohorts born in the late 1970s and early 1980s in the United States, Rao and Chatterjee (2018) consider earnings at age 28–36 for cohorts born two decades earlier also in the United States, and Peter et al. (2018) consider the average earnings between 25 and 64 for cohorts born 1938–1977 in Sweden (however, they do not observe earnings for all ages for any of the cohorts).

women's earnings emerges exactly around the age when most women have their first child. Thus, the timing of the measurement of women's earnings is crucial for understanding the underlying mechanisms of the brother earnings penalty in a modern setting with equal labor market performance between men and women prior to first childbirth (Kleven, Landais and Søgaard, 2018).

This paper also speaks to a broader literature on how the social environment shapes gender differences in behavior and human capital formation. My focus on the childhood environment and the origins of gender conformity is consonant with recent studies tracing gender gaps in educational outcomes to factors such as teacher stereotypes, the gender of school peers and teachers, and parental and sibling role models.[8] For instance, one strand of the literature shows that gender stereotypes in the school environment affect the gender gap in math test scores.[9] However, fewer studies trace effects into outcomes with consequences for economic well-being (such as education, working decisions, and earnings) in adulthood, partly due to limited data availability.

2 Empirical Strategy

The aim is to estimate the causal effect of sibling sex composition on the formation of women's gender conformity. However, simply comparing women from families with different sex compositions would not provide valid estimates of the causal effect of sibling sex composition due to selection. The final gender composition in a family is endogenous, as parents decide whether to have more children after the birth of each child and thus know their current children's sex composition. If parents' decision to have a second child depends on the first child's sex and if such sex preferences also affect how parents raise their children, it is not possible to estimate the causal effect of "current" (first-born) children's sex on "future" (second-born) children's outcomes because not all "future" children are born.[10]

To estimate the causal effect of sibling sex composition, I focus on the random as-

[8] See e.g. Anelli and Peri (2015, 2016); Bottia et al. (2015); Brenøe and Lundberg (2017); Brenøe and Zölitz (2018); Carrell, Page and West (2010); Cheng, Kopotic and Zamarro (2017); Zölitz and Feld (2017); Humlum, Nandrup and Smith (2018); Joensen and Nielsen (2017); Johnston, Schurer and Shields (2014); Oguzoglu and Ozbeklik (2016).

[9] E.g. Alan, Ertac and Mumcu (2018); Carlana (2018); Lavy and Sand (2015); Lavy and Megalokonomou (2017).

[10] Appendix B.2 shows the selection bias problem more formally and discusses other reasons for selection bias aside from parental sex preferences.

signment of the second-born child's sex. Because parents do not know the sex of a subsequent child when they decide to have another child, I *can* causally estimate the effect of a "future" child's sex on "current" children's outcomes. Thus, I leverage the random assignment of the second child's sex in families with a first-born daughter, conditional on having a second child. In other words, I compare first-born women who have a second-born brother with first-born women who have a second-born sister. Thus, the identifying assumption is that conditional on the first child's sex and conditional on having a second child, the sex of the second child is random.[11]

The empirical specification for the main analysis is:

$$Y_i^{First-Born} = \alpha_0 + \alpha_1 Brother_i^{Second-Born} + X_i'\delta + \nu_i, \tag{1}$$

where $Y_i^{First-Born}$ measures woman i's (who is first-born) gender conformity. The estimate of interest is α_1, representing the effect of having a second-born brother. X_i is a vector of fixed effects for birth municipality, year-by-month of birth, spacing in months to the second-born sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education.[12] ν_i is the error term.

As this strategy only relies on the random assignment of the second child's sex, parents can respond to the sex composition of their first two children in terms of subsequent fertility. Consistent with the literature exploiting sibling sex composition as an instrument for family size (e.g. Angrist and Evans (1998)), Appendix Table B1 shows that for the main sample of the analysis (described in Section 3) having two mixed-sex children reduces family size by 0.07 children on average. Therefore, family size could

[11] My strategy is e.g. in contrast to Amin (2009); Anelli and Peri (2015); Bauer and Gang (2001); Butcher and Case (1994); Conley (2000); Cyron, Schwerdt and Viarengo (2017); Hauser and Kuo (1998); Kaestner (1997); Oguzoglu and Ozbeklik (2016); Rao and Chatterjee (2018). Moreover, Gielen, Holmes and Myers (2016) employ a difference-in-differences strategy to estimate the effect of having a male twin on earnings, although their interest lies in whether exposure to prenatal testosterone (rather than sibling sex composition per se) has an effect on earnings. Contemporaneous with this current paper, another paper developed a similar strategy to mine. In their published version, Peter et al. (2018) use a similar strategy to mine, while they in their working paper version only considered the effect of a co-twin's sex (Peter, Lundborg and Webbink, 2015), an approach similar to Cronqvist et al. (2016). Relatedly, Cools and Patacchini (2017) study the association between having any brother and women's earnings, while they in their published version only consider the effect of the sex of a next younger sibling Cools and Patacchini (2019), an approach that Rao and Chatterjee (2018) also consider in a robustness check and that Vogl (2013) also use in the context of marriage institutions in developing countries (though, in the rest of the paper, I will only consider studies from developed countries). Moreover, Healy and Malhotra (2013) use the sex of a next younger sibling as an instrument for the share of sisters within a sibship to examine the effect on political attitudes.

[12] If the parent does not have a field-specific education, I use their field of occupation.

potentially mediate some of the effect of having a second-born brother if family size has an independent impact on gender conformity. Existing studies find that family size does not affect educational attainment in Israel or Norway, using twins as an instrument for family size (Angrist, Lavy and Schlosser, 2010; Black, Devereux and Salvanes, 2005). In Appendix B.1.1, I replicate this finding in the Danish context and show that family size also does not affect the different measures of gender conformity. Appendix B.1.2 provides additional tests of the sensitivity of the findings, which further lend support to the conclusion that the results are robust to family size. Based on this wide battery of tests, family size does not seem to be an important confounder or mediator of the effect of sibling sex.

To reach a comprehensive picture of women's conformity to gender norms, I further examine whether first-born women with a second-born brother to a greater extent conform to traditional gender roles upon motherhood in terms of labor market outcomes than those with a second-born sister. For this, I consider women's labor market trajectory relative to their first childbirth by sibling sex in an event study framework. The difference-in-differences specification is:

$$\begin{aligned} L_{it}^{First-Born} =& \phi + \gamma_i + \sum_{k \in \mathcal{T}} \alpha_k \cdot Time_{ik} + \sum_{k \in \mathcal{T}} \beta_k Time_{ik} \cdot Brother_i^{Second-Born} + \varepsilon_{it} \\ \mathcal{T} =& \{-6, -5, ..., -1, 1, ..., 9\} \end{aligned} \tag{2}$$

where $L_{it}^{First-Born}$ is the woman's labor market outcome (labor supply and earnings) in year t relative to her first childbirth and γ_i represents individual fixed effects. $Time_{ik}$ is a series of event year dummies (i.e., dummy variables for event years -6 to 9, excluding the calendar year of childbirth which is coded as year 0), where the event is entry into motherhood, i.e. the woman's first childbirth. I estimate this regression specification from six years prior to the arrival of the first child through nine years following the birth to rigorously test for pre-trends and to allow for dynamic effects occurring well after the first childbirth. For this analysis, it is important to note that I do not find evidence of any meaningful effect of sibling sex on fertility outcomes, neither in terms of the probability of having any children nor the age at first childbirth (Table 5). Thus, focusing on the sub-sample of women with any children and centering the analysis around the timing of the first childbirth should not introduce any selection issue.

3 Data

3.1 Data and Sample Selection

I use Danish administrative data for the total population from 1980 to 2016. One central feature of this data set compared to most previous studies on sibling sex composition is that I can link all children to their parents, siblings, (cohabiting and marital) partners, and own children. Thus, I observe parents' complete fertility history and thereby correctly measure the sibling sex composition. Furthermore, I have information on parents' date of birth, length, type, and field of education, labor market attachment, and occupation. For the children, I annually observe labor market outcomes, educational enrollment and completion, fertility, cohabitation, and marital status. Finally, I observe the school performance of the children's children.

I restrict the sample to women born between 1962 and 1975 to study the choice of occupation and partner when these women are in their thirties. Moreover, I only include first-born women, who are the first child to both the mother and father.[13] I exclude immigrants.[14] I only consider individuals who have at least one full sibling (same mother and father) born less than four years apart and who survived the first year of life.[15] I exclude families in which either the first or second child is a twin, and finally I exclude those few women who died before the age of 40 or did not live in Denmark at any time between the age of 31 and 40, when the main outcome variables are measured.[16] I refer to this sample of first-born women as the *main sample*.

Table 1 provides descriptive statistics on the childhood family environment for the main sample by the sex of the second-born sibling. As expected, these women come from families with similar predetermined family characteristics regardless of sibling sex. On average, spacing to the younger sibling is 2.5 years, mothers are 22.9 years at birth and have 10.9 years of education, while fathers are 25.7 years and have 11.8 years of ed-

[13] This restriction naturally makes the sample positively selected, as parents who stay together long enough to have two children together on average come from better socio-economic backgrounds. However, this is a necessary restriction, as the sample of women that I study needs to have a sibling in order to study the effect of a younger sibling's sex.

[14] For first-generation immigrants, I do not necessarily have complete sibling or parental information. Second-generation immigrants would have represented approximately one percent of the sample; I decided to exclude them to have a more homogeneous sample. However, including second-generation immigrants does not change the results.

[15] Of all children who fulfill all sample requirements except for the restriction on spacing, 72 percent have less than four years between them and their second-born sibling.

[16] Sibling sex composition does not affect attrition due to these restrictions.

Table 1
Descriptive Statistics on Childhood Family Environment for the Main Sample of First-Born Women

Panel A: Statistic by Sex of the Second-Born Sibling

	Sister		Brother		t-test
	Mean	SD	Mean	SD	p-value
	(1)	(2)	(3)	(4)	(5)
Predetermined Characteristics					
Spacing (months)	29.9	9.6	30.0	9.6	0.16
Mother's age at birth (years)	22.9	3.6	22.8	3.6	0.21
Father's age at birth (years)	25.7	4.4	25.6	4.4	0.06
Mother's education (years)	10.9	3.2	10.9	3.2	0.63
Father's education (years)	11.8	3.3	11.8	3.3	0.55
Mother has $\geq$ 12 years of education	50.8	50.0	51.2	50.0	0.28
Father has $\geq$ 12 years of education	65.7	47.5	65.8	47.4	0.86
Both parents have $\geq$ 12 years of edu	41.5	49.3	41.8	49.3	0.33
Mother in care or administration	15.6	36.3	15.8	36.4	0.43
Father in STEM	8.2	27.4	8.3	27.6	0.59
Mother in care/adm & Father in STEM	2.4	15.2	2.4	15.3	0.68
Parental Response to Sex Composition					
Number of siblings	1.7	0.9	1.6	0.9	$<$0.01
Has $\geq$ 2 siblings	39.9	49.0	34.6	47.6	$<$0.01
Has $\geq$ 3 siblings	8.4	27.8	7.1	25.6	$<$0.01
Lives with both bio parents age 17	81.0	39.2	81.1	39.1	0.63
Lives with mother, sib with father	4.6	20.9	9.9	29.9	$<$0.01
Parents Equal Division of Labor	33.7	47.3	33.4	47.2	0.38
Observations	50,757		53,014		
Panel B: Balancing Test					
Joint F-statistic			0.92		
Prob > F			0.92		

Main sample (first-born women born 1962–1975 with a second-born biological sibling born within four years). Panel A shows the average and standard deviation of family background characteristics for first-born women with a second-born sister (columns (1) and (2)) and brother (columns (3) and (4)). Column (5) reports the p-values from t-tests of significance between the averages of the two groups of women. All binary variables (variables measuring shares) are multiplied by 100 to express percent (percentage points). Panel B tests whether the control variables included in X_i in Equation (1) can predict having a second-born brother. F-test of joint significance of all control variables.

ucation. When it comes to characteristics that the parents can manipulate after realizing the sex composition of their first two children, we see that those with two daughters are more likely to have more children, as discussed in Section 2. Meanwhile, the probability of having both parents working equally[17] during childhood or living with both biological parents at the age of 17 does not differ by sibling sex composition. However, among those not living with both parents at the age of 17, there is a clear difference in the family living arrangement: divorced parents with mixed-sex children are more likely to only live with their same-sex child.

To provide support for the identifying assumption that sibling sex is random, column (5) in panel A tests whether the background characteristics differ by the sex of the second-born sibling. Considering the predetermined characteristics, only the father's age at birth differs marginally between the two groups. Panel B shows statistics from a balancing test that tests whether the demographic characteristics included in X_i in equation (1) can predict sibling sex. More precisely, it reports the F-test of joint significance of all of the covariates in a regression where the outcome is an indicator for having a second-born brother. The F-test strongly rejects joint significance. Thus, this balancing test supports the identifying assumption that the younger sibling's sex is random, conditional on the first child's sex and conditional on having a second child.[18]

3.2 Outcome Variables

The three main outcome variables evaluate the degree of women's gender conformity. The first outcome reflects the extent to which the individual woman's occupational choice is gender-typed. More precisely, I construct this variable as the natural logarithm of the average male share in the woman's four-digit occupation codes observed between the ages of 31 and 40.[19] The second outcome measures the share of years between the

[17] I define this as the tertile of families in which the parents' division of labor until the child turns 19 years is most equal. More precisely, fathers in this group work at most 62 percent of the total parental labor supply. I observe parents' labor supply through a mandated pension scheme (ATP), in which employers contribute for each employee based on the number of hours worked. This is also the variable I use to measure cumulated work experience as the outcome variable; see e.g. Kleven, Landais and Søgaard (2018) for more details on this measure.

[18] The graphs in Appendix Figure B2 illustrate the estimates from an event study of the effect of having a second-born son on a variety of parental socio-economic characteristics. The sex composition of children does not affect parental cohabitation, marital status, length of education, employment, or labor earnings around the birth of their first child.

[19] I use the Danish version of the International Standard Classification of Occupations (DISCO), which I observe from 1991 to 2013.

ages of 31 and 40 during which the woman works in a high-skilled STEM occupation. The choice of this outcome is particularly motived by the recent focus in the literature on women shying away from STEM fields, fields that are traditionally high-paid and heavily male-dominated. The third outcome quantifies how traditional the woman's choice of partner is. This variable measures the natural logarithm of the female share in the partner's occupation.[20] Table 2 provides descriptive statistics on the outcome variables for the main sample of women by sibling sex and for a sample of men with similar selction criteria as for the main sample, for comparison. We observe a strong degree of gender segregation in occupational choice. While men make up 34 percent of workers in women's occupations, they make up 72 percent of workers in men's occupations. At the same time, women with a brother also seem to be slightly more gender conforming in their occupational choice and choice of partner than women with a sister.

To study whether the impact of motherhood causes a differential response on labor market outcomes by sibling sex, I further consider labor force participation and earnings in relation to the arrival of the first child.[21] As measure of labor force participation, I examine the cumulated lifetime work experience at the end of each calendar year, measured in months. Supported by the findings in Kleven et al. (2019), I consider this measure of employment (i.e. the intensive margin) the most relevant measure of labor force participation rather than participation at the extensive margin.[22] This measure of work experience corresponds to full-time equivalent working experience and accounts thereby for periods of (different degrees of) part-time work; periods of un- or non-employment do not enter as work experience. As measure of earnings, I use the earnings percentile by age and cohort, which provides a standardized measure of relative income that includes individuals with zero earnings, is comparable across cohorts and ages, and is constructed based on the total population. For robustness checks, I also consider earnings measured in levels and log-transformed and cumulated lifetime unemployment,

[20] I define the partner as the mode person with whom the woman cohabits or is married between the ages of 31 and 41. Sibling sex has no impact on women's probability of having an observation on the partner's occupation (not reported). I consider the logarithm of the male share in the woman's own occupation and the logarithm of the female share in her partner's occupation because these measures best approximate a normal distribution rather than considering the logarithm of the male share in both persons' occupations.

[21] For the event study estimations of labor market outcomes, I restrict the sample to women who live outside Denmark (and thus do not have an observation during those years) for at most three years of the analysis period.

[22] Kleven et al. (2019) show that the response to motherhood is much larger at the intensive compared to the extensive labor supply margin in Scandinavia and German-speaking countries than in English-speaking countries.

