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ABSTRACT

Closing or Reproducing the Gender Gap? Parental Transmission, Social Norms and Education Choice*

Over the last decade, the economic literature has increasingly focused on the importance of gender identity and sticky gender norms in an attempt to explain the persistence of the gender gaps. Using detailed register data on the latest cohorts of Danish labour market entrants, this paper examines the intergenerational correlation in gender-stereotypical choice of education. Although to some extent picking up inherited and acquired skills, our results suggest that if parents exhibit gender stereotypical labour market behaviour, children of the same sex are more likely to choose a gender stereotypical education. The associations are strongest for sons. Exploiting the detailed nature of our data, we use birth order and sibling sex composition to shed light on the potential channels through which gender differences in educational preferences are transmitted across generations. We propose that such transmissions may attenuate the final closing of the gender gap.

JEL Classification: I23, J16, J24

Keywords: intergenerational transmission, gender differences, gender identity, social norms

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1. INTRODUCTION

In most Western countries, women have successfully gained on men's labour market position over the last 50 years. As a result, the gender gaps in labour force participation and wages have diminished, see for instance Kleven and Landais (2017). In a recent paper, Goldin (2014a) argues that the last chapter of the grand gender convergence is in the pipeline. Specifically, Goldin (2014a) suggests increasing labour market flexibility with respect to remuneration to and timing of working hours as a means to eliminate the remainder of the gender wage gap. Such change has already come about in several sectors, for example technology and health, while other sectors, such as corporate and legal, continue to lack behind. However, in the mid-1990s the gender convergence stagnated and marked differences in pay, promotional patterns and types of activities performed by men and women still exist (Olivetti and Petrongolo, 2016; World Economic Forum 2016).

While we do not dispute the importance of labour market flexibility for promoting female careers discussed by Goldin (2014a), in this paper we hypothesise that the gender convergence may be attenuated in its final stages by sticky social norms. To investigate this hypothesis, we estimate the intergenerational correlation in a measure of gender-stereotypical education choices, specifically the degree to which individuals select into female-dominated educational programs.

We focus on the important role that parents play in determining their children's education choices and, in particular, how social norms may be transferred from parents to children. We consider the correlation of educational rather than occupational characteristics for three reasons.

First, the choice of education is the first major decision individuals make concerning their future labour market career—often chosen prior to starting a family or entering the labour market. Thus, for a particular set of skills, we argue along the lines of Oguzoglu and

Ozbeklik (2016) that choice of education, although indubitably an important determinant of subsequent occupation, is more immediately related to the preferences of individuals, whereas later labour market outcomes, such as occupation, promotion and earnings, to a greater extent reflect fertility and marriage decisions in addition to labour market conditions and employer discrimination.

Second, although female labour force participation rates have been used in many studies (Fortin, 2005) as a proxy for gender attitudes, we do not consider it a satisfactory measure in for example the Nordic countries. Here, most women have been full-time labour market participants for decades; thus, having a mother in the labour force is a weak signal of household gender norms or even maternal comparative advantages.

Third, the occupational segregation is as large (or even larger) in Denmark as in other countries (Gupta and Smith, 2002 and Gupta et al., 2008). Recent figures suggest that while the educational segregation for university college programmes (professional Bachelor's) has decreased somewhat in the recent decade, the educational segregation in higher university has increased despite a reversing gap in educational attainment (SFI, 2016). Consequently, there is little hope that closing the gender gap in labour force participation or educational attainment will close the remaining gaps in occupational positions and earnings.

Reminiscent of Bertrand et al. (2015) and Goldin (2014b) we suggest that, while previously somewhat neglected, male stereotypes are equally important factors of the remaining gender gaps. In particular, while women have assumed certain previously male-dominated educations, for example sociology and veterinary and agricultural sciences, there are no examples of a converse pattern.[1] As demonstrated in Figure 1, women

[1] For example, physiotherapy has seen a marked increase in male graduates from the 1970s to the 2000s; however, with more than 70% female graduates on average in the 2000s it is still decidedly female. Fields such as nursing, teaching and humanities are still predominantly female, while engineering and

graduating in decidedly female-dominated fields on average earn less compared to women with degrees in male-dominated fields. However, unlike women, men face a reduction in expected earnings by entering less stereotypical fields as many female-dominated occupations are in the public sector and on average pay less.

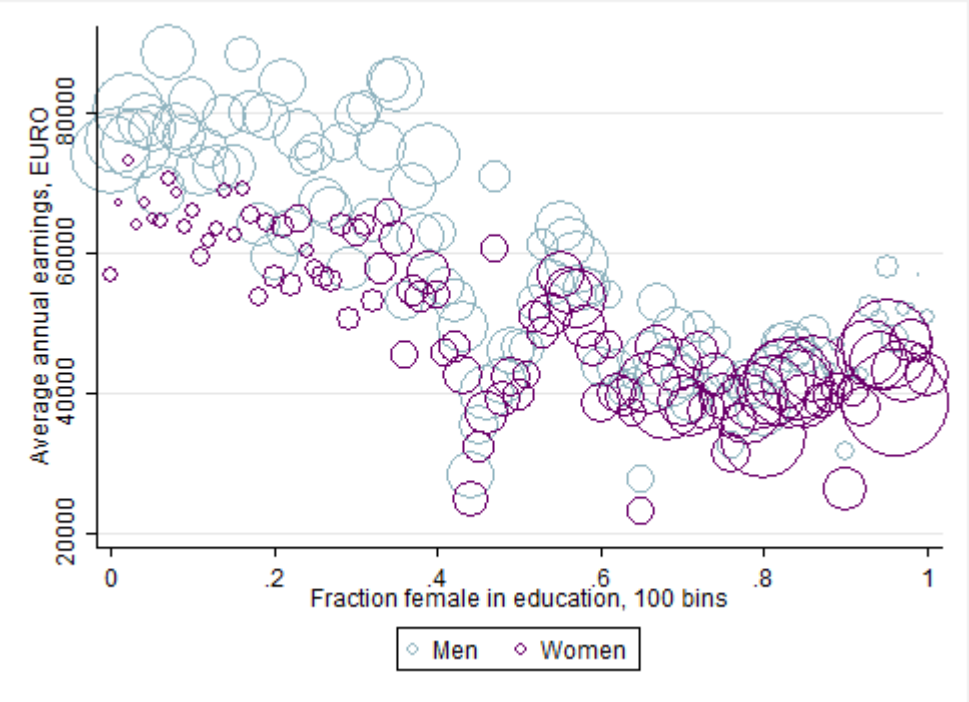

Figure 1: Average annual earnings by female-dominated education choice for men and women, 2010. The sample includes all working individuals with at least a BA in 2010. Fraction female in education is measured as the share of female graduates in the year of enrolment. Markers are weighted by bin size.

This paper contributes to the literature by utilizing data covering the entire population of Danish students born in the period 1970–1986 who enrolled or completed a BA degree. We exploit the richness of the administrative registers to create measures of gender attitudes in educational choices for both the children and their parents. Further, we use the detailed individual-level data to construct a register-based measure of parental attitudes that

business are distinctively male (Goldin, 2014a). Pan (2015) documents that occupational segregation exhibits a "tipping" pattern, i.e. occupations rapidly become predominantly female once the share of females in an occupation exceeds a certain threshold and demonstrates that the threshold is lower when men hold more traditional gender attitudes.

parallels the widely used survey question on gender norms "Do you agree with the statement that a man should earn more than his wife?"

As a main result, we document a positive and significant correlation between parents and their children with respect to the share of females in education choice across generations. The same-sex correlations in the tendency to select into female-dominated educations across generations are dominant, whereas the mother–son and father–daughter correlations are generally smaller and in most cases insignificant. Interestingly, the father–son correlations seem strongest, less related to skill level and less sensitive across specifications. Additionally, the educational choices of daughters are to some extent correlated with the education and labour market behaviour of their fathers, while sons' choices rarely correlate with the behaviour of their mothers. This may in part reflect the aforementioned difference in trade-offs faced by sons and daughters: Since wages are typically lower in women's fields, there is a real trade-off for daughters between choosing (i) an education which is consistent with typical feminine norms but with lower expected future earnings, or (ii) a less gender-congruent education but with higher expected earnings later in life. For sons, the "trade-off" is markedly different: choosing a gender-stereotypical education generally implies higher future earnings, while choosing a less gender-congruent education in a more female-dominated area would typically result in lower future earnings potential. Thus, it may be more difficult to change the gender-stereotypical behaviour of boys.

The remainder of this paper is organised as follows. Section 2 places the intergenerational transmission of education in the context of the relevant literature and presents potential transmission mechanisms. Section 3 introduces the data while Section 4 describes the estimation approach. Section 5 presents the results and discusses the hypotheses tested. Finally, Section 6 discusses and concludes.