Table 2
Descriptive Statistics on Outcome Variables for Sample of First-Born Women by Gender of Second-Born Sibling (and First-Born Men for Comparison)

	Women				Men	
	Sister		Brother		Sister/Brother	
	Mean (1)	SD (2)	Mean (3)	SD (4)	Mean (5)	SD (6)
Choice of Occupation and Partner						
Male share in own occupation	33.6	21.1	33.2	20.9	71.6	22.1
STEM occupation	5.2	19.0	4.8	18.1	14.2	30.3
Female share in partner's occ	28.4	21.4	28.0	21.4	66.4	20.3
Labor Market Outcomes at age 40						
Earnings Percentile	49.0	24.8	48.7	24.7	64.4	27.4
Earnings (1,000 2015-DKK)	320.6	197.6	318.6	197.8	460.7	395.3
Work experience (months)	168.9	63.4	168.6	63.7	192.2	69.0
Education by age 30						
Male share in education	36.0	21.5	35.7	21.5	66.4	25.2
Length of education (months)	159.6	26.7	159.5	26.6	158.8	27.4
Academic high school GPA (std.)	0.02	0.99	0.01	0.99	0.09	1.03
Any STEM enrollment	8.2	27.5	7.6	26.6	41.4	49.3
Any STEM completion	5.1	21.9	4.5	20.8	30.3	45.9
Marital and Fertility History by age 41						
Cohabit share age 18–41	26.8	21.0	26.0	20.7	23.8	19.6
Married share age 18–41	38.9	27.6	38.8	27.7	30.0	25.5
Has any children	88.6	31.7	88.5	31.9	79.4	40.5
Number of Children	2.0	1.1	2.0	1.1	1.7	1.1
Age at first childbirth	27.2	4.6	27.3	4.6	29.3	4.6
First-Born Child's Grade 9 GPA (standardized with mean 0, SD 1)						
Daughter language	0.40	0.93	0.43	0.91	0.36	0.93
Daughter math	0.15	0.95	0.15	0.95	0.09	0.96
Son language	-0.04	0.96	-0.05	0.96	-0.09	0.97
Son math	0.26	0.94	0.25	0.95	0.21	0.96
Observations	50,757		53,014		108,367	

Main sample (first-born women born 1962–1975 with a second-born biological sibling born within four years); the sample of men corresponds to the one of women with the same sample-selection criteria. Columns (1) and (3) show the average outcome variables for first-born women with a second-born sister and brother, respectively, while column (5) shows the average for first-born men regardless of the second-born's gender. All binary variables (variables measuring shares) are multiplied by 100 to express percent (percentage points).

measured in months at the end of each calendar year. At age 40, women have an average earnings percentile of 49, corresponding to a mean labor income of 320,000 DKK in 2015-prices (43,000 EUR). While women only earn 70 percent of men, men and women participate almost equally in the labor market; by age 40, women (men) have 14 (16) years of work experience.

Furthermore, I examine whether sibling sex affects education by age 30 and family formation through age 41. Similar to labor force participation, these cohorts of women and men attain an almost equal length of education: by age 30, women have, on average, completed 13.3 years of education and men have completed 13.2 years. Consistent with the differences in occupational choice, the male share in the highest completed degree is much lower for women (36 percent) than for men (66 percent), and women are much less likely to enroll in and complete any field-specific STEM education.[23] Generally, for these groups of outcomes, differences between women by sibling sex only seem to appear for the outcomes with pronounced gender differences (earnings and male dominance in education).

Family formation might be an aspect of women's life that reflect a certain degree of gender conformity and, at least fertility, affect labor market outcomes (Bertrand, 2011; Lundborg, Plug and Rasmussen, 2017). First, I consider the share of years between ages 18 and 41 during which the woman cohabits without being married (henceforth *cohabit*) and is married, respectively. Second, I consider the probability of having any children, the number of children, and age at first childbirth conditional on having any children. Although having a partner (and being married) and having children might reflect a greater degree of gender-stereotypical behavior, this is not inevitably the case (Bertrand et al., 2016); instead, cohabitation could reflect non-traditional behavior, given that marriage is the tradition.

Finally, the last group of outcomes concerns the school performance of the next generation. For this, I consider the outcomes of the first-born child and split the sample by the child's sex.[24] I examine the externally graded grade-point-average (GPA) from the Grade 9 written language (Danish) and math exams. Both measures are standardized with a mean of zero and a standard deviation (SD) of one by exam year for the entire

[23] See Appendix B.3 for details on the educational outcomes and the educational system in Denmark with emphasis on STEM education.

[24] Given that child sex is independent of the sex of the mother's sibling, this split does not create any bias. Nonetheless, sibling sex might affect the mother's gender preference for her own children and thereby her subsequent fertility choices. Therefore, I only consider women's first-born children. Sibling sex is unrelated to the probability of having an observation on a first-born child's outcomes.

student population. The descriptive statistics for daughters indicate a small difference in language performance between those whose mother have a brother and those whose mother have a sister.

4 Results

This section presents the results on the effect of sibling sex on women's adult outcomes and their children's school performance, using the main sample. Subsection 4.1 provides the main results of the paper by eliciting the effect of sibling sex on women's gender conformity in terms of their choice of occupation and partner, including heterogeneity analyses. Subsection 4.2 complements the main analysis on gender conformity by examining how women with a brother differentially respond to motherhood in the labor market relative to those with a sister. Next, Subsection 4.3 considers whether differences in education and family formation could explain the findings on occupational choice. Finally, Subsection 4.4 examines whether the effects persist to the next generation by studying the school performance of the children of the women in the main analysis.

4.1 Gender Conformity in Choice of Occupation and Partner

Table 3 shows the main results on the impact of sibling sex on women's choice of occupation and partner, with different control versions. The models in column (1) show the raw means between first-born women with a second-born sister and those with a second-born brother, while column (2) includes basic demographic controls. Column (3), the preferred model, further controls for parental education. Finally, column (4) flexibly adds controls for family size and the sex of potential third- and fourth-born siblings.[25] As family size is an outcome of sibling sex composition, the latter control version might bias the estimates. However, this control version works as a robustness check of the results, as family size might also be considered a confounding variable. Regardless of the covariates included, the estimates across the different control versions are almost identical, supporting the assumption that sibling sex is random and illustrating that family size is not a principal mediator of the effect of sibling sex (as discussed in more detail in Appendix B.1). Therefore, the rest of this paper proceeds by presenting the results using the preferred control version in column (3).

[25] The estimates are identical when not controlling for third- and fourth-born siblings' sex.

Table 3
Effect of Sibling Sex on Choice of Occupation and Partner

	(1)	(2)	(3)	(4)
Panel A: Log(Male Share in Own Occupation)				
Second-Born	-1.16**	-1.18**	-1.21***	-1.28***
Brother	(0.48)	(0.47)	(0.47)	(0.47)
Observations	103,771	103,771	103,771	103,771
Panel B: Share of Years Working in STEM Occupation				
Second-Born	-0.38***	-0.37***	-0.38***	-0.41***
Brother	(0.12)	(0.11)	(0.11)	(0.11)
Observations	103,771	103,771	103,771	103,771
Panel C: Log(Female Share in Partner's Occupation)				
Second-Born	-2.01***	-1.77***	-1.91***	-1.91***
Brother	(0.67)	(0.67)	(0.66)	(0.66)
Observations	95,058	95,058	95,058	95,058
No controls	✓			
Basic controls		✓	✓	✓
Parental education			✓	✓
Family size				✓

All estimates are multiplied by 100 to express effects in percentage/log-points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample (first-born women born 1962–1975 with a second-born biological sibling born within four years). Each panel column presents estimates from separate regressions. *Basic controls* include fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, and paternal age at birth. For the own-occupation outcomes, basic controls also include dummies for the number of years observed in the income registry from ages 31–40 and the number of years observed with a valid occupation code from ages 31–40. For partner's occupation, basic controls also include dummies for the partner's number of occupational observations and age at first and last observation. *Parental education* controls include fixed effects for maternal level-by-field of education and paternal level-by-field of education. *Family size* controls include dummies for the number of biological siblings and dummies for the number of children that the mother and father potentially have, respectively, from later relationships, and the sex of potential third- and fourth-born siblings. The occupational outcomes of the first-born women are measured as a mean from ages 31–40. The occupational outcome of the partner is measured mainly at the ages 31–45 for the partner with whom the woman lived for most years from ages 31–41.

Overall, the results show that having a second-born brother relative to a sister enhances women's conformity to traditional gender norms. First-born women with a second-born brother work in occupations with 1.22 percent fewer men compared to first-born women with a second-born sister. Note that this difference in occupational choice is observed well into these women's labor market careers during their thirties (as an average from the age of 31 to 40). Consistent with this, having a brother also reduces women's probability of working in STEM fields by 0.38 percentage points, corresponding to a decrease of 7.3 percent relative to the mean for women with a sister. Consequently, the results clearly show that having a brother induces women to exhibit more traditional choices of occupation. In other words, they are less prone to opt into traditionally male-dominated occupations, including STEM.

Moreover, sibling sex has a significant impact on the choice of partner in terms of the degree to which his occupation is gender-typed. Having a brother rather than a sister induces women to choose a partner who works in more male-dominated occupations. On average, women with a brother have a partner working in occupations with 1.91 percent fewer women than women with a sister.[26] In results not reported, having a brother increases the difference in the male share between the woman's own and her partner's occupations by 0.80 percentage points. Additionally, as a test of the robustness of the main measures of gender conformity, Appendix Table B7 considers two alternative measures. Notably, having a brother also increases the partner's relative earnings in the couple and the age between the woman and the partner. These results demonstrate a powerful effect of having a brother not only on women's choice of gender-stereotypical occupations and partners but also on other aspects of their gender-conforming behavior.

If the effect of sibling sex at least partly is attributable to the way in which parents treat their children, we might observe some heterogeneity by parental characteristics in the effect of having a brother.[27] Panel A in Table 4 includes an interaction term between sibling sex and an indicator for having parents working (almost) equally during childhood. Remarkably, the effect of having a brother on occupational choice disappears for women coming from more gender-equal families. This suggests that women with more gender-stereotypical parents drive the effect of sibling sex on the probability of

[26] Appendix Figure B3 presents quantile regression results to assess whether the effect differs across the different parts of the distribution. The estimates are not statistically significantly different from each other from the 10^{th} to the 90^{th} percentiles, although the effect of having a brother seems to be larger at the lower part of the distribution.

[27] As seen in Table 1, these parental characteristics do not differ by sibling sex composition.

Table 4
Heterogeneity: Choice of Occupation and Partner

	Log(Male Share in Own Occupation) (1)	Share of Years in STEM Occupation (2)	Log(Female Share in Partner's Occupation) (3)
Panel A: Parental Division of Labor During Childhood			
Second-Born	-1.62***	-0.36**	-1.95**
Brother (SBB)	(0.59)	(0.14)	(0.82)
SBB $\times$Equal	1.72*	-0.03	-0.03
	(1.01)	(0.25)	(1.42)
Observations	100,021	100,021	91,676
Panel B: Parental Field of Academic Education			
Second-Born	-0.64	-0.19	-1.75**
Brother	(0.54)	(0.13)	(0.75)
SBB$\times$Mother Care/Adm	-1.44	-1.01***	-1.03
	(1.41)	(0.35)	(1.99)
SBB$\times$Father STEM	-3.79*	-0.75	-1.09
	(2.04)	(0.50)	(2.87)
SBB$\times$Mother Care/Adm	1.98	1.09	1.65
$\times$Father STEM	(3.91)	(0.96)	(5.54)
Observations	100,772	100,772	92,376
Panel C: Parental Years of Education			
Second-Born	0.84	-0.21	-1.63
Brother	(0.96)	(0.24)	(1.35)
SBB$\times$Mother≥ 12&Father< 12	-3.11*	-0.35	4.03
	(1.84)	(0.45)	(2.58)
SBB$\times$Mother< 12&Father≥ 12	-2.93**	-0.06	0.52
	(1.36)	(0.33)	(1.92)
SBB$\times$Mother≥ 12&Father≥ 12	-2.30*	-0.29	-2.00
	(1.21)	(0.30)	(1.70)
Observations	100,772	100,772	92,376

All estimates are multiplied by 100 to express effects in percentage/log-points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample (first-born women born in 1962–1975 with a second-born biological sibling born within four years). Each panel column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. Columns (1) and (2) also include dummies for the number of years observed in the income registry from ages 31–40 and the number of years observed with a valid occupation code from ages 31–40. Column (3) also includes dummies for the partner's number of occupational observations and age at first and last observation. The occupational outcomes of the first-born women are measured as a mean from ages 31–40. The occupational outcome of the partner is measured mainly at the ages 31–45 for the partner with whom the woman lived for most years from ages 31–41. *Equal* indicates the tertile of families in which the parents' division of labor until the child turns 19 years is most equal.

choosing more female-dominated occupations. Moreover, the results in panel B suggest that the effect of having a brother is strongest for those women with more traditional parents in terms of their educational field. The effects seem to be largest in magnitude for those with a mother who has an academic education within care or administration and for those with a father who has an academic education within STEM.

Furthermore, the effect of having a brother is the largest for those with at least one highly educated parent (≥ 12 years of education) for occupational choice. In most cases, a highly educated parent will also imply having a parent with human capital that is traditionally associated with his or her own gender. For instance, most mothers with greater education are in the care and administration fields (e.g. nurse, secretary, and office work) and most fathers are in STEM fields. Therefore, these results again support the previous findings that the effect of having a brother is strongest for those with more gender-stereotypical parents.

Notably, the results also show that women whose parents both have less education do not experience an effect of sibling sex. This suggests that the effect is not due to resource constraints, which has been suggested as a potentially relevant mechanism in the sibling sex composition literature on educational attainment (Amin, 2009; Butcher and Case, 1994). Cools and Patacchini (2019) also observe this pattern, finding an effect of sibling sex on earnings among women with skilled, but not among those with unskilled, parents. Such finding is further consistent with Charles (2017) who shows that the gender gap in STEM aspirations is larger in more affluent countries. The heterogeneity for the other two outcomes in Table 4 are qualitatively consistent with the findings for the male share in the woman's occupation, despite being more imprecisely estimated.

Expanding the sample to include women with up to eight years before their second-born sibling and including interactions between sibling sex and spacing shows that sibling sex does not have an impact for those with long spacing between them and their sibling (Appendix Figure A1).[28] However, the estimated effects by spacing are not statistically significantly different from each other, probably due to the small fraction of children with long spacing between them and their second-born sibling. The finding that individuals with long spacing to their younger sibling do not experience an effect of sibling sex might indicate the importance of sibling interactions. However, it could also be because parents with children spaced far apart treat the first-born daughter similarly

[28] Ninety-seven percent of all second-born full siblings are born within eight years after the first child. Therefore, the sample for children with longer spacing is too small to meaningfully study heterogeneity by longer spacing.

regardless of the younger sibling's sex.

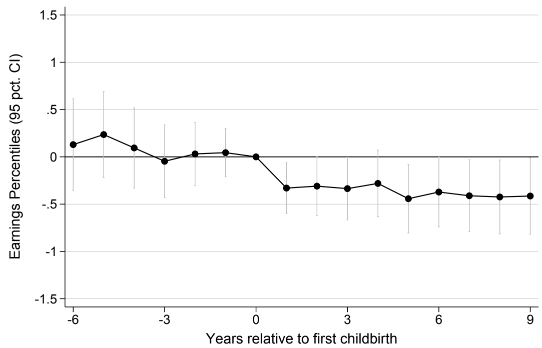
In sum, these heterogeneities indicate that the effect of having a brother is strongest for women from more traditional families. In turn, this suggests that differences in child-parent interactions are important for the effects of sibling sex composition on the formation of women's gender conformity. All other things being equal, we would expect that parents with more gender-stereotypical human capital would transmit gender norms to a stronger extent than those parents with less gender-specific human capital (Humlum, Nandrup and Smith, 2018). Additionally, we would expect that spending more time with the mother than with the father would influence the child more in the direction of the mother's (female) rather than the father's (male) interests. Therefore, the results are consistent with the hypothesis that parents of mixed-sex children invest more time in their same-sex child than parents of same-sex children; Section 5 elaborates more thoroughly on this.

4.2 Gender Conformity in the Response to Motherhood in the Labor Market

To shed further light on how sibling sex impacts women's conformity to traditional gender roles, this subsection examines whether women with a brother respond to motherhood differently than women with a sister in terms of labor supply and earnings. Using data from Denmark similar to mine, Kleven, Landais and Søgaard (2018) document that exactly in the year of the first childbirth, female labor supply and earnings experience an immediate drop and never converge back to their initial level, while the arrival of the first child does not affect men's labor market trajectories. Moreover, Kuziemko et al. (2018) demonstrate that upon motherhood, women in Great Britain adjust their attitudes towards gender roles substantially in a more traditional direction. Based on this evidence, the timing of the first childbirth seems to be a key trigger for women to conform to traditional gender roles. Therefore, studying women's labor market trajectories by sibling sex before, around, and after their first childbirth might help nuance the picture of the impact of having a brother on the development of gender conformity.

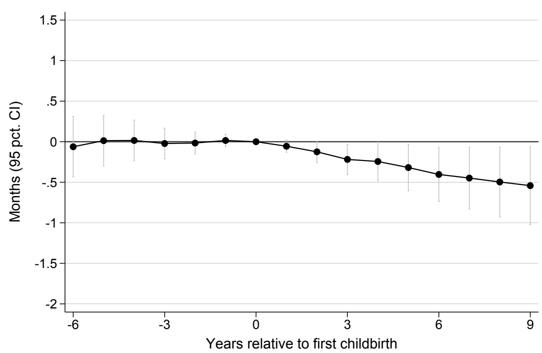
Graph (a) in Figure 1 illustrates that in the six years preceding the first childbirth, sibling sex does not differentially affect womens labor earnings trajectory once taking out time and individual fixed effects. Remarkably, already in the first year after the entry into motherhood, women with a brother experience a larger drop in earnings

Figure 1
Effect of Sibling Sex on Gender Conformity in the Response to Motherhood

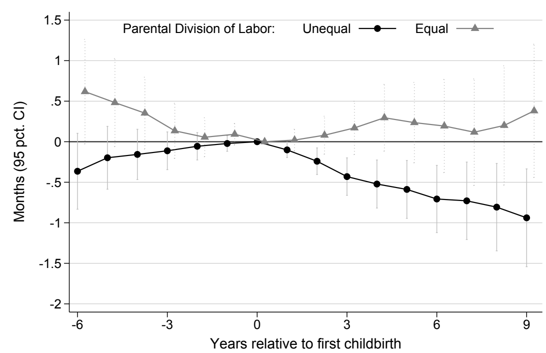


(a) Labor Earnings

(b) Labor Earnings: Heterogeneity



(c) Work Experience



(d) Work Experience: Heterogeneity

Main sample (first-born women born in 1962–1975 with a younger biological sibling born within four years). The whiskers represent the 95 percent confidence interval. Each graph illustrates the estimates from one regression model. All graphs illustrate the estimates from an event study of the effect of having a second-born brother, where the year of first childbirth is the baseline (year 0). Graphs (b) and (d) illustrate this by parental division of labor. All models absorb time-specific fixed effects and individual fixed effects. Graphs (b) and (d) further control for time-specific-"unequal parental labor division" fixed effects. *Earnings Percentile* measures the labor earnings percentile by age and cohort. *Work Experience* measures the cumulated lifetime work experience in months.

by 0.33 percentiles relative to women with a sister.[29] This effect remains stable and statistically significant trough nine years after the first childbirth, i.e. through the end of the period of study. Next, graph (b) explores heterogeneity in the effect of having a brother by childhood family background. For this, I split the effect of sibling sex by parental division of labor during the women's childhood. Thus, I present the estimates

[29] Appendix Figure A2 illustrates that these findings are robust with alternative earnings measures, specifically raw earnings and log(earnings) (graphs (a) to (d)). Moreover, graphs (e) and (f) show that women's unemployment trajectory is unaffected by sibling sex in relation to the timing of childbirth.

of the effect of having a brother for women of parents working (almost) equally during childhood (referred to as *equal* in the graphs) and the effect of having a brother for women of fathers working (much) more than mothers (*unequal*). Strikingly, the negative effect of having a brother on women's earnings trajectory upon entry into motherhood is entirely driven by women from more traditional families: these women experience a drop in earnings that is 0.5 to 0.7 percentile points larger in the nine years following their first childbirth compared to the rest of the sample.

Before entering into motherhood, sibling sex does not differentially affect women's labor supply, measured through their cumulated full-time equivalent work experience (graph (c)). Meanwhile, after the arrival of the first child, a difference by sibling sex emerges. Nine years after entry into motherhood, women with a brother have cumulated 0.54 fewer months of work experience. Again, this difference by sibling sex is solely driven by women from more traditional families: women with a brother from more gender-stereotypical families have cumulated nearly one month less of work experience nine years after the birth of their first child (graph (d)) compared to women with a sister. Put differently, women with a brother from more gender-equal families do not experience a differential labor market trajectory upon entry into motherhood relative to the one of women with a sister.

Previous studies on sibling sex composition have documented negative effects of having a brother on women's earnings (Cools and Patacchini, 2019; Gielen, Holmes and Myers, 2016; Peter et al., 2018) . They have, however, done so without relating the time of measurement to the entry into motherhood and mostly without considering potentially dynamic effects over time. Appendix Figure A3 illustrates the impact of having a brother on women's labor market outcomes from an event study, including individual fixed effects, examining whether women experience different labor market trajectories by sibling sex between age 18 and 40.[30] This shows that for the overall sample (not restricted to women with at least one child) a negative and statistically significant effect of having a brother on earnings emerges from age 28 and persists through age 40 —an effect that is again completely driven by women from traditional families. To relate these results to the ones on the differential response to motherhood, Appendix Figure A5 displays the cumulative distribution of age at first childbirth. By age 28, 55 percent of women have had their first child which help explain the timing of the emerging

[30] Appendix Figure A4 demonstrates that the picture for earnings is similar when considering the earnings level and the natural logarithm of earnings instead and that there is no differential impact on unemployment. At age 18, there is no difference in the labor market outcomes by sibling sex.

"brother" penalty.

To compare the magnitude of these results with other studies, Appendix Figure A3 demonstrates that the negative effect of having a brother on log-earnings in women's thirties corresponds to a decrease of approximately 2 percent. Consistent with my results, Peter et al. (2018) find a negative effect of having a brother on a proxy for women's permanent income in the magnitude of nearly one percent in Sweden. Similarly, Cools and Patacchini (2019) show that first-born women in the United States earn 10 percent less around age 30 when having a second-born brother instead of a sister.[31] These similar findings of a negative impact of having a brother on women's earnings across three different developed countries suggests that my other findings might be generalizable to a broader set of countries. At the same time, the differences in magnitudes also suggest that the effects on gender conformity might be larger in more gender unequal societies.[32]

4.3 Education and Family Formation

Could differences in ability or fertility behavior explain the impact of having a brother on women's increased conformity to traditional gender roles in terms of occupational and partner choice? In short, the answer is no. I do not find any evidence of an impact of sibling sex on educational attainment or school performance (columns (2) and (3) in panel A, Table 5).[33] This is similar to Peter et al. (2018), which is the only existing study with causal estimates of sibling sex on educational attainment. Likewise, Cyron, Schwerdt and Viarengo (2017) does not find an effect of sibling sex on girls' cognitive or non-cognitive skills in first grade in the United States.[34] Thus, sibling sex does not seem to affect differences in ability or (financial constraints in terms of) access to education.

[31] Rao and Chatterjee (2018) do not find a significant correlation between sibling sex composition and women's earnings among slightly older cohorts in the United States, although their estimate of the effect of having a next-younger male sibling indicates a negative impact.

[32] In 2017, Sweden ranked as the fifth-most gender-equal country, Denmark ranked number 14, and the United States ranked number 49 according to the Global Gender Gap Index (World Economic Forum, 2017).

[33] In unreported results, sibling sex does not affect the probability of having an observation on high school GPA or the probability of enrolling in or completing different levels of education. Appendix Table A1 further shows that there is no effect on different types of ability, measured through Grade 9 language and math written exam GPA. Moreover, Kolmogorov-Smirnov tests cannot reject equality of distributional functions for neither of the three GPA measures. Thus, distributional effects do not seem to be important.

[34] Similarly, based on the DALSC sample introduced in Section 5, I do not find any effect of sibling sex on personality traits (Big Five, growth mindset, trust, hedonism) or mental health (Strength and Difficulties Questionnaire (SDQ)) (not reported).

Consequently, these results demonstrate that sibling sex composition does not affect educational achievement or attainment. This supports an interpretation that the channels of the effect of sibling sex on occupational choice are changes in interests or identity.

Table 5
Effect of Sibling Sex on Education and Family Formation

	(1)	(2)	(3)	(4)	(5)
Panel A: Education by age 30					
	Log(Male Share)	Length (months)	High School GPA	STEM Enrollment	STEM Completion
Second-Born Brother	-1.35**	-0.12	-0.01	-0.61***	-0.56***
	(0.53)	(0.15)	(0.01)	(0.17)	(0.13)
Observations	103,542	103,563	47,578	103,771	103,771
Panel B: Family Formation by age 41					
	Cohabit 18–41	Married 18–41	Has Any Children	# of Children	Age at First Birth
Second-Born Brother	-0.80***	-0.12	-0.19	0.00	0.07**
	(0.13)	(0.17)	(0.20)	(0.01)	(0.03)
Observations	103,771	103,771	103,771	103,771	91,895

Estimates in columns (1), (4), and (5) in panel A and columns (1), (2), and (3) in panel B are multiplied by 100 to express effects in percentage/log-points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample (first-born women born in 1962–1975 with a second-born biological sibling born within four years). Each panel column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. The educational outcome models, except for high school GPA, further control for age at last observation in the education registry. *Log(Male Share)* measures the natural logarithm of the share of men in the highest completed education (narrow field-by-level) by age 30. *Length* measures the length of the highest completed education in months by age 30. *High School GPA* measures final GPA from the academic high school and is standardized by track and year of graduation for the total population with a mean of zero and a standard deviation of one. *STEM Enrollment* indicates whether the woman has ever enrolled in field-specific STEM education between the ages of 16–27. *STEM Completion* indicates whether the woman has ever completed a field-specific STEM education by age 30. *Cohabit* measures the share of years of ages 18–41 during which the woman has cohabited with a partner without being married. *Married* measures the share of years of ages 18–41 during which the woman has been married. *Has Any Children* indicates whether the woman has at least one child by the age of 41. *# of Children* measures the number of children the woman has by age 41. *Age at First Childbirth* measures the age at the woman's first childbirth in years, conditional on having any children.

While sibling sex does not affect overall educational attainment, the effect of sibling sex on occupational choice is closely mirrored in field of education by age 30. Having a brother reduces the share of men in the highest completed field-by-level of education by 1.35 percent.[35] Similarly, women with a brother relative to those with a sister are respectively 7.4 and 11.0 percent less likely to ever enroll in and complete any field-specific STEM education. Appendix Table A1 further shows that the effect is already present in the type of first educational enrollment after compulsory education and that the effect is present for STEM degree completion at different levels of education. Thus, having a brother pushes women out of traditionally male-dominated fields as early as age 16, and it is seen in both the field of education as well as occupation.

The magnitude of the effects are comparable with previous studies examining the impact of various aspects of the social environment in school on study choice (Bottia et al., 2015; Carrell, Page and West, 2010; Schneeweis and Zweimüller, 2012; Fischer, 2017). Moreover, the results are broadly comparable with other studies examining correlations between sibling sex composition and field of college major (Anelli and Peri, 2015; Oguzoglu and Ozbeklik, 2016). Appendix Table B12 displays the associations between the gender of a first-born sibling and second-born women's gender conformity, indicating similar but less robust correlations compared with the main results. These results are also closer to those in Anelli and Peri (2015), who do not find a significant association for women's enrollment in high-earning college majors (although the magnitude of their estimate is relatively large). This stresses the importance of rigorously considering selection bias when the aim is to evaluate the causal effect of sibling sex.

A potential reason for the differences in educational and occupational choice by sibling sex could be differences in family formation preferences. Women with a stronger desire to have children early or more children might plan their choice of occupation accordingly, as female-dominated occupations tend to be more family-friendly Goldin (2014); Kleven, Landais and Søgaard (2018). If that were the case, we would expect women with a brother to wish to marry earlier, have children earlier, or have more children than women with a sister.[36] The administrative data do not report women's family

[35] Despite major changes in society over time, the effect of sibling sex on the male share in the highest completed education by the age of 30 does not differ systematically by decade of birth when including cohorts born through 1986 (not reported). This is consistent with the finding by Haines, Deaux and Lofaro (2016) that gender stereotypes have not changed over the last three decades in the United States.

[36] However, such a conjecture implicitly requires that being married and having children is an important aspect of women's gender identity. This might very well not be the case in a modern setting in which women do not face a mutually exclusive choice of having a family and a career (Bertrand et al., 2016; Goldin and Katz, 2002). For instance, the cohorts of women under study have all had access to contraceptives, abortion, various family leave policies, and infant- and child-care options. On the other hand,

preferences, but it rigorously document their actual behavior. Overall, I do not find support of any meaningful impact of sibling sex on the various aspects of family formation reported in panel B in Table 5. The results only suggest a small negative effect of having a brother on cohabitation,[37] while sibling sex has no effect on the probability of being married (column (2)), age of first marriage, the probability of divorce or age at first divorce (the latter three not reported). Thus, the only difference between women with a brother and those with a sister is that the former move in with a partner before marriage slightly later. This might explain the small positive (though negligible) effect on age at first childbirth.[38] Overall, sibling sex has no effect on the fertility rate through age 41, i.e. close to complete realized fertility.[39]

4.4 Persistent Effects to the Next Generation (of Girls)

So far, I have documented that the childhood family environment affects the development of women's gender conformity. Having a brother influences the family environment to such a degree that women choose more female-dominated occupations and more gender-conforming partners. This motivates the final question —before turning to the study of potential mechanisms —whether the effect on gender conformity (and thereby these women's adult family environment) is sufficiently strong to affect the next generation. To investigate this, I examine the school performance in Grade 9 in language and math respectively of these women's first-born daughters and sons separately. In other words, I here focus on school performance in subjects that are associated with traditionally "female" (language) versus "male" (math) skills. In line with the typical finding that boys seem less sensitive to the social environment than girls in terms of

women with a younger sister might experience more competition in terms of being the first among the two who marries and has children, as men (i.e. brothers) on average are older when they start their family formation. These two opposing forces might explain why I essentially do not find any effect of sibling sex on various aspects of family formation, consistent with the findings in Peter et al. (2018).

[37] This could be due to more traditional gender norms, as more traditional women might want to wait longer before moving in with a partner before marriage. The majority of these cohorts cohabit and have children before marriage. Ninety-one percent of the women in the sample have cohabited for at least one year before the year they get married, and 53 percent get married in the year of their first childbirth or later.

[38] In the main sample (sample used for the analysis of the response to motherhood), Kolmogorov-Smirnov tests of age at first birth cannot reject equality of distributional functions by sibling sex ($p = 0.354$; $p = 0.785$), by sibling sex among those with parents working equal ($p = 0.242$; $p = 0.947$) or unequal ($p = 0.706$; $p = 0.627$).

[39] Neither is there any heterogeneity in these family formation outcomes with respect to whether the parents worked equally during childhood (not reported).

Table 6
Effect of Sibling Sex on First-born Children's Grade 9 Performance

	Daughters		Sons	
	Language (1)	Math (2)	Language (3)	Math (4)
Second-Born Borther	2.44** (1.06)	0.21 (1.10)	0.57 (1.11)	0.52 (1.10)
Observations	28,216	28,216	28,669	28,669
Average	40.2	13.7	-5.2	24.5

All estimates are multiplied by 100 to express effects in percent of a standard deviation. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. First-born children to the main sample (first-born women born in 1962–1975 with a second-born biological sibling born within four years) born in 1987–2000. All models absorb fixed effects for the mother's birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. The Grade 9 GPA measures come from the written exam at the end of Grade 9 in respectively, Danish and Math, and are standardized by year of graduation for the total population with a mean of zero and a standard deviation of one.

"gendered" outcomes (Bottia et al., 2015; Carrell, Page and West, 2010; Fischer, 2017), we might expect largest impacts on daughters' performance relative to the one of sons.

A potential effect of sibling sex on the next generation's school performance might either go through a direct transmission of gender norms from parents to children or through the type of parental human capital. On the one hand, more traditional (gender-conforming) parents might impose more gender-stereotypical expectations on their children than less traditional parents. For instance, traditional parents might not have high expectations for their daughters' math performance but in contrast, expect their sons to perform well in math.

On the other hand, parents might have similar expectations but different possibilities to help their children with homework. As mothers are more likely to help children with homework than fathers,[40] maternal skills might be particularly relevant for this channel. Girls with a more gender-conforming mother might receive more help with language homework and, for instance, be more encouraged to read books for leisure than girls with a less gender-conforming mother. As previously shown (Table 5 and Appendix

[40] In the DALSC sample (see Subsection 5.2), mothers, on average, help daughters with homework 4.2 times a week at age 7 and 3.1 times a week at age 11 in contrast to fathers who help 1.7 times a week at both ages. For a comparable sample of sons, mothers help sons with homework 3.5 times a week both at age 7 and 11, while fathers help sons 1.6 times a week at age 7 and 1.7 times at age 11.

Table A1), the sex of the mother's sibling does not affect her own school performance in compulsory education or in overall high school GPA. Yet, sibling sex affects her field of post-compulsory education, changing her competences within certain skill domains. Therefore, girls with a more gender-conforming mother might also receive less-qualified help with math homework. Note, however, that the gender gap in math performance (0.10 SD) is not as large as in language (0.45 SD), suggesting that most of any potential action might happen in the "female" domain of skill acquisition.[41] Consequently, if having a more gender-stereotypical mother (and father) affects the next generation, we would expect daughters to perform better in languages and/or worse in math.

Remarkably, Table 6 shows that daughters whose mother's second-born sibling is male relative to female perform 2.44 percent of a standard deviation better in languages. Meanwhile, I do not detect an effect on daughters' math performance nor on sons' performance in either discipline. Thus, daughters' differences in language and math ability are larger for those with a more gender-conforming mother.[42] This increase in girls' absolute advantage in languages over math might in turn predict more traditional choices of field of education. Notably, I find evidence of very persistent long-run consequences of women's childhood family environment. A likely explanation for this finding is the change in daughters' childhood family environment in terms of the parental skill sets and gender role attitudes, an aspect of the maternal family environment that was unaffected by her sibling's sex.