2. GENDER GAPS IN FIELD PREFERENCES AND INTERGENERATIONAL TRANSMISSIONS

A vast economic literature on gender trends has explored the rise in female labour force participation following World War II; see e.g. Goldin (2014a) and Olivetti and Petrongolo (2016) for recent and comprehensive descriptions. However, where Goldin (2014a) considers the diminishing gender wage gap as evidence of an impending final chapter of the gender convergence, Olivetti and Petrongolo (2016) note that the remaining gender gaps in several labour market outcomes, including college major choice, are remarkably persistent—particularly when considering the reversing gaps in educational attainment in many countries (although, the general progress in gender trends has slowed considerably since the mid-1990s, see e.g. Blau and Kahn, 2006; Olivetti and Petrongolo, 2016).

The economics literature has long been concerned with why men and women select into different labour market fields. In their significant handbook chapter, Altonji and Blank (1999) focus on the traditional topics of differences in comparative advantages and discrimination-based explanations when surveying the literature on gender differences in human capital accumulation and field preferences. Among these, Polachek (1978) theorises that women self-select into occupations in which human capital depreciates relatively slowly, i.e. in which the wage penalty of long-term absences from the labour market, for example in connection with childbirth, is low. While the importance of and interest in these traditional topics have not decreased, Bertrand (2011) surveys the literature on newer explanations of the gender gap in field preferences including societal norms and gender differences in psychosocial traits and tastes.

Seminal works by Akerlof and Kranton (2000, 2002) incorporate the sociological and psychological concept of identity into a standard utility framework. They define one's self-image (identity) as belonging to a social category, which contains a set of appropriate

behaviours prescribing how one ought to behave. Identity then influences educational and labour market outcomes, as deviating from the prescribed behaviour is costly. In the gender identity framework, the social categories 'male' and 'female' and associated prescriptions such as "men care about prestige and career" and "women care for others" would motivate men and women to choose different educational fields. Also in Bordalo et al. (*forthcoming*) the individual's self-identity relies on group affiliation and the stereotypes associated with each group. Because stereotypes exaggerate the differences between groups (e.g. "men are good at math, women are not"), the expected payoffs from graduating with a certain degree are here distorted by individuals' incorrect beliefs about own ability in comparison to that of members of other groups: Men underestimate the competition from women in math-based fields, while women overestimate the competition from men. This relates somewhat to Goldin (2014b)'s pollution theory of discrimination, where female hiring in male-dominated occupations leads to reduced occupational prestige in the opinion of outsiders because of asymmetric information about the value of the individual female's characteristics. In Bordalo's et al. (*forthcoming*) framework, however, the transmission of non-stereotypical information is often ineffective in changing stereotypes as individuals overreact to stereotype-confirming information and fail to update their beliefs in the face of non-stereotypical information.

Traditionally, the literature has focused on the changes in female gender roles to close the gender gaps. Studies by Maccoby (1998) support this in suggesting that the pressure of conforming to gender identity is greater for girls than boys, and Johnston et al. (2014) demonstrate that gender attitudes are transmitted from mothers to both daughters and sons, although, only daughters' labour market outcomes appear to be affected by this. Fernández et al. (2004), however, present evidence of changing societal norms in that wives of men whose mothers participated in the labour force during WWII are more likely to work

themselves, and suggest that the operating channel is the change in norms of these men. Therefore, upholding male gender stereotypes may be an important factor in closing the remaining gender gaps (e.g. Goldin 2014b, Pan 2015, and Bordalo et al. *forthcoming*).

Zafar (2013) shows that gender differences in college majors are explained by differences in preferences rather than in skill levels. While such differences to some extent may reflect pre-market discrimination, a recent literature considers differences in psychological traits, such as attitudes toward risk, competition, negotiation etc., between men and women as drivers of the gaps in field preferences: Bonin et al. (2007) empirically demonstrate that more risk-averse individuals tend to sort into occupations with more stable earnings, which are on average lower paid due to compensating wage differentials for risk-averse agents. Women on average exhibit more risk-averse behaviour than men (Reuben et al., *forthcoming*). Also, Maestripieri et al. (2009) empirically link individuals' testosterone levels to risk aversion and further present evidence that career choice is related to testosterone levels. Antecol and Cobb-Clark (2013) determine that entry into male-dominated fields is related to traditional 'masculine' psychosocial traits such as impulsivity, independence and non-emotion. Humlum et al. (2012) find that identity-related social and career factors, on which men and women load differently, are related to the planned field of study. Reuben et al. (*forthcoming*) conclude that major choice, as defined by four broad fields, is unrelated to their experimental measures of competitiveness and overconfidence (which differs systematically between genders), although they may operate through the choice of specific major within the broad categories.

Although many personality traits may in part be biologically determined, for example differences in testosterone levels and risk aversion in Maestripieri et al. (2009), they are potentially exacerbated by societal norms and stereotypes. Interestingly, evidence suggesting that gender differences arise as a product of societal factors rather than

biological endowments only has surfaced over the last decades. Specifically, adhering to gender categories may drive the observed differences in behaviour within same-sex and coed school environments. For example, Fryer and Levitt (2010) demonstrate a negative relationship between the gender gap in math and societal gender equality indicators, except for Muslim countries where same-sex classrooms and schools are prevalent. Likewise, Booth and Nolen (2012a, b) and Booth et al. (2014) find that girls from single-sex schools behave more like boys in terms of risk attitudes and willingness to compete. The authors speculate that girls may reinforce stereotypical behaviour to appear attractive when boys are present, while boys may exhibit assertiveness to attract the opposite sex and reduce threats from competitors. Based on the prescription that "a man should earn more than his wife", Bertrand et al. (2015) demonstrate that wives with a potential to earn more than their husbands distort their labour supply to appear less threatening by reducing earnings and increasing the time spent on household chores.

Parents have a considerable potential for influencing the education choice of their children: in a study of North-western University sophomores, Zafar (2013) finds that one of the greatest determinants of individuals' college major choices is to gain the approval of their parents. Importantly, a prominent literature on intergenerational mobility documents considerable positive correlations between educational and occupational outcomes of parents and children (e.g. recent and comprehensive reviews by Björklund and Salvanes, 2011; Black and Devereux, 2011) where in particular the same-sex correlations appear strong. Although possibly also arising from other channels, this evidence is in line with inheritable or sticky social norms. Much of the literature concerning intergenerational evidence of occupation and education choice focus on the transmission of economic resources and human capital from parents to children, including information, networks, and transfers of acquired and inheritable skills (e.g. Laband and Lentz, 1992; Dunn and Holz-

Eakin, 2000; Black and Devereux, 2011; Corak and Piraino, 2011). However, Lindquist et al. (2015) find that acquired skill transfers (post-birth factors) account for twice as much as inherited skills (pre-birth factors) when decomposing the intergenerational association in entrepreneurship using the Swedish adoption registers.

Such intergenerational transmissions are likely to cause positive associations in education and occupation choice across generations, although from an income-maximizing perspective they alone cannot explain the dominant same-sex associations demonstrated in the empirical literature. A number of studies, however, show that parents tend to invest more in their same-sex children (Lundberg, 2005), which potentially produces larger correlations along the same-sex dimension, although, Grönqvist et al. (*forthcoming*) demonstrate that labour market outcomes for children of both sexes are equally and strongly related to the skills of both mothers and fathers.

Meanwhile there is growing evidence suggesting that gender norms transmitted from parents affect the labour market preferences of individuals. In accordance with the remarkable persistence in gender attitudes within cultures as demonstrated in Alesina et al. (2013), several papers find evidence that parents' gender attitudes are related to women's labour supply (Blau et al., 2013; Fernández et al., 2004; Fernández and Fogli, 2009; Johnston et al., 2014). These inherited or transmitted stereotypes generate positive same-sex associations in education and occupation choices across generations and, consequently, the remaining gender gaps in field choices may be highly persistent. Even if parents do not deliberately transmit gender stereotypes to the next generation, children may acquire norms by observing gender roles in the household or the surrounding society. Based on the theory of role model identification, Ruef et al. (2003) suggest that role models are typically of the same sex (although the theory of same-sex role modelling extends far beyond the transfer

of stereotypes—or even acquired skills), which may contribute to the dominant same-sex associations in the intergenerational literature.

3. DATA, SAMPLE AND DESCRIPTIVES

We exploit the detailed nature of the Danish administrative registers to collect information on actual education and labour market behaviour of the parents of entire population cohorts. From the birth registers, we identify all 1,133,658 children (cohort members) in Denmark born in 1970–1986. We further restrict the estimation sample to individuals for whom we can identify parents and parental country of origin. To obtain a homogenous sample of young adults and avoid e.g. integration aspects, we focus on children whose parents are both of Danish ancestry, i.e. where both parents are born in Denmark and Danish citizens. Further, educational outcomes for the parent generation are generally more unreliable and to a larger extent missing for immigrants. This leaves 949,862 observations, see Table 1.

Table 1: Sample overview

	Observations		Per cent
Individuals born of Danish ancestry 1970–1986 with matched parents	949,862		100.0%
First choice BA at or before age 28	312,741		32.9%
Sons	123,708	39.6%	
Daughters	189,033	60.4%	
Completed a BA at or before age 28[a)]	256,372		27.0%
Sons	97,619	38.1%	
Daughters	158,753	61.9%	

Notes. Summary educational statistics of cohort members in the estimation samples. First choice BA is defined as the first enrolment choice if that was at a BA level, not conditional on completion.
[a)] Information on the gender composition of the program in the year of enrolment is missing for 3,983 observations (1.5% of the BA sample) due to newly established or periodic educational fields. Consequently, the BA estimation sample includes 256,372 observations in total.