5 Gender-Specific Parenting as a Relevant Mechanism

5.1 Related Literature

The previous section documents that sibling sex affects women's development of conformity to traditional gender norms and that the impact seems to be strongest among women from more gender-stereotypical families. This subsection draws on the literature to identify relevant mechanisms behind these findings, while the subsequent subsection provides some empirical evidence. Overall, I consider changes in identity to be the main

[41] This could be because the degree to which math is considered masculine is smaller than the femininity of language in primary school or simply because most math learning takes place in school, while a larger degree of language learning is acquired outside school, e.g. through practicing reading skills.

[42] This difference is statistically significant (insignificant) for daughters (sons) with an estimate of 2.22 (0.05) and standard error of 0.95 (0.98).

channel of the impacts on gender conformity, as the previous analysis does not suggest that differences in educational attainment, ability, labor force participation before motherhood, family size, or resource constraints are important or driving mechanisms. Consistent with the same-sex education literature (Booth, Cardona-Sosa and Nolen, 2014; Schneeweis and Zweimüller, 2012), the overarching argument is that girls with a brother are more exposed to gender-stereotypical behavior in the family, and therefore they are more inclined to acquire traditional gender norms. In this context, gender-stereotypical behavior could become more salient through changes in the nature of either child-sibling and/or child-parent interactions.[43]

First, parents might interact differently with their children depending on the sex composition in terms of the quantity, quality, and content of time spent together. Assuming that both parents spend at least some time with their children, a traditional household specialization model suggests that parents gender-specialize their investment in children when they have mixed-sex children if mothers have the comparative advantage of creating female human capital and fathers are more productive in creating male human capital (Becker, 1973). Parents might also derive more utility from spending time with a same- compared to an opposite-sex child due to the type of activities undertaken with the child. In both cases, it would be optimal for parents of mixed-sex children to gender-specialize their parenting investments to a greater extent than those of same-sex children.

McHale, Crouter and Whiteman (2003) suggest that because parents of mixed-sex children have the opportunity to gender-differentiate their parenting, children with opposite sex siblings might have the strongest explicit gender stereotypes. Endendijk et al. (2013) find some evidence that fathers with mixed-sex children exhibit stronger gender-stereotypical attitudes than those with same-sex children. Previous research has further documented that overall mothers talk more in general and more about interests and attitudes with daughters than sons (Maccoby, 1990; Leaper, Anderson and Sanders, 1998; Noller and Callan, 1990). By contrast, fathers talk more and spend more time with sons than daughters and have a greater emotional attachment to sons (Bonke and Esping-Andersen, 2009; Morgan, Lye and Condran, 1988; Noller and Callan, 1990). Based on this, we might expect that parents of mixed-sex children gender-specialize their parenting more and thereby expose their children more to gender-stereotypical behavior than

[43] Appendix B.4 provides a brief overview of alternative mechanisms discussed in previous papers on sibling sex composition. These mechanisms cannot be the dominating explanations, as they are not compatible with the empirical findings.

parents of same-sex children. This in turn might result in a stronger transmission of gender norms in families with mixed-sex children.

Second, first-born girls might interact differently with their second-born sibling depending on the siblings' sex. In particular, having a brother might make girls more aware of "appropriate" female behavior or more likely to want to differentiate themselves from their sibling and thereby induce them to develop more gender-stereotypical behaviors and attitudes. For instance, Booth and Nolen (2012) show that girls attending same-sex schools are no more risk averse than boys, while girls attending mixed-sex schools are significantly more risk averse. Women are generally less competitive than men and this sex difference in competitiveness seems to be stronger in mixed-sex relative to same-sex environments (Bertrand, 2011; Niederle and Vesterlund, 2011). Traditionally male-dominated (STEM) fields are considered more competitive (Buser, Niederle and Oosterbeek, 2014). Therefore, having a brother instead of a sister might change women's degree of competitiveness and thereby their preferences for working in competitive environments. For that reason, having a brother might induce women to develop more gender-stereotypical attitudes due to a greater awareness of gender through sibling interactions. This in turn could be reinforced by parents' increased gender specialization. For instance, Rao and Chatterjee (2018) find that women with a larger share of brothers tend to hold more traditional family attitudes.[44]

Thus, differences in child-parent interactions and in particular increased gender specialization in families with mixed-sex children is a particularly important mechanism for the observed effect of sibling sex on women's formation of gender norms, which I am able to empirically test. In the remainder of this section, I explore this mechanism by investigating the impact of sibling sex composition on parental time investment. More precisely, in daily child-parent interactions, we might observe that parents of mixed-sex children invest more quality time in their same-sex child. This could explain the heterogeneity in the effect of sibling sex documented in Table 4. Furthermore, in the case of parental divorce, we might expect that children from mixed-sex child families would be more likely to live with their same-sex parent compared to same-sex children due to a stronger degree of gender-specialized parenting. Consequently, it is common for these predictions that a parent of mixed-sex children influences his or her same-sex child more than a parent of same-sex children.

[44]For one out of four gender role attitudes questions, Healy and Malhotra (2013) reach a similar finding.

5.2 Empirical Evidence on Gender-Specific Parenting

To investigate whether sibling sex composition affects child-parent interactions, I draw on the Danish Longitudinal Survey of Children (DALSC), which I have linked to administrative data.[45] The survey has followed children born between September and October 1995 to a mother with Danish citizenship from the age of 0 throughout childhood. It is a unique survey due to its very detailed information on parental time use and family socio-economic characteristics. For this analysis, I select first-born girls who have a second-born sibling born within five years.[46] Appendix Table B8 presents descriptive statistics on predetermined parental characteristics and balancing checks. Parental characteristics balance across sibling sex composition. Moreover, as expected given the difference in birth years between the main and the DALSC samples, parents in the DALSC sample are on average better educated and older at their child's birth.

At the age of 7 and 11, both parents report how often they undertake different types of activities together with their first-born daughter. I construct an index on parental quality time investment, using principal component analysis, and standardize it with a mean of zero and a standard deviation of one (Appendix Table B9). I define quality time as playing with the child, helping with homework, doing out-of-school activities, reading/singing, and going on an excursion.

Columns (1) to (4) in Table 7 provide the results on parental time investment by each parent for the two ages, separately. Mothers of a first-born daughter and a second-born son invest 15 percent of a standard deviation *more* time in their first-born daughter at both ages compared to mothers with two daughters. By contrast, fathers invest 21–24 percent of a standard deviation *less* time in their first-born daughter when having mixed-sex children. This reduction in total paternal time investment is driven by reduced time spent playing, helping with homework, and reading for the daughter (Appendix Table A2).[47] This finding indicates that girls with a younger brother receive less-qualified

[45] The study was designed by researchers from SFI, the Danish National Centre for Social Research, in collaboration with other research institutions. The survey includes 6,011 randomly sampled children and their parents and was conducted in 1996, 1999, 2003, 2007, 2011, and 2015.

[46] I allow for spacing within five years (and not four years as in the main sample) to increase the sample size and thereby, power.

[47] Inspired by my results, Cools and Patacchini (2019) also consider a five-point scale index of activities with the mother and father separately during adolescence. However, their index is only a crude measure of high-frequency, high-quality activities with the child. They also find that mothers spend more time with their daughter when the next-youngest child is male, while they do not find an effect on father's activities.

Table 7
Effect of Sibling Sex on Parental Time Investment in First-Born Daughters and Family Structure

	Parental Time Investment (Born 1995)				Family Structure (Born 1962–75)	
	Mother		Father		Lives w Both Parents	Lives w Mother & Sib w Father
	Age 7	Age 11	Age 7	Age 11		
	(1)	(2)	(3)	(4)	(5)	(6)
Second-Born	0.14*	0.15*	-0.21**	-0.24**	0.12	5.30***
Brother	(0.08)	(0.08)	(0.10)	(0.10)	(0.23)	(0.38)
Observations	611	586	444	434	102,139	19,197
Average	-0.00	0.00	-0.00	-0.00	81.1	7.3
DALSC Sample	✓	✓	✓	✓		
Main Sample						
All					✓	
Divorced						✓

Standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. DALSC sample: Columns (1) to (4). Main sample: Columns (5) and (6). Estimates for the main sample are multiplied by 100 to express effects in percentage points. Each column represents the results from separate regressions. All models using the DALSC sample control for (quadratic) mother's and father's age and fixed effects for spacing to the younger sibling in years, region of birth, and maternal and paternal level of education. Both models using the main sample absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, paternal level-by-field of education, and age at observation of family structure. *Parental time investment* is constructed using principal component analysis based on reports on how often each parent undertakes certain quality-time activities (playing, doing homework, doing out-of-school activities, reading/singing, going on an excursion) with the child on a weekly basis and is standardized with a mean of zero and standard deviation of one; see Appendix Table B9. *Main Sample All* includes all who live with at least one biological parent, while *Main Sample Divorced* excludes those living with both biological parents. *Lives w Both Parents* indicates that the first-born daughter lives with both biological parents at the age of 17. *Lives w Mother & Sib w Father* indicates that the first-born daughter lives with her mother and the second-born child lives with the father at the age of 17.

help with homework in traditionally male-dominated subjects, which might prevent them from growing interests in these fields. Furthermore, this effect on father-daughter interactions translates into a substantially worse relationship between fathers and their first-born daughters when the second-born child is male relative to female (Appendix Table B10). Overall, girls receive the same time investment regardless of their younger sibling's sex, as mothers in absolute terms tend to spend more time with their daughter than fathers. These results clearly show that first-born girls with a second-born brother experience more gendered parenting relative to those with a younger sister.[48]

Ideally, I would have had similarly detailed data on parental inputs for the main sample. However, such information is not observed in the administrative registries. Instead, I observe all children's family structure at age 17.[49] Sibling sex composition does not alter the probability of living with both biological parents (column (5) in Table 7). In the case of parental divorce or separation (henceforth *divorce*), the living arrangement between parents and children in the main sample might additionally shed light on child-parent interactions in terms of splitting parents' time. If parents of mixed-sex children gender-specialize more than those of same-sex children, we would expect that divorced families with mixed-sex children would be more likely than families with same-sex children to have a living arrangement in which the first-born daughter lives with her mother and the second-born child lives with the father.

Conditional on living in a divorced family, the results show a pattern consistent with the prediction (column (6)). First-born daughters with a second-born brother are 5.30 percentage points (115 percent) more likely to live with their mother while their younger sibling lives with the father. These results consequently show a strong effect on the living arrangement among divorced families, thereby lending support to the previous findings (based on the much smaller DALSC sample) on more gender-specific parenting and time investment in families with mixed-sex children. In conclusion, these findings support the hypothesis that parents of mixed-sex children gender-specialize their parenting more than those of same-sex children, thereby strengthening the transmission of traditional

[48] Given the sample size, it is not feasible to conduct any meaningful heterogeneity analysis. For first-born boys, the overall picture is similar (not reported). Note, I cannot determine whether this increase in gender specialization is driven by changes in demand (children) or supply (parents). Having a brother might cause the daughter to demand more maternal and less paternal time. However, the results clearly show that parents respond to sibling sex composition and parental response is the relevant margin, as any policy aiming to reduce the transmission of gender norms would most likely need to address parents and not children as young as 7 years.

[49] I observe the family structure on January 1 each year and use the observation for the year when the person turns 18 or the last year in which the child lived with at least one biological parent.

gender-specific interests and behaviors.[50]

6 Conclusion

This study documents that the childhood family environment has a long-run impact on women's conformity to traditional gender norms, with persistent effects to the next generation of girls. The results show that having a second-born brother relative to a sister increases first-born women's gender conformity, as measured through their choice of occupation and partner. I further show that having a brother negatively affects labor supply and earnings upon entry into motherhood and that this pattern in entirely driven by women growing up in more gender-stereotypical families. I provide compelling evidence that changes in child-parent interactions—and in particular increased gender-specialized parenting in families with mixed-sex children—play an important role for the changes in gender conformity. This suggests that the transmission of traditional gender norms is stronger in families with mixed-sex children. Finally, I show that the increased gender conformity among women with a brother persists into the next generation of girls, as indicated by an increase in daughters' comparative advantage in language over math performance in school.

To eliminate gender inequality caused by gender-conforming behavior, my findings imply that policy-makers need to focus on the formation conformity to gender norms among girls in the childhood family environment. I show that having a brother already affects girls' study choices in a more gender-stereotypical direction at the end of compulsory schooling. This indicates that girls' development of gender conformity by adolescence has important consequences for their later-life educational and labor market outcomes.

References

Akerlof, George A., and Rachel E. Kranton. 2000. "Economics and Identity." *The Quarterly Journal of Economics*, 115(3): 715–753.

[50] In unreported results, considering heterogeneity by living in a traditional family on occupational choice shows that the effect is strongest for women from divorced families. This is consistent with increased gender specialization in these families. However, there is no significant heterogeneity by family structure for working in STEM occupations or choice of partner.

Alan, Sule, Seda Ertac, and Ipek Mumcu. 2018. "Gender Stereotypes in the Classroom and Effects on Achievement." *The Review of Economics and Statistics*.

Amin, Vikesh. 2009. "Sibling Sex Composition and Educational Outcomes: A Review of Theory and Evidence for the UK." *LABOUR*, 23(1): 67–96.

Anelli, Massimo, and Giovanni Peri. 2015. "Gender of Siblings and Choice of College Major." *CESifo Economic Studies*, 61(1): 53–71.

Anelli, Massimo, and Giovanni Peri. 2016. "The Effects of High School Peers' Gender on College Major, College Performance and Income." *The Economic Journal*, 0(0).

Angrist, Joshua D, and William N Evans. 1998. "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size." *The American Economic Review*, 88(3): 450.

Angrist, Joshua, Victor Lavy, and Analia Schlosser. 2010. "Multiple Experiments for the Causal Link between the Quantity and Quality of Children." *Journal of Labor Economics*, 28(4): 773–824.

Bauer, Thomas, and Ira Gang. 2001. "Sibling Rivalry in Educational Attainment: The German Case." *LABOUR*, 15(2): 237–255.

Becker, Gary S. 1973. "A theory of marriage: Part I." *Journal of Political economy*, 81(4): 813–846.

Becker, Gary S, and Nigel Tomes. 1986. "Human capital and the rise and fall of families." *Journal of labor economics*, 4(3, Part 2): S1–S39.

Bertrand, Marianne. 2011. "New Perspectives on Gender." 4: 1543–1590.

Bertrand, Marianne, Patricia Cortés, Claudia Olivetti, and Jessica Pan. 2016. "Social Norms, Labor Market Opportunities, and the Marriage Gap for Skilled Women." , (22015).

Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes. 2005. "The More the Merrier? The Effect of Family Size and Birth Order on Children's Education." *The Quarterly Journal of Economics*, 120(2): 669–700.

Blau, Francine D., and Lawrence M. Kahn. 2017. "The Gender Wage Gap: Extent, Trends, and Explanations." *Journal of Economic Literature*, 55(3): 789–865.

Bonke, Jens, and Gosta Esping-Andersen. 2009. "Parental Investments in Children: How Educational Homogamy and Bargaining Affect Time Allocation." *European Sociological Review*, 10(20): 1–13.

Booth, Alison L., and Patrick Nolen. 2012. "Gender differences in risk behaviour: does nurture matter?" *The Economic Journal*, 122(558): F56–F78.

Booth, Alison, Lina Cardona-Sosa, and Patrick Nolen. 2014. "Gender differences in risk aversion: Do single-sex environments affect their development?" *Journal of Economic Behavior & Organization*, 99: 126–154.

Booth, Alison L., Lina Cardona, and Patrick J. Nolen. 2013. "Do Single-Sex Classes Affect Exam Scores? An Experiment in a Coeducational University." , (ID 2223114).