Our main analyses are based on individuals obtaining at least a Bachelor's degree (BA) at age 28. This cut-off should leave plenty of time to finish a BA even including a couple of gap years, which are common for Danish students (Humlum, 2007); compulsory school

is generally completed at age 15. A three-year high school education (or alternatively two-year plus grade 10) qualifies for admission in most BA programmes. Table 1 shows that 27% of cohort members obtain at least a BA at or before age 28. As in most Western countries, female graduates dominate the BA programmes, although with large differences across fields: 62% of the individuals obtaining a Bachelor's degree are female. Table 1 also includes information on an alternative sample based on cohort members' first enrolment in a BA education. First choice of enrolment likely reflects educational preferences with less consideration of the individual's skill level. Therefore, we include first enrolment in a BA programme without conditioning on completion in our supplemental analyses.

3.1. Measuring gender-stereotypical education and labour market choices

We measure gender-stereotypical education choice for cohort members, FF_i, as the share of female graduates in the education programme (a similar measure is used by Antecol and Cobb-Clark, 2013, and Eriksson, 2015) in the year the individual enrolled in the education programme. Thus, our outcome variable depicts the gender composition of the educational programme as observed by the individual when he or she applied to higher education.[2]

The key explanatory variables are measures of the gender-stereotypical norms of the father and the mother or the parents taken together. Since we use register data, we do not have access to survey questionnaire responses on norms or attitudes. Instead, we use three alternative measures as proxies for stereotyping norms.

[2] Several papers study transmissions of self-reported gender roles or self-stereotyping using surveys and retrospective questionnaires (for example, Johnston et al., 2014). However, survey measures of self-reported gender roles and self-stereotyping may suffer from different types of measurement problems. In particular, the respondent may not answer truthfully if gender norms and identity are considered a controversial area (Eriksson et al., 2016). Therefore, the degree to which children would pick up or respond to these self-reported measures is uncertain.

The first measure is parents' gender-stereotypical education choice which is defined as the share of female graduates obtaining the parent's degree at age 30 of the parents, not restricting the level of the highest attained degree (i.e. we also include compulsory school or vocational training).[3] If parents did not obtain a formal education, the fraction of females in the highest attained general education level (compulsory school or high school) is applied (Appendix Figure A.1 describes the distribution of parents' gender stereotypical education choice).

Our second measure of parents' gender-stereotypical norms is the mother's share of household earnings, as inspired by the behavioural prescription examined in Bertrand et al. (2015): "a man should earn more than his wife". We define mother's share of household earnings as $HHshareMom_i = EarningsMom_i/(EarningsMom_i+EarningsDad_i)$. Traditional gender norms would prescribe the father's status as breadwinner, and thus we would expect sons (daughters) to select into relatively more male-(female-) dominated fields the lower the $HHshareMom_i$. We use the term household casually, as we do not condition on parents living together. Where both parents have zero earnings, we set $HHshareMom_i = 0$ and define a dummy for zero total household earnings (see Appendix Figure A.2).

However, a large ratio of maternal to paternal earnings may both reflect that the mother is highly career-oriented (or at least successful in generating earnings) and that the father is not a high-income earner. These two explanations may have different implications if children predominantly reflect the behaviour of the same-sex parent as hinted previously. Thus, our third measure attempts to capture parental career ambitions individually as expressed in earnings deviations from their respective demographic groups (see Bertrand et al., 2015). For each individual *i*, we construct the potential earnings of both parents

[3] Year of enrolment and graduation is incomplete before 1971, thus, we match the share of female graduates in the year the parent turns 30 to the highest attained education for parents when their son or daughter is 15 years old.

($PotentialMom_i$ and $PotentialDad_i$) as the mean of the earnings of working individuals in the mother's or father's demographic group. We assign demographic groups based on gender, a five-year age interval (due to incomplete information on graduation year, we are unable to use experience intervals) and education programme. We calculate deviations from potential (deflated) earnings for mothers and fathers at child age 15 as $EarningsGapParent_i = (EarningsParent_i - PotentialParent_i)/PotentialParent_i$, for $Parent_i = \{mom, dad\}$.

Table 2: Gender attitude measures for sons and daughters and their parents

	Sons		Daughters	
Variables	Mean	SD	Mean	SD
Outcome variable				
Fraction female in BA education	0.424	0.243	0.709	0.208
Parental gender attitude variables				
Fraction female in mother's education	0.666	0.197	0.665	0.195
Fraction female in father's education	0.331	0.267	0.324	0.269
Mother's share of household earnings	0.416	0.271	0.423	0.277
Mother earns more than 50% of household earnings	0.252		0.263	
Mother's earnings gap	-0.107	0.487	-0.116	0.482
Father's earnings gap	-0.055	0.594	-0.083	0.586
Total observations	97,619		158,753	

Notes. Sample includes individuals of Danish ancestry born in 1970–1986 with at least a BA at age 28. Observations with missing information are excluded from the table unless otherwise indicated.

Table 2 summarises the sample means of the various gender attitude measures. We note a marked difference in the gender compositions of sons' and daughters' BA programmes; on average, sons graduate in fields with almost 30 percentage points less females compared to daughters. The gender compositions of mothers' and fathers' obtained education are very similar for sons and daughters, however, there are slight differences in the mothers' share of household earnings and the fathers' earnings gap.

3.2. Control variables

We include a wide range of controls observed to capture cohort, region or family characteristics that may jointly affect parental labour market behaviour and cohort-member educational behaviour, see Table 3. Family and parental controls are measured at age 15 of the child, which coincides with the end of compulsory education and, thus, the beginning of tracking in the Danish education system.[4]

Specifically, our vector of control variables includes the individual's high school GPA to control for ability that is potentially correlated with both parental abilities and future labour market behaviour for the cohort member. The decision to attend high school is in itself likely based on future educational expectations and is as such not exogenous. It is, however a prerequisite for enrolling in most BA programmes.[5] We further control for parental educational attainment (compulsory, high school, vocational and higher education), log earnings, mother's and father's work hours (outside labour market, part-time or full-time), whether a parent died between age 15 and year of entry in tertiary education, number of siblings (children of the same mother) and older siblings of the same and opposite sex. In addition, we add a full set of indicators for year of birth, mother's and father's year of birth and residential municipality (at age 15). Specifically, birth year fixed effects for children and parents capture the general rise in the ratio of female to male BA graduates across years.

[4] Although, parental characteristics at age 15 may in part reflect behavioural response to the child itself, for our purpose we prefer to use the later measures to capture the household norms at the age when the child faces the first actual educational choices and already has developed an autonomous 'persona' presumably reflected in the parents' behaviour. For example, Burt and Scott (2002) confirm that gender role attitudes extend back into early adolescence. Furthermore, using age 15 instead of a younger age (e.g. age 5) allows us to obtain a larger sample. Sensitivity checks using variables measured at age 5 (i.e. cohorts born in 1975–1986) yield very similar results.

[5] The older high school registers are limited to two types of general high schools (STX and HF), with single-course HF included from 1992 and technical (HTX) and business (HHX) high schools from 2001 onwards. Further, only passed GPAs (above 5.5, equivalent to D by US standards) are recorded. Overall, high school GPA is therefore missing for a relatively large fraction of individuals (15%). Where information on non-primary individual controls is missing, a dummy variable adjustment approach is used.

Table 3: Sample descriptives

	Sons		Daughters	
Control variables	Mean	SD	Mean	SD
Birthweight < 2500	0.037		0.046	
Born in first quarter	0.258		0.254	
—second quarter	0.276		0.274	
—third quarter	0.250		0.253	
—fourth quarter	0.215		0.219	
Firstborn	0.476		0.468	
Multiple born	0.021		0.020	
No. of siblings (by mother)	1.411	0.853	1.432	0.875
No. of older brothers	0.357	0.596	0.364	0.605
No. of older sisters	0.335	0.578	0.348	0.588
High school GPA	8.584	0.923	8.429	0.930
Parents (child age 15)				
Mother's logearnings	10.81	3.856	10.70	3.925
Mother zero earnings	0.109		0.115	
Mother outside labour force	0.119		0.121	
Mother working part-time	0.210		0.200	
Mother working full-time	0.671		0.679	
Mother's age	43.06	4.373	42.69	4.461
Parents separated	0.122		0.130	
Father's logearnings	10.97	4.260	10.74	4.421
Father zero earnings	0.126		0.140	
Father outside labour force	0.159		0.166	
Father working part-time	0.017		0.016	
Father working full-time	0.824		0.817	
Father's age	45.43	5.047	45.21	5.109
Mother's education:				
—None/missing	0.020		0.019	
—Max. high school	0.216		0.262	
—Vocational	0.306		0.330	
—Higher	0.457		0.388	
Father's education:				
—None/missing	0.035		0.038	
—Max. high school	0.177		0.215	
—Vocational	0.338		0.394	
—Higher	0.450		0.353	
Total observations	97,619		158,753	

Notes. Sample includes individuals of Danish ancestry born in 1970–1986 with at least a BA at age 28. Observations with missing information are excluded from the table unless otherwise indicated

Not surprisingly, in the light of the considerable overweight of women in the BA programmes, Table 3 reveals that males in the sample are on average of slightly higher 'quality' than females: better high school GPAs, higher earnings as well as more highly educated parents.