Bottia, Martha Cecilia, Elizabeth Stearns, Roslyn Arlin Mickelson, Stephanie Moller, and Lauren Valentino. 2015. "Growing the roots of STEM majors: Female math and science high school faculty and the participation of students in STEM." *Economics of*

Education Review, 45: 14–27.
Brenøe, Anne Ardila, and Shelly Lundberg. 2017. "Gender gaps in the effects of childhood family environment: Do they persist into adulthood?" *European Economic Review*.
Brenøe, Anne Ardila, and Ulf Zölitz. 2018. "Exposure to More Female Peers Widens the Gender Gap in STEM Participation." *University of Zurich Working Paper*.
Brim, Orville G. 1958. "Family Structure and Sex Role Learning by Children: A Further Analysis of Helen Koch's Data." *Sociometry*, 21(1): 1–16.
Brody, Charles J., and Lala Carr Steelman. 1985. "Sibling Structure and Parental Sex-Typing of Children's Household Tasks." *Journal of Marriage and Family*, 47(2): 265–273.
Buser, Thomas, Muriel Niederle, and Hessel Oosterbeek. 2014. "Gender, Competitiveness, and Career Choices." *The Quarterly Journal of Economics*, 129(3): 1409–1447.
Butcher, Kristin F., and Anne Case. 1994. "The Effect of Sibling Sex Composition on Women's Education and Earnings." *The Quarterly Journal of Economics*, 109(3): 531–563.
Carlana, Michela. 2018. "Stereotypes and Self-Stereotypes: Evidence from Teachers' Gender Bias." *IZA Discussion Papers*, , (11659).
Carrell, Scott E., Marianne E. Page, and James E. West. 2010. "Sex and Science: How Professor Gender Perpetuates the Gender Gap." *The Quarterly Journal of Economics*, 125(3): 1101–1144.
Charles, Maria. 2017. "Venus, Mars, and Math: Gender, Societal Affluence, and Eighth Graders' Aspirations for STEM." *Socius*, 3: 2378023117697179.
Cheng, Albert, Katherine Kopotic, and Gema Zamarro. 2017. "Can Parents' Growth Mindset and Role Modelling Address STEM Gender Gaps?" *EDRE Working Paper*.
Conley, Dalton. 2000. "Sibship sex composition: Effects on educational attainment." *Social Science Research*, 29(3): 441–457.
Cools, Angela, and Eleonora Patacchini. 2017. "Sibling Gender Composition and Women's Wages." *IZA Discussion Paper*, 11001.
Cools, Angela, and Eleonora Patacchini. 2019. "The Brother Earnings Penalty." *Labour Economics*, forthcommig.
Cronqvist, Henrik, Alessandro Previtero, Stephan Siegel, and Roderick E. White. 2016. "The Fetal Origins Hypothesis in Finance: Prenatal Environment, the Gender Gap, and Investor Behavior." *The Review of Financial Studies*, 29(3): 739–786.
Cyron, Laura, Guido Schwerdt, and Martina Viarengo. 2017. "The effect of opposite sex siblings on cognitive and noncognitive skills in early childhood." *Applied Economics Letters*, 24(19): 1369–1373.
Endendijk, Joyce J., Marleen G. Groeneveld, Sheila R. van Berkel, Elizabeth T. Hallers-Haalboom, Judi Mesman, and Marian J. Bakermans-Kranenburg. 2013. "Gender Stereotypes in the Family Context: Mothers, Fathers, and Siblings." *Sex Roles*, 68(9-10): 577–590.
Fischer, Stefanie. 2017. "The downside of good peers: How classroom composition differentially affects men's and women's STEM persistence." *Labour Economics*, 46: 211–226.
Gielen, Anne C., Jessica Holmes, and Caitlin Myers. 2016. "Prenatal Testosterone and

the Earnings of Men and Women." *Journal of Human Resources*, 51(1): 30–61.

Goldin, Claudia. 2014. "A Grand Gender Convergence: Its Last Chapter." *American Economic Review*, 104(4): 1091–1119.

Goldin, Claudia, and Lawrence F. Katz. 2002. "The Power of the Pill: Oral Contraceptives and Women's Career and Marriage Decisions." *Journal of Political Economy*, 110(4): 730–770.

Grotevant, Harold D. 1978. "Sibling Constellations and Sex Typing of Interests in Adolescence." *Child Development*, 49(2): 540–542.

Haines, Elizabeth L., Kay Deaux, and Nicole Lofaro. 2016. "The Times They Are a-Changing ... or Are They Not? A Comparison of Gender Stereotypes, 1983–2014." *Psychology of Women Quarterly*, 40(3): 353–363.

Hauser, Robert M., and Hsiang-Hui Daphne Kuo. 1998. "Does the Gender Composition of Sibships Affect Women's Educational Attainment?" *The Journal of Human Resources*, 33(3): 644–657.

Healy, Andrew, and Neil Malhotra. 2013. "Childhood socialization and political attitudes: Evidence from a natural experiment." *The Journal of Politics*, 75(4): 1023–1037.

Humlum, Maria Knoth, Anne Brink Nandrup, and Nina Smith. 2018. "Closing or reproducing the gender gap? Parental transmission, social norms and education choice." *Journal of Population Economics*, 1–46.

Joensen, Juanna Schrøter, and Helena Skyt Nielsen. 2017. "Spillovers in education choice." *Journal of Public Economics*.

Johnston, David W., Stefanie Schurer, and Michael A. Shields. 2014. "Maternal gender role attitudes, human capital investment, and labour supply of sons and daughters." *Oxford Economic Papers*, 66(3): 631–659.

Kaestner, Robert. 1997. "Are Brothers Really Better? Sibling Sex Composition and Educational Achievement Revisited." *Journal of Human Resources*, 32(2): 250–284.

Kahn, Shulamit, and Donna Ginther. 2017. "Women and STEM." , (23525).

Kleven, Henrik, Camille Landais, and Jakob Egholt Søgaard. 2018. "Children and Gender Inequality: Evidence from Denmark." , (24219).

Kleven, Henrik, Camille Landais, Johanna Posch, Andreas Steinhauer, and Josef Zweimüller. 2019. "Child Penalties Across Countries: Evidence and Explanations."

Koch, Helen. 1955. "Some personality correlates of sex, sibling position, and sex of sibling among five-and six-year-old children." *Genetic Psychology Monographs*, 52(1): 3–50.

Kuziemko, Ilyana, Jessica Pan, Jenny Shen, and Ebonya Washington. 2018. "The Mommy Effect: Do Women Anticipate the Employment Effects of Motherhood?"

Lavy, Victor, and Edith Sand. 2015. "On The Origins of Gender Human Capital Gaps: Short and Long Term Consequences of Teachers' Stereotypical Biases." , (20909).

Lavy, Victor, and Rigissa Megalokonomou. 2017. "Persistency in teachers' grading biases and effect on longer term outcomes: University admission exams and choice of field of study."

Leaper, Campbell, Kristin J. Anderson, and Paul Sanders. 1998. "Moderators of Gender

Effects on Parents' Talk to Their Children: A Meta-Analysis." *Developmental Psychology*, 34(1): 3–27.

Lundborg, Petter, Erik Plug, and Astrid Würtz Rasmussen. 2017. "Can women have children and a career? IV evidence from IVF treatments." *American Economic Review*, 107(6): 1611–37.

Maccoby, Eleanor E. 1990. "Gender and relationships. A developmental account." *The American Psychologist*, 45(4): 513–520.

McHale, Susan M., Ann C. Crouter, and Corinna J. Tucker. 1999. "Family Context and Gender Role Socialization in Middle Childhood: Comparing Girls to Boys and Sisters to Brothers." *Child Development*, 70(4): 990–1004.

McHale, Susan M., Ann C. Crouter, and Shawn D. Whiteman. 2003. "The Family Contexts of Gender Development in Childhood and Adolescence." *Social Development*, 12(1): 125–148.

Morgan, S. Philip, Diane N. Lye, and Gretchen A. Condran. 1988. "Sons, Daughters, and the Risk of Marital Disruption." *American Journal of Sociology*, 94(1): 110–129.

Niederle, Muriel, and Lise Vesterlund. 2011. "Gender and Competition." *Annu. Rev. Econ.*, 3(1): 601–630.

Noller, Patricia, and Victor J. Callan. 1990. "Adolescents' perceptions of the nature of their communication with parents." *Journal of Youth and Adolescence*, 19(4): 349–362.

OECD. 2016. *Education at a Glance 2016: OECD Indicators.*

OECD. 2017. "OECD Labour Force Statistics 2017."

Oguzoglu, Umut, and Serkan Ozbeklik. 2016. "Like Father, Like Daughter (Unless There is a Son): Sibling Sex Composition and Women's Stem Major Choice in College." , (ID 2810463).

Peter, Noemi, Petter Lundborg, and Dinand Webbink. 2015. "The Effect of Sibling's Gender on Earnings, Education and Family Formation." *Tinbergen Institute Discussion Paper*, TI 2015-073/V.

Peter, Noemi, Petter Lundborg, Sara Mikkelsen, and Dinand Webbink. 2018. "The effect of a sibling's gender on earnings and family formation." *Labour Economics*, 54: 61–78.

Powell, Brian, and Lala Carr Steelman. 1989. "The Liability of Having Brothers: Paying for College and the Sex Composition of the Family." *Sociology of Education*, 62(2): 134–147.

Rao, Neel, and Twisha Chatterjee. 2018. "Sibling gender and wage differences." *Applied Economics*, 50(15): 1725–1745.

Schneeweis, Nicole, and Martina Zweimüller. 2012. "Girls, girls, girls: Gender composition and female school choice." *Economics of Education Review*, 31(4): 482–500.

United Nations Statistics Division. 2018. "United Nations Statistics Division: Gender Statistics Manual."

Vogl, Tom S. 2013. "Marriage institutions and sibling competition: Evidence from South Asia." *The Quarterly journal of economics*, 128(3): 1017–1072.

World Economic Forum. 2017. *The global gender gap report: 2017.* Geneva:World Economic

Table A1
Effect of Sibling Sex on STEM Education and Educational Performance

	STEM Focus in First Enrollment	HS STEM Track Completion	Vocational STEM Completion	College STEM Completion	Grade 9 Language GPA	Grade 9 Math GPA
	(1)	(2)	(3)	(4)	(5)	(6)
Second-Born	-1.23***	-1.12***	-0.23**	-0.34***	-0.81	-0.80
Brother	(0.25)	(0.23)	(0.10)	(0.10)	(0.59)	(0.60)
Observations	103,771	103,771	103,771	103,771	83,123	82,479
Average	22.7	18.9	2.4	2.5	44.4	22.3

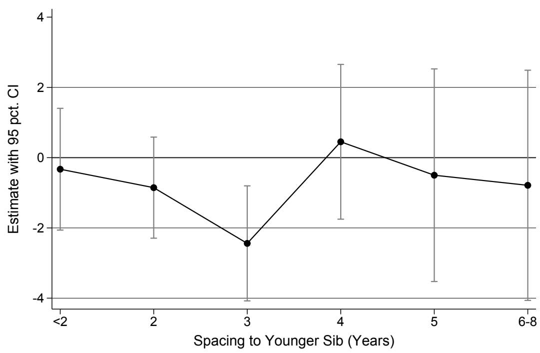
All estimates are multiplied by 100 to express effects in percentage points/percent of a standard deviation. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample (first-born women born in 1962–1975 with a second-born biological sibling born within four years) for STEM outcomes; girls born between 1986 and 1999 with the same selection criteria as for the main sample for the grade 9 outcomes. Each column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. The STEM outcome models further control for age at last observation in the education registry. *STEM Focus in First Enrollment* indicates whether the woman's first place of enrollment after compulsory schooling is in the academic high school math track or in a field-specific vocational STEM education. *HS STEM Track Completion* indicates whether the woman has completed the academic high school math track. *Vocational STEM Completion* indicates whether the woman has completed either secondary or tertiary vocational field-specific STEM education. *College STEM Completion* indicates whether the woman has completed a college degree or higher within STEM (excluding biology). The Grade 9 GPA measures come from the written exam at the end of grade 9 in respectively Danish and Math and are standardized by year of graduation for the total population with a mean of zero and standard deviation of one.

Forum. OCLC: 1012177619.

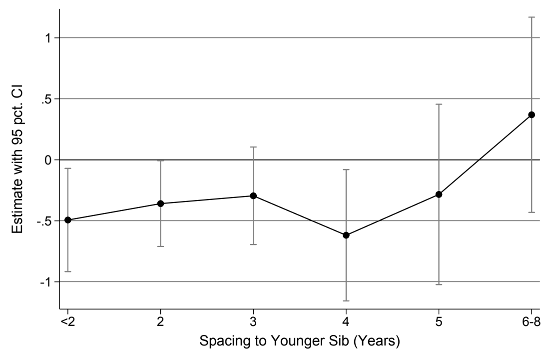
Zölitz, Ulf, and Jan Feld. 2017. "The Effect of Peer Gender on Major Choice." *University of Zurich Working Paper*.

A Appendix Tables and Figures

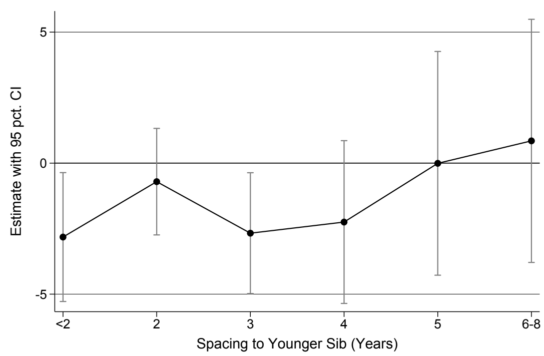
Figure A1
Effect of Sibling Sex on Choice of Occupation and Partner: Heterogeneity by Spacing



(a) Log(Male Share in Own Occupation)



(b) Share of Years in STEM Occupation

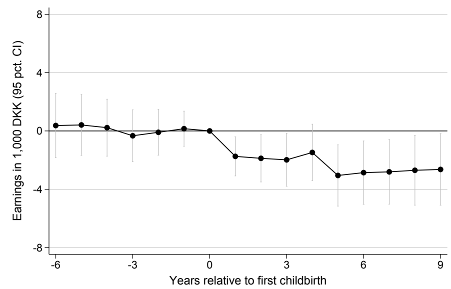


(c) Log(Female Share in Partner's Occupation)

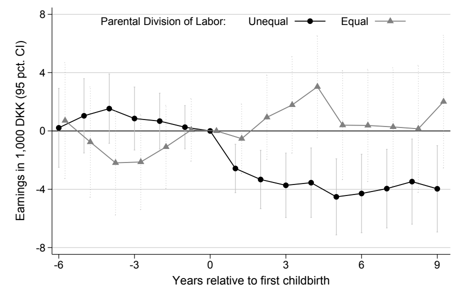
Main sample (first-born women born in 1962–1975) including individuals with a second-born biological sibling born up to eight years. All graphs illustrate the estimated effect of having a second-born brother by birth spacing. The whiskers represent the 95 percent confidence interval. Each graph shows the estimates from a separate regression. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. The models with own occupation also include dummies for the number of years observed in the income registry from ages 31–40 and the number of years observed with a valid occupation code from ages 31–40. For partner's occupation, the controls also include dummies for the partner's number of occupational observations and age at first and last observation. The occupational outcomes of the first-born women are measured as a mean from ages 31–40. The occupational outcome of the partner is measured mainly at the ages 31–45 for the partner with whom the woman lived for most years from ages 31–41.

Figure A2

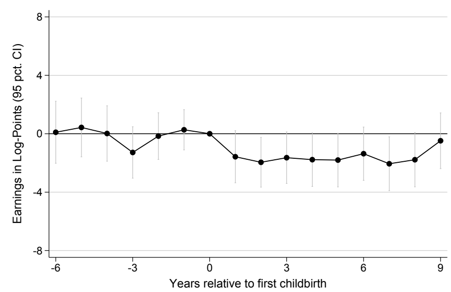
Effect of Sibling Sex on Gender Conformity in the Response to Motherhood: Additional Outcomes



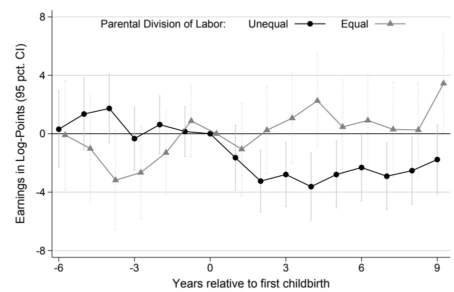
(a) Labor Earnings



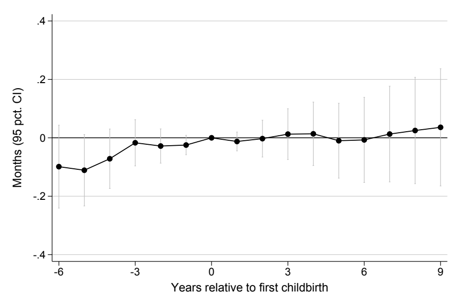
(b) Labor Earnings: Heterogeneity



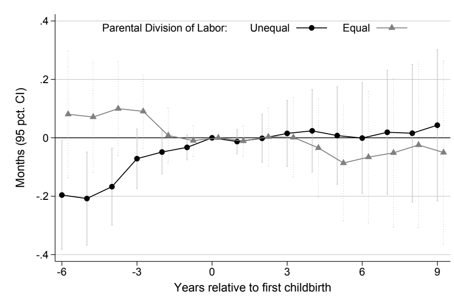
(c) Log(Earnings)



(d) Log(Earnings): Heterogeneity



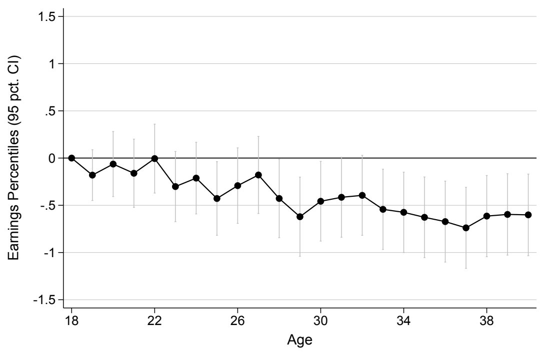
(e) Unemployment



(f) Unemployment: Heterogeneity

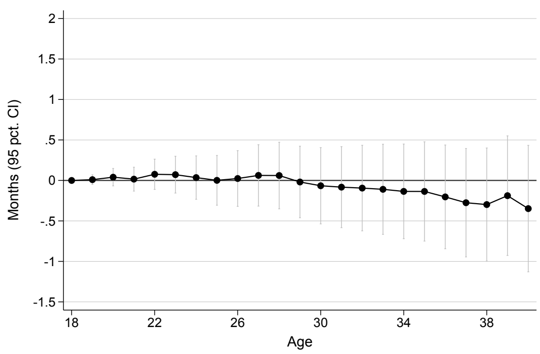
Main sample (first-born women born in 1962–1975 with a younger biological sibling born within four years). The whiskers represent the 95 percent confidence interval. Each graph illustrates the estimates from one regression model. All graphs illustrate the estimates from an event study of the effect of having a second-born brother, where the year of first childbirth is the baseline (year 0). Graphs (b) and (d) illustrate this by parental division of labor. All models absorb time-specific fixed effects and individual fixed effects. Graphs (b) and (d) further control for time-specific-"unequal parental labor division" fixed effects. *Labor Earnings* is measured in 1,000 DKK 2015-prices. *Log(Earnings)* is the natural logarithm of *Labor Earnings*. *Unemployment* measures the cumulated lifetime unemployment in months.