4. EMPIRICAL METHODOLOGY

We are interested in the important role that parents play in determining their children's education choices and specifically how social norms may be transferred from parents to children. This is a challenging undertaking since the transmission of social norms and associated stereotypes are not readily quantifiable. Consequently, we take a more indirect approach and begin by estimating the intergenerational correlation in gender-stereotypical choice of education. The transmission of social norms and in particular gender norms is one of several possible channels through which educational and occupational gender segregation persist across generations.

To estimate the intergenerational correlation in gender-stereotypical choice of education, we specify the following reduced form model for individual *i*

$$FF_i = \alpha_0 + \alpha_1 FFmom_i + \alpha_2 FFdad_i + \alpha_3 X_i + u_i, \quad (1)$$

where the outcome *FF* denotes measures of gender-stereotypical choice of education for sons and daughters. *FFmom* and *FFdad* denote measures of parental gender norms, which we operationalise via alternative register data measures, in particular, gender-stereotypical choice of education for parents (see Table 2). X_i are child and family characteristics presented in Section 3.2 and u_i is the error term. The coefficients α_1 and α_2 reflect the mother–child and the father–child intergenerational correlations in female-dominated educational choices, respectively. Other transmissions affecting educational preferences,

e.g. from peers and siblings, and other kinds of parental transfers not captured by the share of female graduates in the field of study or in the controls in X_i will be contained in u_i. The results from eq. (1) are partial correlations rather than causal effects and should only be interpreted as such.

Choice of educational field is considered a major determinant of labour market success in adulthood, but—as previously discussed—this choice likely reflects more immediate preferences and self-image of the individual compared to later labour market outcomes (Oguzoglu and Ozbeklik, 2016). We therefore use education choice characteristics as our main outcome variable, but we can easily adjust the framework above to analyses of our other measures of gender-stereotypical choices.

The first step in our analysis is to test the hypothesis that parents' education choices affect the education choices of their children and, thus, whether α_1 and α_2 differ significantly from zero. Acknowledging that determinants for education choice and that the influence of gender stereotypes potentially operate through different channels for sons and daughters (Blau et al., 2013; Johnston et al., 2014), we proceed by estimating eq. (1) separately by gender.

The intergenerational correlation in our measure of stereotypical education choice likely picks up a range of factors related to the share of female graduates across generations other than gender norms, for example inherited and acquired comparative advantages in certain skills.

5. RESULTS

The empirical analysis first considers the intergenerational correlation in gender-stereotypical education choice, focuses second on differential patterns by family structure and sibling composition to lure out potential channels, and third on alternative measures of gender-stereotypical choices in parental labour market behaviour.

5.1. Intergenerational correlation in gender-stereotypical choice of education

We begin by documenting the size of the correlation between the share of females in parents' education and the share of females in their daughters' and sons' choice of education. We refer to this as the intergenerational correlation in gender-stereotypical (or female-dominated) choice of education. To establish a baseline, we report the estimated coefficients from eq. (1) with a full set of controls in Table 4 (see Appendix Table A.1 for the full estimation results).[6]

Table 4: Determinants of gender-stereotypical education choice: Baseline

	(1)		(2)		(3)	
Dependent variable:	All, baseline		Sons, baseline		Daughters, baseline	
Fraction female	Coeff.	SE	Coeff.	SE	Coeff.	SE
Daughter	0.270 ***	(0.005)				
Frac female, mother's educ	0.028 ***	(0.003)	-0.004	(0.004)	0.054 ***	(0.005)
Frac female, father's educ	0.039 ***	(0.002)	0.084 ***	(0.004)	0.013 ***	(0.003)
High school GPA	-0.047 ***	(0.001)	-0.018 ***	(0.002)	-0.064 ***	(0.002)
Observations	227,042		86,297		140,745	
R-squared	0.323		0.067		0.121	
Birth year & region indicators	YES		YES		YES	
Covariates	YES		YES		YES	

Notes. Samples include individuals of Danish ancestry born in 1970–1986 with at least a BA at age 28. Estimates obtained by OLS regression. See Table 3 for a full list of covariates. Standard errors corrected for clustering within birth year in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Not surprisingly, daughters are more likely to enter female-dominated fields of study than sons. Conditioning on the full set of controls, daughters select into fields with a 27-percentage points greater share of female graduates in the year of enrolment. This coefficient is very similar to that found by Antecol and Cobb-Clark (2013), who further condition on self-reported psychosocial characteristics to estimate a gender gap of 22 percentage points. This difference in preferences is driven neither by demographic and

[6] We do not include fixed effects for parental field of study in our regressions with the shares of female graduates in parents' education as the primary regressors. Were we to condition on parental educational field, the intergenerational correlations would be identified only by the variation in the share of females to obtain a certain degree over time, which is undesirable if educational gender stereotypes are sticky. Including fixed effects for 11 broad educational fields does not change our findings, although it does to some extent affect the magnitude of the correlation coefficients.

socioeconomic characteristics nor by human capital as captured by high school GPA. Although we cannot rule out discrimination before education completion, it seems likely that this gender segregation at least in part reflects different preferences for educational (and later occupational) characteristics. As expected, the coefficient on high school GPA in Table 4 is negative meaning that higher-ability individuals sort into less female-dominated fields.

The results in Table 4, columns (2) and (3), establish significant and positive intergenerational correlations in female-dominated choice of education, although the same-sex parent correlations dominate. Roughly speaking, a 10-percentage point increase in share of females in father's education increases the share of females in the son's education by 0.9 percentage points, although, in terms of standard deviations the size of the correlation is modest. The correlation is lower along the female (mother–daughter) dimension but from a markedly higher baseline. Also for daughters, there is a significant and positive correlation with share of females in father's education, although, it is only one quarter the size of the correlation with the mother's educational characteristics. [7, 8]

In order to relate these intergenerational transfers to general and specific human capital accumulation, Table 5 presents the same correlations using different controls or samples: Columns (1) and (2) exclude high school GPA as a control variable; columns (3) and (4) restrict the sample to children obtaining a high school GPA grade above 10 (top five per

[7] One might hypothesise that the correlations in gender compositions are particularly strong in the tails due to stronger transmission of gender stereotypes, i.e. for fathers and mothers who have chosen an education that is either very gender-stereotypical or not at all. Our findings suggest that same-sex correlations are largest when fathers and mothers have a very male-dominated education. The results are available on request from the authors.

[8] In a number of auxiliary estimations, we have tested alternative models and used different subsamples of children. Instead of children completing a BA degree using the completed type of education as the measure of educational choice, we have used the sample of children who enrolled at a BA as a first choice of education. First choice might reflect gender attitudes better than completed education. The results are available on request from the authors and do not deviate notably from the results in Table 4.

cent in the distribution); and columns (5) and (6) restrict the sample to children who do not graduate from the same or a similar program as one or both of their parents.

The intergenerational same-sex correlations in female-dominated education choice are significantly higher when excluding high school GPA, although markedly more for daughters. In line with our earlier reasoning, we expect that the intergenerational correlation further picks up inherited and acquired cognitive skills. To the extent that children's high school GPA captures such general skill transfers, conditioning on GPA leads to an estimate of the intergenerational correlation net of these types of transfers. On the other hand, high school GPA is potentially affected by parental gender attitudes, for example, a mother with traditional gender attitudes may raise her daughter to be less ambitious which may be reflected in a lower high school GPA. The negative coefficients on GPA in Table 4 suggest that individuals who are more able graduate in less female-dominated fields. The coefficient is three times larger for daughters than for sons (albeit the difference is potentially caused by selection into our sample), thus, in particular high-ability daughters seem to endeavour to enter less female-dominated fields.

Table 5: Determinants of gender-stereotypical education choice: Channels of general and specific skill transfers

Dependent variable:	No GPA control		GPA > 10, (top 5 pct.)		Not same education as parents	
Fraction female	(1)	(2)	(3)	(4)	(5)	(6)
	Sons	Daughters	Sons	Daughters	Sons	Daughters
Frac female, mother's educ	-0.002	0.081***	0.004	0.044***	0.000	0.028***
	(0.004)	(0.006)	(0.016)	(0.018)	(0.004)	(0.005)
Frac female, father's educ	0.088***	0.008***	0.052***	0.042**	0.058***	0.009*
	(0.004)	(0.002)	(0.014)	(0.055)	(0.004)	(0.003)
Observations	86,297	140,745	4,651	5,817	82,587	132,210
R-squared	0.040	0.054	0.104	0.104	0.063	0.119
Birth year & region FE	YES	YES	YES	YES	YES	YES
Covariates	YES	YES	YES	YES	YES	YES

Notes. Estimates obtained by OLS regression. See Table 3 for a full list of included covariates (high school GPA excluded in columns (1) and (2)). Columns (3) and (4) use the subsamples of children who graduate with a GPA above 10, and columns (5) and (6) use the subsample of children who do not graduate with the same education as their parents. Standard errors corrected for clustering within birth year in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

For the highly selected group of students with a GPA in the top 5 percentile (columns (3) and (4) in Table 5), we find similar same-sex patterns as for the full sample of BA students, i.e. the correlations between mothers and daughters and fathers and sons are significantly positive albeit lower than in the full sample. Highly able daughters reflect the behaviour of their mothers and fathers equally.[9]

In addition to general human capital transfers, transmissions of specific human capital may add to the intergenerational correlations in educational preferences. To render probable that transfers of education-specific human capital and information are not driving our results, we estimate the model excluding children who graduate from the same or a similar programme as one or both of their parents (see columns (5) and (6) in Table 5). The correlation coefficients decrease in magnitude but remain positive and statistically significant.[10] We interpret this as evidence that transfers of education- or occupation-specific human capital drive a smaller part but not all of the same-sex correlations in female-dominated educational choice across generations.

In summary, Tables 4–5 present evidence that sons and daughters mirror the education choice of particularly their same-sex parent when choosing field of study.[11] More able women are less likely to choose a female-dominated (gender-stereotypical) education and are less (more) influenced by their mother (father). Men, on the other hand, are much less sensitive to ability level and reflect the behaviour of their fathers only. We note that

[9] Supplemental analyses on an alternative sample for which detailed information about subject-specific grades is available to us suggest that only fathers influence girls with very high math skills. Further, better high school grades in Danish actually increase the fraction of females in men's education, while decreasing it for women. For both genders, better grades in high-level math reduce the probability of choosing a female-dominated education.

[10] Eriksson (2015) presents correlation estimates from specifications excluding observations where children to a varying degree have the same occupation as one of their parents for Swedish cohorts born in 1943-1952. Her findings are consistent with ours.

[11] Johnston et al. (2014) present mother-daughter correlations in gender role attitudes of 0.09 SD (mother-son correlations are similar though labour market outcomes for sons appear unaffected, and gender role attitudes are only measured for mothers). Black and Devereux (2011) survey intergenerational correlations for other labour market outcomes, in particular noting stronger father-son correlations in earnings than the corresponding father-daughter associations. Eriksson (2015) documents similar correlations for share of females in occupation.

although the estimated correlations are significant and positive, the correlation sizes are modest and the explanatory power of female-dominated education choice for parents is small compared to for example high school GPA (for daughters only). Overall, the results from specifications to assess the importance of transfers of general and specific human capital are in line with our ex-ante expectations.

In particular, the presence of gender-specific transfers across generations is interesting in the light of the recent findings of Grönqvist et al. (*forthcoming*), who demonstrate that for Swedish youths born around 1980 the cognitive and non-cognitive skill transmissions from mothers and fathers are equally strong for children of both sexes. Adding our insights, these results suggest that children inherit (acquire) skills from both parents while their labour market behaviour mainly reflects that of the same-sex parent. This is consistent with the evidence presented in Johnston et al. (2014) that both sons and daughters hold the gender attitudes of their mothers although these are reflected only in the labour market behaviour of the daughters.

5.2. Intensity of contact: Family structure and birth order

In this section, we make use of the detailed nature of the data to investigate whether intensity of contact with the parents in terms of varying family structures and sibling compositions affects the size of the intergenerational correlation in gender-stereotypical education choice. If more intense contact with the parents increases the estimated correlations, it is indicative evidence that acquired norms from parents during childhood take part in determining the educational choices of the children. In other words, if transmissions from a parent—other than biological endowments—are important in shaping the educational preferences of children, we would expect that the intergenerational

correlations in educational characteristics are increasing with the intensity of parental presence and time allocation during childhood.[12]

First, we use information on family structure as a proxy for parental presence during childhood. Information on where the child lives if parents are divorced along with information on new spouses are available in detail from 1990 and onwards, thus covering cohorts born in 1975–1986 at age 15. Columns (1)–(5) and columns (6)–(10) in Table 6 present the results for sons and daughters, respectively. Columns (1) and (6) present the correlation coefficients for individuals living with both parents at age 15, comprising the majority of the sample. These correlations are very similar to the baseline in Table 3. The correlation coefficients remain unchanged for children living only with their same-sex parent or their same-sex parent and a new partner (columns (4)–(5) for sons and (7)–(8) for daughters).[13] Interestingly, when sons live with their mothers alone, the coefficient on the share of females in their mothers' education increases and becomes marginally significant. The influence of the father remains unchanged (column (2)). When the mother finds a new partner (column (3)), her influence disappears and the father's decrease as well, though the correlation with the education choice of the new spouse is not significant. Although less convincing due to severely limited sample sizes, the intergenerational correlations for daughters living with their fathers exhibit the same pattern.

These differential patterns are in line with our expectations if educational preferences are indeed affected by parental transmissions during childhood. In the absence of the same-sex parent, the opposite-sex correlations increase. The pattern blurs somewhat when the

[12] We further attempted to separate out (some) biological determinants by exploiting information of adopted individuals to establish whether the intergenerational correlations are lower for adoptive children. Unfortunately, adoptive registers for this sample do not include year nor type of adoption, which complicates the identification of biological/adoptive parents as for example stepparents may adopt individuals well into adulthood. Nonetheless, the adoption sample is relatively small (around 1,500 individuals) resulting in very imprecisely estimated intergenerational correlations of gender-stereotypical education choice.

[13] Individuals living with their mother because their father died and vice versa are excluded from the samples. Due to small sample sizes, estimations on subsamples in which parents have died from external causes do not add much information to our analysis and are therefore omitted here.

parent finds a new partner; for sons the influence of both parents is reduced, for daughters it is larger in magnitude but insignificant. However, it is important to stress that child custody decisions are not random as further indicated by the large discrepancies in the numbers of children living with their mother versus father in case of a divorce. One may therefore easily construct selection-based explanations with the same hypothesised outcomes; for example, families in which fathers gain physical custody of the children probably have untraditional family norms.

Secondly, we use information on birth order and sibling sex composition as proxies for intensity of contact. A firstborn child (multiple born excluded) will necessarily have enjoyed a period of "undivided" attention from its parents, and so we might expect that the associations are stronger for firstborns if the parental transmissions captured by gender-stereotypical education choice indeed contribute to forming children's educational preferences. Relatedly, there is evidence that parents generally invest more in their firstborns (e.g. Averett et al., 2011; Lehmann et al., 2016).

To quantify the influence of birth order on the parental transmissions for children's educational choice, we estimate the following model (again separately for men and women):

$$FF_i = \beta_0 + \beta_1 FFmom_i + \beta_2 FFdad_i + \beta_3 Firstborn_i + \beta_4 FFmom_i \times Firstborn_i + \beta_5 FFdad_i \times Firstborn_i + \beta_6 X_i + v_i, \quad (2)$$

where β_4 and β_5 depict the differential responsiveness of firstborns compared to later-borns of the same sex to transfers from their mothers and fathers, respectively. For example, when estimating eq. (2) for women, β_4 denotes the differential influence of mother's transmissions on daughters born as the first child compared to daughters born as the

second or third child. Eq. (2) does not include family fixed effects so we do not compare daughters within families initially.

Columns (1) and (5) in Table 7 present the intergenerational correlation coefficients by birth order as estimated by eq. (2) for sons and daughters from families with two or more children (all children need not be in the sample), respectively. The intergenerational correlations are slightly higher in these samples compared to the baseline, 0.090 ($p < 0.01$) for father–sons, 0.082 ($p < 0.01$) for mother–daughters and 0.008 ($p < 0.05$) for father–daughters. The mother–son correlation is still insignificant.

In line with the predictions of increased parental investments in firstborns and our previous documentation of a negative relationship between ability and female-dominated education choice, firstborns generally graduate in less female-dominated fields. Importantly, though, the intergenerational correlation in female-dominated education choice is higher in the same-sex dimension only, i.e. mother–firstborn daughter and father–firstborn son. The mother's (father's) educational choice on average influences daughters (sons) who are firstborns relatively more than daughters (sons) who are born second or later.