Figure A3
Effect of Sibling Sex on Labor Earnings and Supply at Ages 18–40

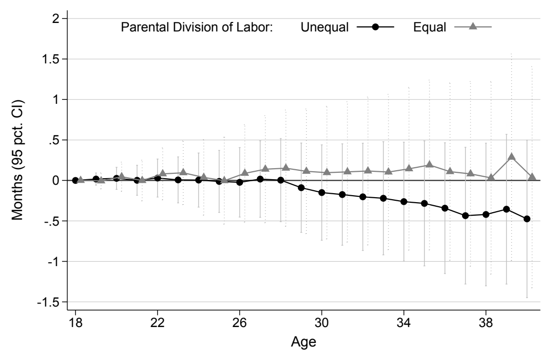


(a) Labor Earnings

(b) Labor Earnings: Heterogeneity



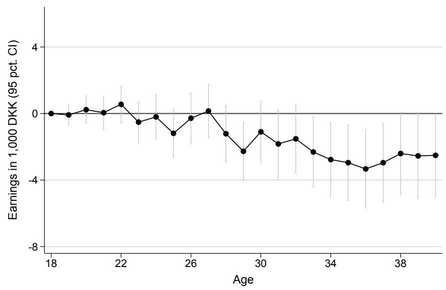
(c) Work Experience



(d) Work Experience: Heterogeneity

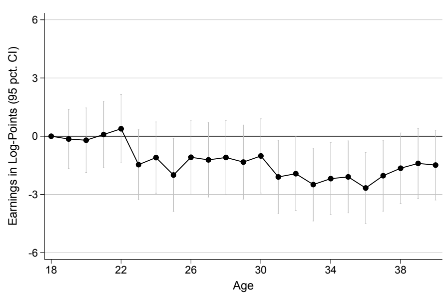
Main sample (first-born women born in 1962–1975 with a younger biological sibling born within four years). The whiskers represent the 95 percent confidence interval. The graph illustrates the estimates from an event study of the effect of having a second-born brother, where the base is age 18. Graphs (b) and (d) illustrate this by parental division of labor. All models absorb age-specific and individual fixed effects. Graphs (b) and (d) further control for age-specific-"unequal parental labor division" fixed effects. *Earnings Percentile* measures the labor earnings percentile by age and cohort. *Work Experience* measures the cumulated lifetime work experience in months.

Figure A4
Effect of Sibling Sex on Labor Earnings and Supply at Ages 18–40:
Additional Outcomes



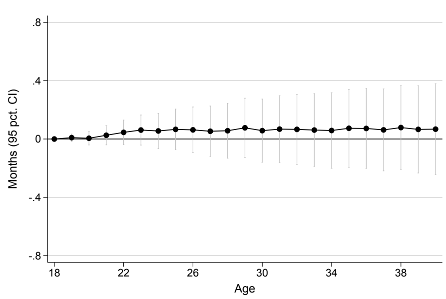
(a) Labor Earnings

(b) Labor Earnings: Heterogeneity

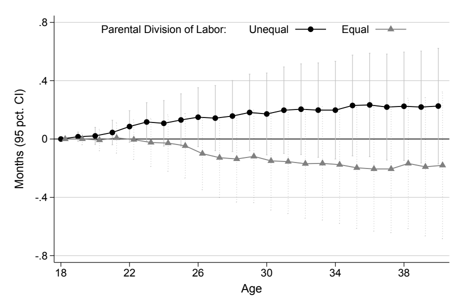


(c) Log(Earnings)

(d) Log(Earnings): Heterogeneity



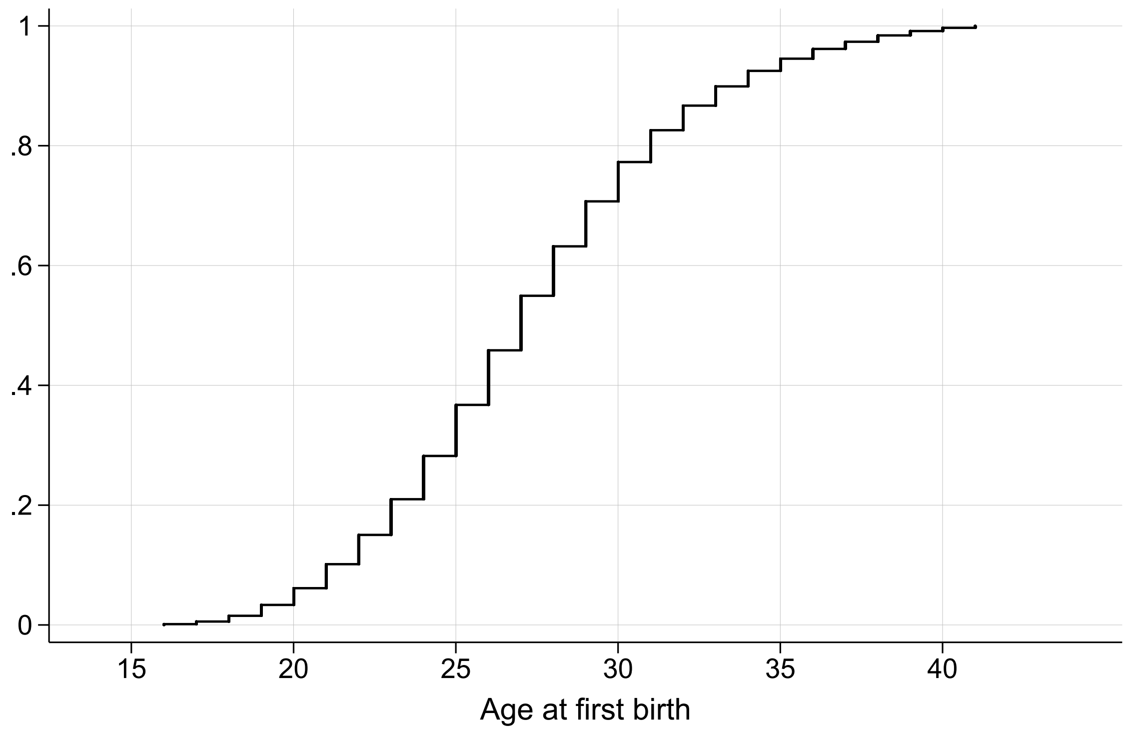
(e) Unemployment



(f) Unemployment: Heterogeneity

Main sample (first-born women born in 1962–1975 with a younger biological sibling born within four years). The whiskers represent the 95 percent confidence interval. The graph illustrates the estimates from an event study of the effect of having a second-born brother, where the base is age 18. Graphs (b) and (d) illustrate this by parental division of labor. All models absorb age-specific and individual fixed effects. Graphs (b) and (d) further control for age-specific-"unequal parental labor division" fixed effects. *Labor Earnings* is measured in 1,000 DKK 2015-prices. *Log(Earnings)* is the natural logarithm of *Labor Earnings*. *Unemployment* measures the cumulated lifetime unemployment in months.

Figure A5
Cumulative of Age at First Birth



Main sample (first-born women born in 1962–1975 with a younger biological sibling born within four years). The graph depicts the cumulative distribution of age at first birth among women who had their first child between the ages of 15 and 41.

Table A2
Effect of Sibling Sex on Components of Parental Time Investment at Age 7 and 11

	Play	Home-work	Out-of-School Activ-ity	Read/ Sing	Excur-sion
	(1)	(2)	(3)	(4)	(5)
Panel A: Maternal Investment at age 7 ($N = 611$)					
Second-Born	0.14*	0.04	-0.01	0.03	0.15*
Brother	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Panel B: Maternal Investment at age 11 ($N = 586$)					
Second-Born	0.11	0.17**	0.03	0.09	0.07
Brother	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Panel C: Paternal Investment at age 7 ($N = 444$)					
Second-Born	-0.09	-0.17*	-0.04	-0.25***	-0.04
Brother	(0.10)	(0.10)	(0.10)	(0.09)	(0.10)
Panel D: Paternal Investment at age 11 ($N = 434$)					
Second-Born	-0.21**	-0.25***	-0.11	-0.05	-0.09
Brother	(0.10)	(0.10)	(0.10)	(0.09)	(0.10)

Standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. DALSC sample. Each panel column represents the results from separate regressions. All models control for (quadratic) mother's and father's age and fixed effects for spacing to the younger sibling in years, region of birth, and maternal and paternal level of education. Each of the individual components is standardized with a mean of zero and standard deviation of one.

B Appendix For Online Publication

B.1 Family Size

Parents in developed countries are more likely to have a third child if their first two children are of same compared to mixed gender (Angrist and Evans, 1998; Angrist, Lavy and Schlosser, 2010; Black, Devereux and Salvanes, 2005). Appendix Table B1 shows that this is also the case in the main sample of the analysis. First-born women with a second-born brother are 13.2 percent less likely to have at least two siblings relative to those with a sister. The rest of this appendix examines whether family size has an independent effect on gender conformity and studies rigorously the robustness of the main results to family size.

Table B1
Effect of Sibling Sex on Parental Realized Fertility

	# of Siblings (1)	$\geq$ 2 Siblings (2)	$\geq$ 3 Siblings (3)
Second-Born	-0.07***	-5.26***	-1.32***
Brother	(0.01)	(0.28)	(0.16)
Observations		103,771	
Average	1.6	37.2	7.7

Estimates for the outcomes ≥ 2 *Siblings* and ≥ 3 *Siblings* are multiplied by 100 to express effects in percentage points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample (first-born women born in 1962–1975 with a second-born biological sibling born within four years). Each column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. *# of Siblings* measures the total number of siblings the individual has, including full and half siblings. $\geq 2(3)$ *Siblings* takes the value of one if the person has at least two (three) full siblings and zero otherwise.

B.1.1 Does Family Size affect Gender Conformity?

Black, Devereux and Salvanes (2005) use twins as an instrument for family size to show that family size does not affect educational attainment, using Norwegian registry data; Angrist, Lavy and Schlosser (2010) find the same for Israel. However, they only consider length of schooling and not gender conformity. Consistent with their findings and

Table B2

The Effect of Family Size on Gender Conformity using Twins as Instrument

	First Stage	Second Stage				
		Choice of Occ and Partner			Education	
	# of Siblings	Log(Male Share in own Occ)	Works in STEM	Log(Female Share in Partner's Occ)	Log(Male Share in Edu)	Length (months)
	(1)	(2)	(3)	(4)	(5)	(6)
Twins at 2^{nd} parity	0.71***					
	(0.02)					
# of Siblings	4.04	0.70	-0.95	-1.24	0.42	
	(3.35)	(0.82)	(4.84)	(3.78)	(1.06)	
F-statistic of IV	1020.11					
Prob>F	< 0.001					
Observations	104,783	104,783	104,783	95,949	104,554	104,554
Effect×-0.07		-0.28	-0.05	0.07	0.09	-0.03

All second stage estimates (except *Length of Education*) are multiplied by 100 to express effects in percentage/log points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample including twin siblings born at second parity (first-born women born in 1962–1975 with a second-born biological sibling born within four years). Each column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. *# of Siblings* measures the total number of siblings the individual has, including full and half siblings. Columns (2) and (3) also include dummies for the number of years observed in the income registry from ages 31–40 and the number of years observed with a valid occupation code from ages 31–40. Column (4) also includes dummies for the partner's number of occupational observations and age at first and last observation. The occupational outcomes of the first-born women are measured as a mean from ages 31–40. The occupational outcome of the partner is measured mainly at the ages 31–45 for the partner with whom the woman lived for most years from ages 31–41. The effects are multiplied by -0.07 (*Effect×-0.07*), as it is the magnitude of the effect of having a brother on the number of siblings.

employing a similar strategy in the Danish context, in this supplementary analysis I show that family size does not affect educational attainment or the measures of gender conformity used in the main analysis.

I use a sample with similar sample restrictions as for the main sample (see Subsection 3.1), with the exception that I include first-born singleton children who have younger twin siblings born at the second parity.[51] The instrument for family size is having twins at the second parity. Column (1) in Appendix Table B2 shows that the instrument is strong and relevant; see Angrist, Lavy and Schlosser (2010) and Black, Devereux and Salvanes (2005) for a discussion of the validity of the instrument.

Columns (2) to (6) show the second stage results. Similar to the findings for Norway and Israel, family size does not affect the length of highest completed education by the age of 30, neither does it significantly affect the woman's occupational choice, her choice of partner or her type of education. The last row in the table scales the estimates by -0.07 (i.e. the effect of having a second-born brother on the total number of siblings). This statistic (*Effect*$\times$*0.07*) illustrates that if family size (despite not having any statistically significant effect on the outcomes) would mediate some of the effect of sibling sex, any potential bias would be tiny.

B.1.2 Robustness to Family Size

As shown in Appendix Tables B1 and B2, sibling sex composition affects family size but family size does not affect gender conformity. To further test the robustness of the main results to family size (in addition to flexibly controlling for family size, as done in column (4) in Table 3 in the main text), this subsection employs two alternative strategies: 1) dividing the sample by family size and 2) studying the effect of having a co-twin brother. Although family size is endogenous to sibling sex composition, strategy (1) is useful to the degree that it informs about the sensitivity of the results. These robustness analyses, together with the evidence of no differential effect by sibling sex on educational attainment or labor market participation (Table 5 and Figure A3) and the absence of an effect of family size on gender conformity, provide convincing evidence that family size does not confound the effects of sibling sex composition.

The first strategy is to split the sample by family size. For this, I restrict the sample to individuals who only have biological siblings, i.e. none of their parents have children with another person than the parent, although the results are similar when including

[51] I include all multiple births; however, twins represent the vast majority of all multiple births.

Table B3
Splitting Sample by Family Size

	Log(Male Share in Own Occ)		Share of Years in STEM Occupation		Log(Female Share in Partner's Occ)	
	(1)	(2)	(3)	(4)	(5)	(6)
Second-Born	-1.07*	-1.11	-0.48***	-0.37**	-2.25**	-1.88*
Brother	(0.62)	(0.82)	(0.16)	(0.18)	(0.88)	(1.12)
Observations	58,314	36,011	58,314	36,011	53,131	33,324
Average	788.4	784.9	5.5	4.4	299.3	290.7
# of Siblings	1	≥ 2	1	≥ 2	1	≥ 2

All estimates are multiplied by 100 to express effects in percentage/log points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample with only full siblings (first-born women born in 1962–1975 with a second-born biological sibling born within four years). Each panel column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. Columns (1) through (4) also include dummies for the number of years observed in the income registry from ages 31–40 and the number of years observed with a valid occupation code from ages 31–40. Columns (5) and (6) also includes dummies for the partner's number of occupational observations and age at first and last observation. The occupational outcomes of the first-born women are measured as a mean from ages 31–40. The occupational outcome of the partner is measured mainly at the ages 31–45 for the partner with whom the woman lived for most years from ages 31–41. *1 Sibling*-models restrict the sample to those who only have one full sibling and no half siblings. ≥ 2 *Siblings*-models restrict the sample to those who have at least two full siblings and no half siblings.

those with half siblings. Given that family size is endogenous, this robustness check comes with a selection problem. If those parents of same-sex children (born at the first two parities) who have a third child are more gender-stereotypical and influence their children's outcomes in such a direction to a greater extent than those who do not have a third child, we would expect the effect of having a second-born brother to be stronger in magnitude among first-born children from two-child families than for the entire sample. Similarly, we would expect the effect of sibling sex to be smaller among children from families with at least three children. This is exactly what the results in Table B3 show.