Table 6. Determinants of gender-stereotypical education choice: Intensity of contact and family structure

Dependent variable: *Fraction female*	(1) Sons, both parents	(2) Sons, only mom	(3) Sons, mom w. new partner	(4) Sons, only dad	(5) Sons, dad w. new partner	(6) Daughters, both parents	(7) Daughters, only mom	(8) Daughters, mom w. new partner	(9) Daughters, only dad	(10) Daughters, dad w. new partner
Frac female, mother's educ	-0.002	0.032*	0.008	-0.012	0.014	0.050***	0.049***	0.053***	0.040*	0.073
	(0.003)	(0.016)	(0.022)	(0.035)	(0.059)	(0.005)	(0.015)	(0.013)	(0.020)	(0.062)
Frac female, father's educ	0.089***	0.087***	0.035***	0.071**	0.068	0.014***	0.013	0.007	0.031	0.046
	(0.005)	(0.013)	(0.010)	(0.025)	(0.039)	(0.004)	(0.008)	(0.009)	(0.024)	(0.026)
Frac female, new partner			0.021		-0.017			-0.003		-0.056
			(0.016)		(0.072)			(0.006)		(0.037)
Mean dependent variable	0.433	0.458	0.466	0.456	0.454	0.706	0.715	0.730	0.712	0.713
Observations	52,801	5,657	3,142	1,185	740	86,209	10,667	6,822	1,441	864
R-squared	0.065	0.101	0.143	0.286	0.412	0.121	0.148	0.171	0.307	0.466
Birth year & region FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Covariates	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes. Column headers denote samples, cohorts 1975–1986 only. Estimates obtained by OLS regression. See Table 3 for a full list of included covariates. Standard errors corrected for clustering within birth year in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Determinants of gender-stereotypical education choice: Intensity of contact, birth order and sibling composition

	Sons				Daughters				Both sexes	
	(1) 2+ families	(2) Matched brothers OLS	(3) Matched brothers FE	(4) Matched brothers FE	(5) 2+ families	(6) Matched sisters OLS	(7) Matched sisters FE	(8) Matched sisters FE	(9) Matched siblings OLS	(10) Matched siblings FE
Female									0.229***	0.205***
									(0.006)	(0.008)
Frac female, mother's educ	-0.006	0.005	0.066	0.063	0.047***	0.040***	-0.003	-0.005	-0.013**	-0.069***
	(0.006)	(0.012)	(0.073)	(0.073)	(0.005)	(0.008)	(0.049)	(0.049)	(0.006)	(0.022)
Frac female, father's educ	0.077***	0.082***	0.045	0.047	0.012***	0.017***	-0.063	-0.060	0.095***	0.039
	(0.005)	(0.009)	(0.138)	(0.138)	(0.004)	(0.006)	(0.077)	(0.077)	(0.005)	(0.055)
Firstborn	-0.019**	-0.012	-0.021		-0.021***	-0.036***	-0.033***			
	(0.007)	(0.013)	(0.014)		(0.005)	(0.009)	(0.010)			
First son/daughter				-0.020				-0.015		
				(0.017)				(0.012)		
Birthorder interactions										
Firstborn × $FFMom$	0.007	0.001	0.014		0.014**	0.030***	0.027**			
	(0.008)	(0.016)	(0.017)		(0.005)	(0.011)	(0.012)			
Firstborn × $FFDad$	0.018***	0.008	0.006		0.001	0.001	-0.004			
	(0.006)	(0.013)	(0.013)		(0.004)	(0.008)	(0.009)			
First of each sex × $FFMom$				0.021				0.029***		
				(0.016)				(0.011)		
First of each sex × $FFDad$				0.001				-0.007		
				(0.013)				(0.008)		
Gender interactions										
Female × $FFMom$									0.069***	0.084***
									(0.008)	(0.0010)
Female × $FFDad$									-0.077***	-0.073***
									(0.006)	(0.008)
Observations	79,139	17,792	17,792	17,792	129,218	32,911	32,911	32,911	87,897	87,897
R-squared	0.069	0.092			0.122	0.133			0.309	
Birth year & region indicators	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Covariates	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Within-family fixed effects	NO	NO	YES	YES	NO	NO	YES	YES	NO	YES

Notes. Estimates obtained by OLS and FE regressions. Column headers denote samples. Selected variables are shown; see Table 3 for a full list of included covariates. Matched siblings denotes the subsample of children who have at least one sibling from the same mother in the BA estimation sample. Matched brothers and sisters, respectively, denotes the subsamples of matched same-sex siblings. Cluster-robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Columns (1) and (5) correct for clustering within birth year, remaining columns cluster within families.

In an attempt to address family-specific factors that directly affect children's latent outcomes, for example shared genetics, columns (3) and (6) consider the differential responsiveness by birth order to parental transmissions within families.[14] The coefficients on the share of females in parents' education are identified only by variation in these measures between siblings at age 15. Because there is little variation in attained parental education between adolescent siblings, these are both imprecisely determined and difficult to interpret. The coefficients on the interaction terms are, however, determined as the differential influence of e.g. mother's educational characteristics on firstborns *relative* to later-born siblings of the same sex. Here, the father's differential influence on firstborn sons relative to later-born sons disappears, although estimating eq. (2) on the subsample of matched brothers suggests that the decrease is driven by selection into this sample (column (2)). The point estimate of the differential influence of mothers' education on firstborn daughters roughly doubles. For completeness, columns (4) and (8) include an indicator for being the firstborn of your sex instead of being firstborn among both sexes. This yields very similar results. We find evidence that in particular mothers' educational preferences are transmitted to the firstborn daughters.[15]

By using information on birth order, we have—at least to some extent—eliminated biological transfers as a confounding factor in our estimates of the intergenerational correlation. The observed difference in intergenerational correlations by birth order suggests that alternative mechanisms are at play. Furthermore, the intergenerational correlations are higher for firstborns (or the first child of either sex). These results are

[14] This approach is inspired by Autor et al. (2015) who analyse the SES gradient in the gender gap between siblings.

[15] Autor et al. (2015) argue that gaps in neonatal health may act as proxies for the gaps in latent outcomes between children. For example, Black et al. (2007) and Lesner (2016) show that birthweight is a strong predictor for later labour-market outcomes. In estimations not shown here but available from the authors, we show that the birth order and gender gap in birthweight is insignificantly related to our measures of parents' gender-stereotypical education choice, suggesting that differential in utero investments across birth order or sex is unrelated to parents' stereotypical education choice. The same-sex differential pattern between first- and later-borns are therefore likely to arise from post-natal transmissions.

consistent with e.g. younger sisters identifying with older sisters rather than their mother, which would lower the extent of maternal influence on later-borns. Alternatively, maternal investments may be particularly strong for their firstborn daughters.

Sibling sex composition has been associated with parental educational investments of particularly daughters. For example, Oguzoglu and Ozbeklik (2016) propose that in the absence of a son, fathers may choose to invest in (one of) their daughters; that the presence of siblings of the opposite sex may reinforce gender roles (alternatively, reduce these if siblings mirror each other); or lastly, assuming that paternal investments are rival goods, that daughters being more adverse to competition are discouraged from paternal investments in the presence of sons. Empirically, Oguzoglu and Ozbeklik (2016) demonstrate that having a brother significantly lowers the probability of women choosing STEM majors when the father is in a STEM occupation relative to when he is not.

We hypothesise that transfers of parental norms and attitudes are rival goods to a much lower extent than for example skill transfers, as norms and attitudes may be transferred without one-to-one parent-child interactions. Auxiliary analyses suggest that same-sex sibling rivalry is not an important factor in our estimated intergenerational correlations. Having any brother(s) (sisters) does not significantly affect the intergenerational correlations in female-dominated education for sons (daughters) compared to when only opposite-sex children are in the family, although in accordance with the birth-order correlations presented in Table 7 the presence of older same-sex sibling(s) decreases the same-sex intergenerational correlations in female-dominated education choice. We find marginal evidence that the presence of a sister decreases the intergenerational transmission from mothers to sons, which is consistent with mothers preferring daughters to sons. However, unlike Oguzoglu and Ozbeklik (2016), we do not find evidence that the presence

of sons lowers the educational transmission from fathers to daughters (results are available on request).[16]

Next, we use the within-family variation in sibling sex composition to reduce the influence from family-specific confounding factors in the transfer of educational preferences. In the spirit of Autor et al. (2015), we estimate the intergenerational transmission of female-dominated education choice for sisters relative to brothers within families. Again, due to little variance in highest obtained education of parents across siblings one should not pay too much attention to the estimated level correlation coefficients. Columns (9) and (10) in Table 7 present results from linear regression and including parental fixed effects, respectively, on the sample of matched siblings. In both specifications, we add a female indicator as well as interactions between the female indicator and the share of female graduates in both parents' education to the full set of covariates in Table 3.[17]

Even when including parental fixed effects in column (10), female cohort members on average choose educational fields that are 20-some percentage points more female-dominated. A higher share of female graduates in mothers' education increases the share of females in her daughter's education relative to her son's. Consequently, having a mother or a father with a more gender-stereotypical education choice contributes to a larger gender

[16] Differential fertility patterns for parents on the range of female-dominated education programmes potentially explain these results. For example, the difference in father–daughter correlation estimates when a brother is present compared to when not is attenuated if fathers with strong male identities are more likely to continue having children until they father a boy. Evidence from supplementary analyses on parents of 2+-children families with at least one child born in 1970–1986 suggests that once controlling for parental education level, log earnings and birth year fixed effects, the probability of having boys is on average not significantly related to share of females in either parents' education.

[17] In supplementary analyses not shown here, we have used information on birthweight. The gender gap in birthweight is generally unrelated to parental gender-stereotypical labour market behaviour. These differential effects likely arise from post-natal influences: Differential sensitivity of boys versus girls to transmissions from mothers and fathers and/or differential parental investments in boys versus girls. Still, our analyses have not addressed that neighbourhoods and school environments may vary with parental gender attitudes.

gap between the daughters' and sons' educational choices, whereas less gender-stereotypical parental education reduces the gender gap in siblings' educational choices.