Table B4
Effect of Having a Co-Twin Brother on Gender Conformity in Education

	Next Birth	Log(Male Share in Edu)	STEM Enroll-ment	STEM Comple-tion
	(1)	(2)	(3)	(4)
Co-Twin Brother	-1.14	-4.31**	-1.62***	-1.48***
	(0.73)	(2.03)	(0.57)	(0.43)
Observations	9,383	9,360	9,383	9,383
Average	28.9	331.7´9	7.2	4.2

All estimates are multiplied by 100 to express effects in percentage/log points. Standard errors are in parentheses, clustered at the mother level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Each column presents estimates from separate regressions. The sample comprises twins born in 1962–86. All models absorb fixed effects for birth county, year of birth, mother's level and field of education, father's level and field of education, parity, and age at last educational observation. The models further control for (cubed) mother's age at birth and (cubed) father's age at birth. *Next Birth* indicates if the parents have a subsequent child. *Log(Male Share in Edu)* measures the natural logarithm of the male share in the highest completed education (narrow field-by-level) by the age of 30. *STEM Enrollment* indicates whether the woman has ever enrolled in a field-specific STEM education at the ages 16–27. *STEM Completion* indicates whether the woman has ever completed a field-specific STEM education by the age of 30.

Finally, to circumvent potential confounding effects from family size, I examine the effect of having a co-twin brother as an alternative empirical strategy. This approach is similar to the one in Cronqvist et al. (2016) and Peter et al. (2018), except that I do not have information on zygocity. To increase power, I include birth cohorts 1962–1986 and consider the gender conformity in educational outcomes by age 30. The key empirical feature of the sample of twins is that twin sex composition only has a very limited impact on family size (Appendix Table B4, column (1)). Overall, the effects of having a co-twin brother on educational choice are similar to the main results. However, the magnitude of the effects are much larger. This might be due to the greater intensity of the exposure to a co-twin compared with a younger sibling.

B.2 The Selection Bias Problem

To show the selection bias problem more formally, I here follow Peter et al. (2018). Assume a latent outcome $Y_i^* = \alpha + \beta G_i^{old} + X_i'\gamma + \epsilon_i$, where G_i^{old} is the sex of the older sibling and X_i is a vector of observable exogenous characteristics. ϵ_i contains other relevant unobservable variables, such as parental sex preferences denoted by P_i, and $E[\epsilon_i] = 0$. The bias arises due to the latent nature of Y_i^*, as we only observe the outcome if child i is born. In other words, $Y_i = Y_i^*$ if the child is born ($S_i = 1$) and Y_i is missing if the child is not born ($S_i = 0$). The selection depends on both parental preferences and the older child's sex, $S_i = f(P_i, G_i^{old})$. We can only estimate the effect for the sample of children who are born which gives the expected value of Y_i:

$$E[Y_i|S_i = 1, G_i^{old}, X_i] = \alpha + \beta G_i^{old} + \gamma X_i + E[\epsilon_i|S_i = 1, G_i^{old}, X_i] \tag{3}$$

$$= \alpha + \beta G_i^{old} + \gamma X_i + E[\epsilon_i|f(P_i, G_i^{old}) = 1, G_i^{old}, X_i].$$

As long as selection depends on the first child's sex and parental preferences affect the way in which parents raise their children $E[\epsilon_i|f(P_i, G_i^{old}) = 1, G_i^{old} = 1, X_i] \neq E[\epsilon_i|f(P_i, G_i^{old}) = 1, G_i^{old} = 0, X_i]$. This implies that the estimate of the older sibling's sex is biased.

A selection problem could also arise in the absence of parental sex preferences. Assume that first-born children have n normally-distributed traits, such as how easy the child is to take care of and how well it behaves. Suppose parents only want a second child if their first child has a value of each trait above a certain threshold. The threshold for or the distribution of each trait could be sex-specific. In both cases, parents who progress to the next parity would, on average, have different types of first-born children depending on the child's sex. For instance, if boys and girls have the same distribution of how well they behave but parents require girls to behave better than boys to have a second child, second-born children would, on average, have a better behaving older sibling if they have a sister compared to a brother. In this example, the estimated effect of the older sibling's sex on the younger child's outcomes might thus be due to the older sibling's behavior rather than due to his or her sex.

B.3 Educational System and Field of Study

Throughout, I follow the International Standard Classification of Education (ISCED) for the definition of all educational measures. I include observations through the age of 27 for all enrollment measures and through the age of 30 for all completion measures to give people time to complete the education in which they enroll. I define the *male share in education* as the share of men who had their highest completed education at the age of 30 within the same narrow field and level of education for cohorts born 1–5 years before the individual. The academic high school grade point average (GPA) is standardized with a mean of zero and standard deviation of one at the year of graduation and high school track level for the total population; however, note that it is only observed for those completing the academic high school.

In the final year of 9^{th} grade, at the age of 16, students decide whether to apply for secondary education or enter the labor market.[52] Secondary education (ISCED level 3) comprises two types: academic high school and vocational training. The academic high school is generic (i.e. not field-specific) and prepares students for tertiary education. For the cohorts of study, the academic high school had two tracks: language and math. Vocational education is, in contrast, field-specific and prepares students for specific occupations; I group Information and Communication Technologies and Engineering (ISCED fields 61 and 71) as STEM.

Tertiary education (ISCED levels 5–8) comprises three types: vocational, professional, and academic. I refer to the latter two jointly as *college*. Similarly, I group vocational secondary and vocational tertiary educations as *vocational education*. A vocational secondary degree usually only gives direct access to vocational tertiary programs within the same specific field,[53] while an academic high school diploma gives access to all types of tertiary education. An application to tertiary education is an application to a specific program. Most college STEM programs require certain high school STEM courses as

[52] They can also choose to enroll in an optional 10^{th} grade, which is a formal continuation of primary school. In the analysis, I restrict the attention to enrollment in and completion of programs after primary school, i.e. after grade 9 and 10.

[53] Students with a vocational secondary degree will often be required to have taken one or two academic high school courses at a basic level, such as math and English. However, many vocational secondary programs do not have a natural continuation at the tertiary level.

prerequisites, such as advanced math and intermediate physics and chemistry. Therefore, an academic high school STEM diploma gives much easier access to college STEM majors than other secondary school degrees, although it is possible to take complementary courses after high school graduation. Acceptance to college mainly depends on high school GPA and most STEM programs admit all eligible applicants (or have very low GPA cut-offs).

To mirror the definition of field-specific STEM education to the one of STEM occupation, I define STEM in college as Physical Sciences, Mathematics, Statistics, Economics, Information and Communication Technologies, and Engineering (ISCED fields 53, 54, 311, 61, 71). However, the results are similar when including biology. Another important reason for excluding biology is that women's underrepresentation in STEM is limited to math-intensive —and, generally, better paid—science fields (Kahn and Ginther, 2017). The analysis of STEM education considers field-specific STEM educations in any type and at any level of education after primary school. This is to not potentially confound the results on STEM choice with educational attainment. Thus, the main STEM outcomes of interest indicate whether the individual ever enrolls in and completes a field-specific STEM education preparing for the labor market, including secondary and tertiary vocational STEM programs and college STEM majors.

Moreover, I complement the main STEM measures with four additional outcomes; the results are reported in Appendix Table A1. I examine whether the first place of enrollment after primary school has a STEM focus, i.e. whether it is either secondary STEM vocational education or in the math track in the academic high school. In line with this, I consider the probability of ever completing the academic high school math track. Finally, I split field-specific STEM educations by type, thereby investigating effects on the probability of completing a vocational STEM program and a college STEM major, separately.[54]

B.4 Alternative Mechanisms

This appendix describes alternative mechanisms to those discussed in Subsection 5.1. However, these mechanisms cannot be the dominating ones, as they are not compatible with the empirical findings.

[54] Considering whether the highest completed education is within STEM reveals similar results as for having any field-specific STEM degree (not reported). Moreover, considering the probability of enrolling in the different types of STEM education rather than completing them also provides similar results.

The effect of sibling interactions might also go in the opposite direction for two reasons. First, the spillover model in developmental psychology hypothesizes that siblings imitate and influence each other with their gender-specific traits. For instance, Brim (1958) and Koch (1955) show that mixed-sex siblings exhibit more traits of the opposite sex and fewer of their own sex compared to same-sex sibling pairs. Second, the reference group theory in sociology suggests that as soon as a same-sex sibling is present in the family, the same-sex sibling will be the child and parents' reference group (Butcher and Case, 1994). Therefore, having a same-sex sibling might induce the child to behave more gender-stereotypically. Meanwhile, given the empirical findings, neither of these two theories can be the dominating mechanism for the effect of sibling sex composition on the development of women's gender conformity.

Studies examining the relationship between sibling sex composition and educational attainment have argued that budget constraints may play an important role (Amin, 2009; Butcher and Case, 1994). If parents face no borrowing constraints, they should, according to standard economic theory, invest in each child until marginal costs equal marginal benefits. However, if parents face borrowing constraints, they might decide to allocate their financial resources depending on the sex composition of their children. If parents want income equality between their children and the returns to education are smaller for women than men, then having a brother instead of a sister would be beneficial. However, parental aversion to income inequality cannot be the dominating channel, as we would otherwise have observed that having a sibling of the opposite sex should make the educational choice less gender-stereotypical.

In contrast, parents might want to maximize the total income of their children, thereby investing more in the child with the greatest returns to education. If returns to education are higher for men than women, having a brother would have adverse effects on educational attainment. In support of this argument, Powell and Steelman (1989) find for students enrolled in one college in the U.S. that the number of brothers puts more pressure on parents' financial support than do the number of sisters. Nevertheless, this is not a likely mechanism in the Danish context because there is no tuition fee at any educational level. Moreover, students in vocational training typically receive apprenticeship wages and students in tertiary education receive governmental student grants and loans to cover living expenses. For all cohorts in the analysis, students in tertiary education have at least had access to a combination of grants and loans of 1,000 USD a month in 2017-prices. It is also less clear how borrowing constraints should affect field choice, given sibling sex composition has no effect on the probability of enrolling in any type of program after compulsory education. Moreover, a more recent study shows that, for later generations in the U.S., parents do not differentially invest in their daughters depending on their children's sibling sex composition (Cools and Patacchini, 2019).

B.5 First-Born Men and their Second-Born Sisters

The main analysis investigates the effect of sibling sex on the origins of women's conformity to traditional gender norms. This Appendix briefly presents a corresponding analysis for men. However, I do not consider men's choice of partner or the school performance of their first-born children because I find that sibling sex affects men's family formation in terms of both having a partner and having any children (panel B in Appendix Table B6). Put differently, considering those outcomes might create selection issues and potentially bias the estimates. I construct the sample of men with identical selection criteria as for the main sample of women and conduct an identical analysis with the same variable definitions and controls.

Overall, the results for first-born men suggest that having a second-born sister relative to a second-born brother enhances men's gender conformity (Appendix Table B5). Men with a sister have a slightly higher (borderline significant) share of men in their occupation, and they are 0.51 percentage points (3.7 percent) more likely to work in STEM occupations.[55] However, having a sister also reduces the probability of working in managerial occupations by 0.44 percentage points (6.6 percent).[56] This decrease in the likelihood of working in (high-paid) managerial positions may help explain why men with a sister experience lower labor earnings than men with a brother (Appendix Figure B1). At the same time, men with a sister cumulate less work experience at the end of their thirties relative to those with a brother, while there is no effect on lifetime unemployment by age 40. Thus, men with a sister appear somewhat less successful in the labor market.

Similar to my findings, previous studies find negative effects of having sisters relative to brothers on men's earnings in Sweden and the United States (Peter et al., 2018;

[55] The results are comparable when considering a binary indicator for having ever worked in a STEM field from ages 31 to 40 (not reported).

[56] In unreported results, I find a tight zero effect of sibling sex on women's probability of working in managerial occupations (the estimated effect is 0.04 percentage points ($se = 0.07$)).

Table B5
Men: Effect of Sibling Sex on Choice of Occupation

	(1)	(2)	(3)	(4)
Panel A: Log(Male Share in Own Occupation)				
Second-Born	0.51**	0.48*	0.44*	0.52**
Sister	(0.26)	(0.25)	(0.25)	(0.25)
Observations	108,366	108,366	108,366	108,366
Panel B: Share of Years Working in STEM Occupation				
Second-Born	0.44**	0.48***	0.51***	0.47***
Sister	(0.18)	(0.18)	(0.18)	(0.18)
Observations	108,366	108,366	108,366	108,366
Panel C: Share of Years Working as Manager				
Second-Born	-0.46***	-0.45***	-0.44***	-0.44***
Sister	(0.12)	(0.12)	(0.11)	(0.12)
Observations	108,366	108,366	108,366	108,366
No controls	✓			
Basic controls		✓	✓	✓
Parental education			✓	✓
Family size				✓

All estimates are multiplied by 100 to express effects in percentage/log points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Male main sample (first-born *men* born in 1962–1975 with a second-born biological sibling born within four years). Each panel column presents estimates from separate regressions. *Basic controls* include fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, number of years observed in the income registry from ages 31–40, and the number of years observed with a valid occupation code from ages 31–40. *Parental education* controls include fixed effects for maternal level-by-field of education and paternal level-by-field of education. *Family size* controls include dummies for the number of biological siblings and dummies for the number of children the mother and father potentially have, respectively, from later relationships, and the sex of potential third- and fourth-born siblings. The outcomes are measured as mean from ages 31–40.

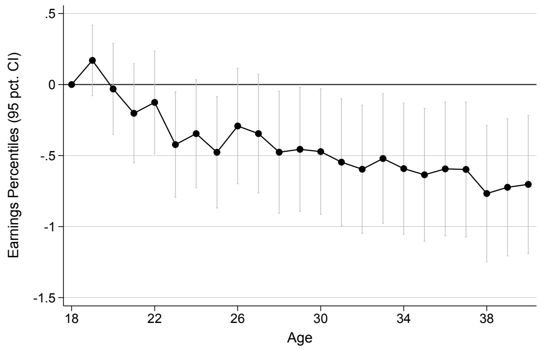
Table B6
Men: Effect of Sibling Sex on Education and Family Formation

	(1)	(2)	(3)	(4)	(5)
Panel A: Education by age 30					
	Log(Male Share)	Length (months)	High School GPA	STEM Enrollment	STEM Completion
Second-Born Sister	0.47	-0.07	0.01	1.17***	0.45
	(0.29)	(0.15)	(0.01)	(0.30)	(0.28)
Observations	107,899	107,922	31,971	108,366	108,366
Panel B: Family Formation by the Age of 41					
	Cohabit 18–41	Married 18–41	Has Any Children	# of Children	Age at First Birth
Second-Born Sister	-0.39***	-0.89***	-1.56***	-0.04***	0.09***
	(0.12)	(0.15)	(0.25)	(0.01)	(0.03)
Observations	108,366	108,366	108,366	108,366	86,020

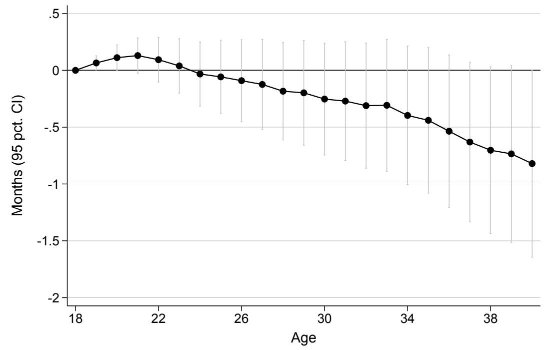
Estimates in columns (1), (4), and (5) in panel A and columns (1), (2), and (3) in panel B are multiplied by 100 to express effects in percentage/log points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Male main sample (first-born *men* born in 1962–1975 with a second-born biological sibling born within four years). Each panel column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. The educational outcome models (except for high school GPA), further control for age at last observation in the education registry. *Log(Male Share)* measures the natural logarithm of the share of men in the highest completed education (narrow field-by-level) by the age of 30. *Length* measures the length of the highest completed education in months by the age of 30. *High School GPA* measures final GPA from the academic high school and is standardized by track and year of graduation for the total population with a mean of zero and standard deviation of one. *STEM Enrollment* indicates whether the man has ever enrolled in a field-specific STEM education at the ages 16–27. *STEM Completion* indicates whether the man has ever completed a field-specific STEM education by the age of 30. *Cohabit* measures the share of years aged 18–41 during which the man has cohabited with a partner without being married. *Married* measures the share of years aged 18–41 during which the man has been married. *Has Any Children* indicates whether the man has at least one child by the age of 41. *# of Children* measures the number of children the man has by the age of 41. *Age at First Childbirth* measures the age at the man's first childbirth in years, conditional on having any children.

Figure B1

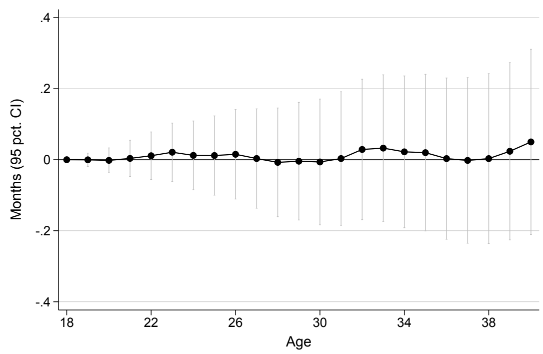
Men: Effect of Sibling Sex on Labor Market Outcomes at Ages 18–40



(a) Earnings Percentile



(b) Cumulated Work Experience



(c) Unemployment

Male main sample (first-born *men* born in 1962–1975 with a younger biological sibling born within four years). The whiskers represent the 95 percent confidence interval. All graphs illustrate the estimates from an event study of the effect of having a second-born brother, where the base is age 18. All models absorb age-specific and individual effects. *Earnings Percentile* measures the labor earnings percentile by age and cohort. *Work Experience* measures the cumulated lifetime work experience in months. *Unemployment* measures the cumulated lifetime unemployment in months.

Rao and Chatterjee, 2018). Rao and Chatterjee (2018) show that in the United States, brothers help each other more in job searches than mixed-sex siblings, which could help explain the negative effect on earnings and be a mechanism counteracting our ability to observe men's gender conformity through occupational choice. Moreover, Peter et al. (2018) discuss competition between brothers as an important channel of the positive effect of having a brother on earnings. Brothers might compete with each other to a much greater extent than mixed-sex siblings, both because men are more competitive than women and because having a same-sex sibling might change the reference point of competition (Butcher and Case, 1994; Conley, 2000). Joensen and Nielsen (2017) show that brother pairs especially influence each other in terms of educational choice. Panel A in Appendix Table B6 shows that having a sister increases men's probability of ever enrolling in any field-specific STEM program, supporting a change in their gender conformity. However, the effect does not persist into actual degree completion, which again may suggest that having a sister reduces competitive behavior, making them strive and ultimately achieve less. Besides the effect on STEM enrollment, sibling sex does not influence men's educational attainment or achievement.

Like Peter et al. (2018), I also find that having a sister negatively affects men's family formation. Men with a sister cohabit and are married fewer years from ages 18 to 41. Furthermore, having a sister reduces men's probability of having any children and their number of children. These findings could reflect less-competitive behavior among men with a sister relative to those with a brother not only in the labor market but also in the marriage market. Thus, despite finding indications of similar effects of having an opposite-sex sibling on men's development of gender norms as for women, competition might play a similar or more important role in terms of how men fare in the labor and marriage markets.

B.6 Appendix Tables and Figures For Online Publication

Table B7
Effect of Sibling Sex on Relative Earnings and Age Difference

	(1)	(2)	(3)	(4)
Panel A: Relative Difference Between Partner's and Woman's Earnings				
Second-Born	0.74***	0.76***	0.77***	0.80***
Brother	(0.23)	(0.23)	(0.23)	(0.23)
Observations	91,216	91,216	91,216	91,216
Average	22.3	22.3	22.3	22.3
Panel B: Age to Partner (days)				
Second-Born	19.41**	20.99**	21.32**	21.54***
Brother	(8.29)	(8.31)	(8.31)	(8.32)
Observations	95,058	95,058	95,058	95,058
Average	1,014.9	1,014.9	1,014.9	1,014.9
No controls	✓			
Basic controls		✓	✓	✓
Parental education			✓	✓
Family size				✓

All estimates in panel A are multiplied by 100 to express effects in percentage points. Standard errors are in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Main sample (first-born women born in 1962–1975 with a second-born biological sibling born within four years). Each panel column presents estimates from separate regressions. *Basic controls* include fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, and paternal age at birth. For the earnings difference, basic controls also include a dummy indicating whether the woman and her partner have the same number of earnings observations. *Parental education* controls include fixed effects for maternal level-by-field of education and paternal level-by-field of education. *Family size* controls include dummies for the number of biological siblings and dummies for the number of children the mother and father potentially have, respectively, from later relationships, and the sex of potential third- and fourth-born siblings. *Relative Difference Between Partner's and Woman's Earnings* measures the difference between the partner's and the woman's labor earnings as a share of the couple's total earnings during the first five years the couple lives together when the woman is 31–40 years. *Age to Partner* measures the number of days the partner is older than the woman and is set to zero if the woman is older than the partner.

Table B8

Descriptive Statistics of DALSC Sample

Panel A: Statistic by Sex of the Second-Born Sibling	Sister		Brother		*t*-test
	Mean	SD	Mean	SD	*p*-value
	(1)	(2)	(3)	(4)	(5)
Spacing (months)	33.31	11.31	33.47	11.50	0.86
Mother's age at birth (years)	26.99	3.80	26.74	3.61	0.39
Father's age at birth (years)	29.08	4.19	28.79	4.03	0.37
Mother's education (years)	12.77	2.11	12.90	2.08	0.43
Father's education (years)	13.21	2.30	13.05	2.22	0.35
Observations	326		335		
Panel B: Balancing Test					
Joint F-statistic			1.00		
Prob > F			0.4652		

DALSC sample (first-born girls born 1995 with a second-born sibling born within five years). Panel A shows the average and standard deviation of family background characteristics for first-born girls with a second-born sister (columns (1) and (2)) and brother (columns (3) and (4)). Column (5) reports the *p*-values from *t*-tests of significance between the averages of the two groups of girls. Panel B tests whether the control variables included in the models using the DALSC sample in Table 7 can predict having a second-born brother. *F*-test of joint significance of all control variables.

Table B9

Principal Component Analysis: Parental Time Investment

	Mother		Father	
	Age 7	Age 11	Age 7	Age 11
First Principal Component				
Play	0.51	0.58	0.49	0.53
Homework	0.32	0.37	0.47	0.43
Out-of-school activity	0.39	0.45	0.38	0.51
Read/sing	0.49	0.40	0.47	0.34
Excursion	0.49	0.42	0.41	0.40
Eigenvalue				
First Component	1.54	1.63	1.81	1.84
Second Component	0.97	1.09	0.92	0.95

DALSC sample. Higher values reflect that parents do the specific activity more often.

Table B10
Effect of Sibling Sex on Quality of Child-Parent and Child-Sibling Relations

	Mother's	Father's	Child's relationship to		
	Relationship to Child		Mother	Father	Siblings
Child Age	11/15	7	15	15	15
	(1)	(2)	(3)	(4)	(5)
Second-Born	-0.12	-0.22**	0.08	-0.16*	-0.39***
Brother	(0.10)	(0.10)	(0.09)	(0.09)	(0.09)
Observations	467	456	533	526	514

Standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. DALSC sample. Each column represents the results from separate regressions. All models control for (quadratic) mother's and father's age and fixed effects for spacing to the younger sibling in years, region of birth, and maternal and paternal level of education. All child-parent relationship indexes represent the first component from principal component analyses, shown in Appendix Table B11, are standardized such that a higher value reflects a better relationship, the mean is zero, and the standard deviation is one. *Child's relationship to siblings* is an index of how easy the child thinks it is to talk to his/her siblings about matters that really bother her (standardized with a mean of zero and standard deviation of one).

Table B11

Principal Component Analysis: Child-Parent Relations

	Mother's	Father's	Child's rel. to	
	Rel. to Child		Mother	Father
First Principal Component				
Age 11: How close is the relationship between you and your daughter (1–4)?	0.71			
Age 15: How close is the relationship between you and your daughter (1–3)?	0.71			
Age 7: How close is the relationship between you and your daughter (1–4)?		0.71		
Age 7: Are you satisfied with the relationship between you and your daughter (1(yes)–2(no))?		0.71		
Age 15: Your mother/father plays a very big role in your life (1–5)			0.32	0.36
Age 15: Your relationship with your mother/father is important to you (1–5)			0.35	0.37
Age 15: Your mother/father loves you (1–5)			0.35	0.28
Age 15: You trust your mother/father (1–5)			0.38	0.40
Age 15: You can expect your mother/father to listen to you (1–5)			0.35	0.37
Age 15: You can go to your mother/father for advice (1–5)			0.40	0.36
Age 15: You can count on help from your mother/father if you have a problem (1–5)			0.36	0.37
Age 15: How easy is it to talk with your mother/father about matters that really bother you (1–5)			0.29	0.29
Eigenvalue				
First Component	1.34	1.25	4.07	4.53
Second Component	0.66	0.75	0.95	0.79

DALSC sample. All questions are answered on a Likert scale with lower values being better. Therefore, the standardized measures used in Table B10 are all reversed, such that a higher value reflects a better relationship.

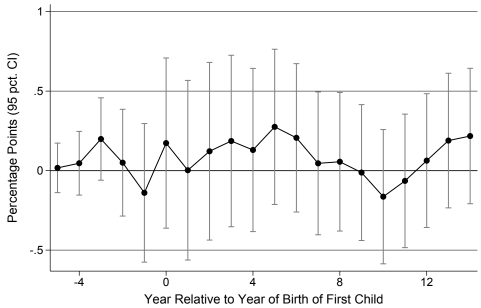
Table B12

Association Between First-Born Sibling's Sex and Second-Born Women's Gender Conformity

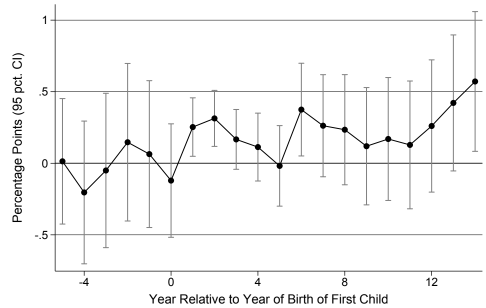
	Log(Male Share in own Occ)	Works in STEM	Log(Female Share in Partner's Occ)
	(1)	(2)	(3)
First-Born Brother	-0.87*	-0.10	-1.22*
	(0.46)	(0.11)	(0.67)
Observations	105,444	105,444	95,570
Average	787.6	4.623	292.2

Sample of second-born women born in 1962–1975 with a first-born biological sibling born within four years. Each column presents estimates from separate regressions. All models absorb fixed effects for birth municipality, year-by-month of birth, spacing in months to older sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education. For the own-occupation outcomes, controls also include dummies for the number of years observed in the income registry from ages 31–40 and the number of years observed with a valid occupation code from ages 31–40. For partner's occupation, controls also include dummies for the partner's number of occupational observations and age at first and last observation.

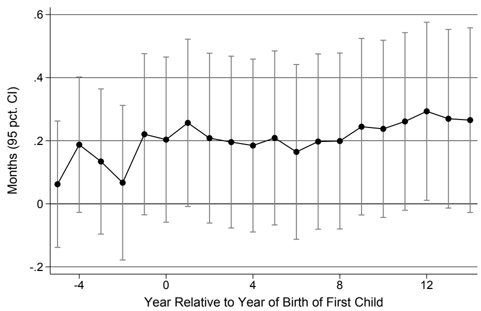
Figure B2
Parental Socio-Economic Status by Sibling Sex Composition



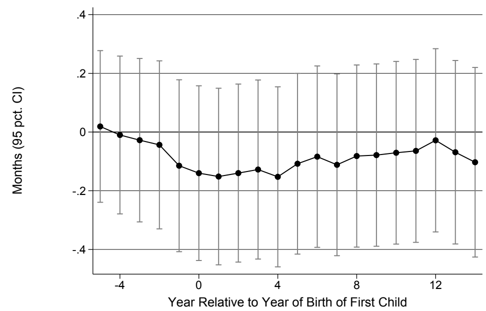
(a) Parents are Married



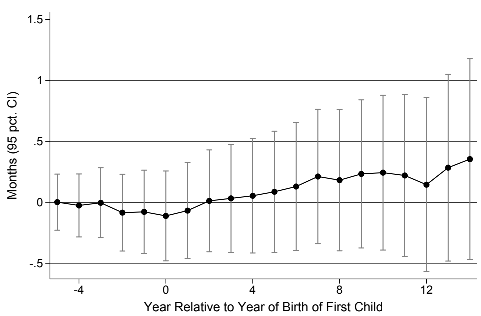
(b) Parents Cohabit/are Married



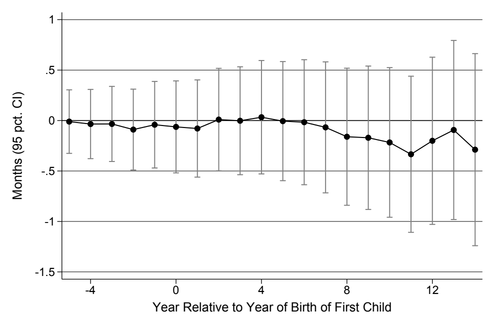
(c) Mother's Edu (months)



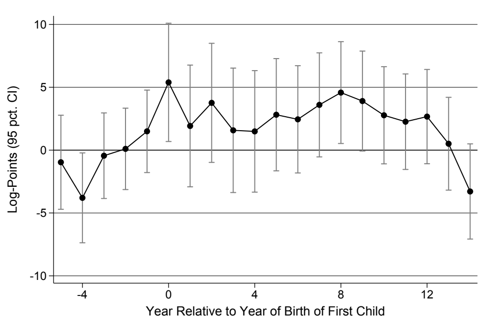
(d) Father's Edu (months)



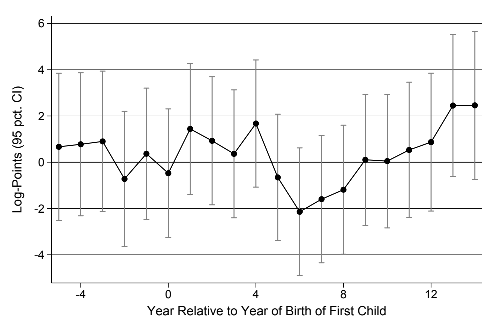
(e) Mother's Work Experience



(f) Father Work Experience



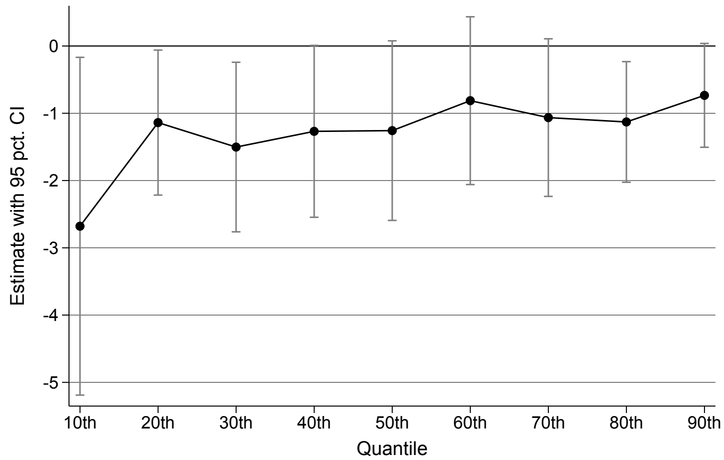
(g) Mother's log(Earnings)



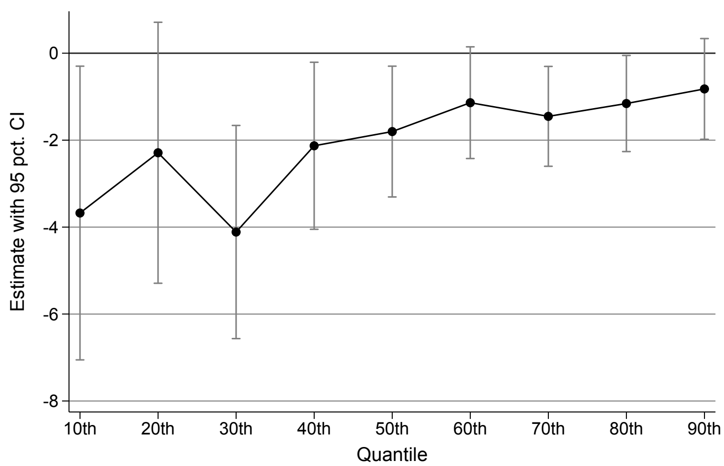
(h) Father's Log(Earnings)

Sample of first-born girls born between 1985 and 2002 with a second-born biological sibling born within four years. The whiskers represent the 95 percent confidence interval. All graphs illustrate the estimates from an event study of the effect of having a second-born brother. All models absorb time-specific fixed effects for birth municipality, year-by-month of birth, spacing in months to younger sibling, maternal age at birth, paternal age at birth, maternal level-by-field of education, and paternal level-by-field of education.

Figure B3
Distributional Effects of Sibling Sex on Choice of Occupation and Partner



(a) Log(Male Share in Own Occupation)



(b) Log(Female Share in Partner's Occupation)

All estimates are multiplied by 100 to express effects in log points. The whiskers represent the 95 percent confidence interval. Main sample (first-born women born in 1962–1975 with a second-born biological sibling born within four years). All estimates come from separate quantile regressions. All models control for quadratic spacing to the second-born sibling, mother's and father's cubed age at birth, and absorb fixed effects for year of birth, indicators for missing parental age information, and a constant. The models in Graph (a) further control for dummies indicating the number of occupational observations and the models in Graph (b) control for the partner's number of occupational observations and age at first and last observation.