Consistent with our ex ante hypothesis of gender identity transmissions, the share of females in a mother's education is positively related to the share of females in her daughter's education. Significantly more so than for her sons', and vice versa for the father-children relationships. While this evidence is not entirely conclusive, our analyses document a persistent pattern in education choice across generations that is not only explained by individuals opting for the same education as their parents. Our explorations in this section have largely supported our previous findings while uncovering some interesting channels within families and across sibling compositions, suggesting that intensity of contact is an important factor in intergenerational transmission of gender-stereotypical choices.

5.3. 'A man should earn more than his wife'—the importance of fathers' and mothers' relative earnings

In order to dig deeper into the intergenerational transmission mechanisms of gender attitudes, we use our rich administrative register data sources to mimic the survey question used in many empirical studies on gender norms where respondents are asked to evaluate whether they agree with the statement 'A man should earn more than his wife'. The administrative registers allow us to define a measure that captures whether an individual's actual behaviour reflects this statement. We also construct a variable which indicates whether the parent earns more than 'what might be expected, given his or her education

and demographic group'; i.e. this measure is intended to capture (besides 'luck' and random shocks) unobserved ambitions and abilities of the parents, see Section 3.1.[18]

Columns (1) and (4) of Table 8 present the point estimates of the mother's share of household earnings in regressions of share of females in the education of sons and daughters, respectively, on all control variables in Table 3 and *HHshareMom*. Further, because we are no longer interested in the variation of parents' educational characteristics, we include education fixed effects for both the mother and father (for both parents, we use about a hundred categories of type of education). This means that the correlations between the child's educational choice with respect to fraction females and the mother's share of total household earnings is *conditional* on the type of both father's and mother's education. Thus, the correlations in Table 8 cannot be attributed to 'pure' educational choices alone making it more plausible that the observed correlations to some extent pick up gender norms and attitudes.

[18] Inspired by Fernández and Fogli (2009) and Blau et al. (2013), we also attempt to capture parental gender norms by using information on the source country of second-generation immigrants. In particular, we focus on cultural proxies measured by the fertility rate (the World Bank Indicators) and the ratio of male to female labour force participation rates (International Labour Organization, ILO), relating an increase in either measure to originating from countries with more traditional gender roles. These cultural proxies ideally reflect the aggregate preference and attitude distributions of parents' source countries. Contrary to Fernández and Fogli (2009) and Blau et al. (2012), we do not find significant and robust correlations in cultural proxies. For daughters, there is marginal evidence that a larger male relative to female labour force participation rate in the father's source country increases the share of females in the completed education. These results are available on request from the authors.

Table 8. Determinants of female-dominated field of study. Alternative measures of household gender roles

	(1) Sons	(2) Sons	(3) Sons	(4) Daughters	(5) Daughters	(6) Daughters	(7) Matched siblings FE	(8) Matched siblings FE	(9) Matched siblings FE
Female							0.241***	0.239***	0.235***
							(0.004)	(0.003)	(0.003)
HHshareMom	0.024**			0.010*			0.020		
	(0.008)			(0.006)			(0.016)		
HHshareMom > 0.5		0.003			-0.004**			0.000	
		(0.002)			(0.001)			(0.005)	
Mother's earnings gap			0.001			-0.022***			0.027***
			(0.002)			(0.002)			(0.007)
Father's earnings gap			-0.013***			-0.014***			0.008
			(0.002)			(0.001)			(0.005)
Sibling sex interactions									
Female × $HHshareMom$							-0.006		
							(0.008)		
Female × $\mathbf{1}[HHshareMom > 0.5]$								-0.003	
								(0.005)	
Female × $EarningsGapMom$									-0.029***
									(0.004)
Female × $EarningsGapDad$									-0.012***
									(0.003)
Observations	92,947	92,947	92,708	150,617	150,617	150,237	92,174	92,174	90,802
R-squared	0.087	0.087	0.087	0.130	0.130	0.131			
Birth year & region indicators	YES	YES	YES	YES	YES	YES	YES	YES	YES
Parental education indicators	YES	YES	YES	YES	YES	YES	NO	NO	NO
Within-family fixed effects	NO	NO	NO	NO	NO	NO	YES	YES	YES
Covariates	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes. Estimates obtained by OLS and FE regressions. Selected variables are shown, see Table 3 for a full list of included covariates. Matched siblings denotes the subsample of children who have at least one sibling from the same mother in the BA estimation sample. Cluster-robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Columns (1)–(6) correct for clustering within birth year, remaining columns cluster within families.

In column (1), the coefficient to $HHshareMom_i$ is of the expected sign indicating that the larger share of household earnings brought in by the mother, the less of a male-dominated education her sons graduate. For daughters, the coefficient is also positive, contrary to a priori expectations, but only marginally significant (column (4)). As discussed in Bertrand et al. (2015), gender identity in relative earnings is more plausibly related to the prescription "a husband should earn more than his wife" rather than the actual earnings difference, although children in our setting may not observe the precise earnings difference. Correspondingly, columns (2) and (5) substitute *HHshareMom* with an indicator for mothers earning more than fathers do (*HHshareMom* > 0.5). The coefficients on this indicator reflect our ex-ante expectations for daughters. Daughters of breadwinning mothers obtain a less female-dominated degree (less gender-stereotyped) while sons are largely unaffected by this margin.

Specifications (3) and (6) model educational preferences of children by parental earnings gaps instead. A positive earnings gap indicates that the parent earns more than the potential (mean) earnings in his or her demographic group based on gender, field of study and age range, for example, because of higher career ambition or better skills. If we use the interpretation proposed by Bertrand et al. (2015), a negative (positive) earnings gap for mothers (fathers) reflects gender-stereotypical labour market behaviour and, thus, we should expect negative coefficients of the same-sex parent's variable and—possibly—positive coefficients for the opposite-sex parent. The coefficient on father's earnings gap in column (3) is significantly negative for his sons and the mother–daughter association in column (6) likewise, though slightly larger numerically. Consistent with expectations, there is no significant relationship between mother's earnings gap and son's education choice, but daughters' education choices seem influenced by their fathers' earnings gap as well: within education, fathers earning 10% more than their potential earnings tend to have sons

and daughters who obtain degrees in programmes with 9 percentage points lower share of female graduates.

Columns (7)–(9) present the within-family differential impact of these alternative gender norm measures on daughters' stereotypical education choice relative to sons'. Having a breadwinning mother does not significantly affect the within-family daughter-son gap in female-dominated education choice, whereas having parents who exceed their potential earnings reduces the gap in female-dominated education choice between sisters and brothers. In particular, a 'career-minded' mother reduces this gap by three times as much as a career-minded father. In other words, a mother exhibiting less gender-stereotypical labour market behaviour (although not in relation to her husband's earnings) during her children's adolescence reduces the difference in her daughters' and sons' preferences for female-dominated education programmes.

Thus, conditional on a wide range of covariates, including parents' type of education and individuals' high school GPA, the more successful one's parents are compared to their equals, the less female-dominated is the son's or daughter's choice of education. Our results may point to the same mechanisms as the results concerning children's GPAs, parental educational level and household income level: The more success in the educational system or in the labour market, the lower is the share of females in the education chosen by the individual; and sons predominantly reflect paternal behaviour while daughters are influenced by both parents although more strongly by the mother.

6. CONCLUDING REMARKS

Motivated by a number of recent papers that emphasise and document the role of gender-stereotypical preferences in explaining the remaining gender gaps in the labour market, we investigate the intergenerational correlation in gender-stereotypical education and labour

market choices. We use the share of females in the chosen educational programme to measure children's gender-stereotypical choices.

We find a positive and significant intergenerational correlation of the share of females in education choice. Specifically, we document significant same-sex correlations in the tendency to select into female-dominated educations across generations. Daughters' education choices are more highly correlated with their mothers' behaviour, while sons' education choices are more highly correlated with their fathers' behaviour. The mother–son and father–daughter correlations are generally smaller and in most cases insignificant. Interestingly, the father–son correlations seem strongest, less related to skill level and less sensitive across specifications. Additionally, sons are rarely influenced by the behaviour of the mother; however, this may in part reflect the lower wages in women's fields. Auxiliary analyses suggest that smaller parts of the intergenerational correlations appear to be driven by general and education-specific human capital.

Using information on sibling composition, we analyse in detail how these correlations differ with the intensity of the parent-child relationship. The same-sex intergenerational correlations are generally higher for firstborns than for later-borns.

Our results also indicate that conditional on a wide range of covariates including detailed controls for parents' education, the more successful one's parents are in the labour market compared to their equals, the less female-dominated is the choice of education of the children. Sons predominantly reflect fathers' behaviour while daughters are influenced by both parents although more strongly by the mother. The estimated correlations can result from various transmission mechanisms. While we cannot definitively eliminate any of these channels, our results are consistent with intergenerational transmission of gender stereotypes resulting in sticky gender norms. Specifically, the symmetry of father-son and mother-daughter correlations (and the absence of corresponding opposite-sex correlations)

suggests the presence of gender-specific transfers within families. In comparison, Grönqvist et al. (*forthcoming*), find that the cognitive and non-cognitive skill transmissions from mothers and fathers are equally strong for children of both sexes. Taken together, these results suggest that children inherit skills from *both parents* while their labour market behaviour mainly reflects that of the *same-sex parent*.

Even if the demonstrated intergenerational correlations are driven by skill rather than norm transfers, the dominant same-sex correlations in gender-stereotypical educational choice offer an explanation of why gender gaps remain in labour markets even where women have been part of the labour force for decades and where they have outperformed their male peers with respect to quantity of education. If men and women reflect the choice behaviour of their same-sex parent, horizontal occupational segregation will remain. Changes in job flexibility and other job attributes may facilitate women's entry into more male-dominated occupations and may also play a role for occupational desegregation but more research is needed to determine whether simple changes in labour market conditions in themselves are sufficient to close the gender gap.

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APPENDIX

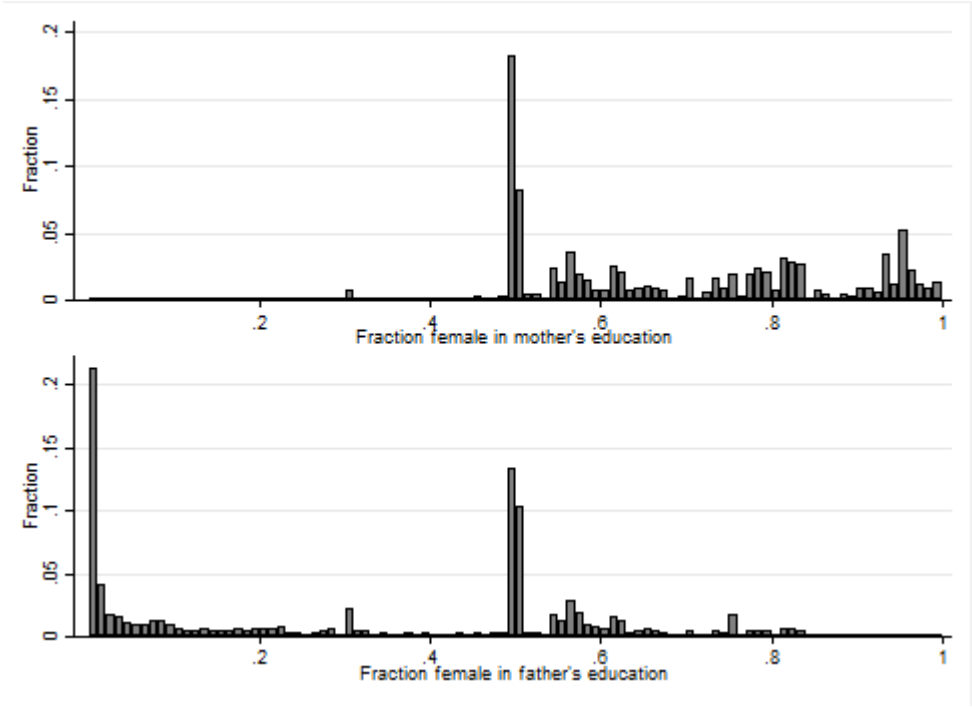

Figure A.1: Distribution of parents' female-dominated education choice in BA sample.
Fraction female in mother's (upper) and father's (lower panel) education is measured as the share of female graduates in their choice of education at age 30.

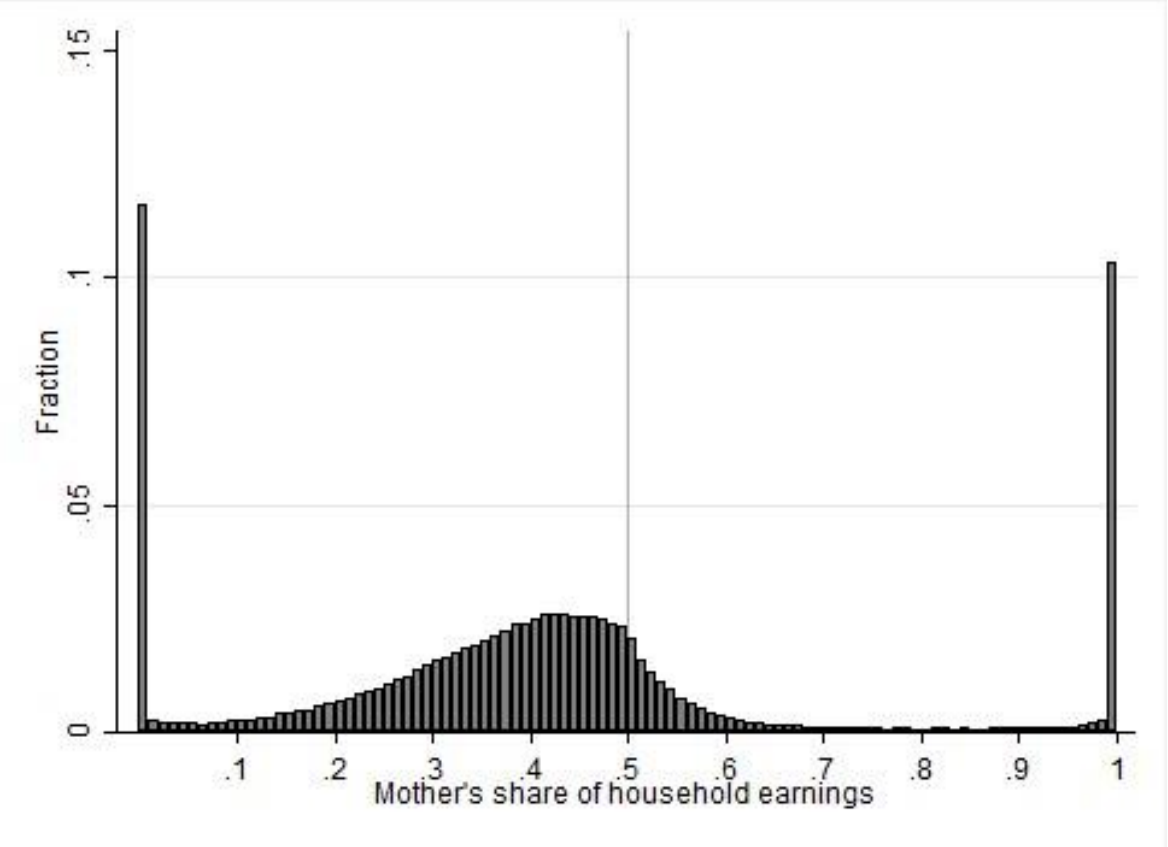

Figure A.2: Distribution of mother's share of household earnings in BA sample.
Strictly negative earnings are excluded, while observations with zero total household earnings are set to zero.

Table A.1: Determinants of female-dominated field of study: fraction female (full OLS regression)

	(1)			(2)		
Outcome: Fraction female in education programme	Sons, baseline			Daughters, baseline		
	Coef.		SE	Coef.		SE
Frac female, mother's educ	-0.004		(0.004)	0.054	***	(0.005)
Frac female, father's educ	0.084	***	(0.004)	0.013	***	(0.003)
High school GPA	-0.018	***	(0.002)	-0.064	***	(0.002)
Born in second quarter	-0.003	*	(0.002)	-0.001		(0.001)
— third quarter	-0.001		(0.002)	-0.003	**	(0.001)
— fourth quarter	0.001		(0.002)	-0.004	**	(0.002)
Low birthweight (< 2500 g)	0.019	***	(0.004)	0.008	**	(0.003)
Firstborn	-0.005		(0.003)	-0.010	***	(0.002)
Multiple born	-0.005		(0.005)	-0.000		(0.005)
No. of siblings (by mother)	-0.005	***	(0.001)	0.001		(0.001)
No. of older sisters	0.012	***	(0.003)	0.006	***	(0.002)
No. of older brothers	0.019	***	(0.003)	0.007	***	(0.002)
Mother's logearnings	-0.002		(0.001)	-0.004	***	(0.001)
Mother zero earnings	-0.020		(0.014)	-0.043	***	(0.009)
Mother works < 30 hrs/week	-0.007	***	(0.002)	0.003	**	(0.001)
Mother outside labour market	-0.011	***	(0.003)	-0.006	**	(0.002)
Mother's age	-0.007	***	(0.000)	-0.001		(0.000)
Mother's education:						
—None/missing	0.007		(0.011)	-0.001		(0.007)
—Vocational	-0.006		(0.003)	-0.017	***	(0.003)
—Higher	0.014	***	(0.004)	-0.024	***	(0.003)
Separated parents	0.015	***	(0.002)	0.006	***	(0.001)
Father's logearnings	-0.007	***	(0.001)	-0.005	***	(0.001)
Father zero earnings	-0.084	***	(0.012)	-0.060	***	(0.007)
Father works < 30 hrs/week	0.008		(0.009)	-0.015	***	(0.003)
Father outside labour force	-0.020	***	(0.004)	-0.012	***	(0.003)
Father's age	-0.011	***	(0.001)	-0.002	***	(0.000)
Father's education:						
—None/missing	-0.024	*	(0.012)	0.002		(0.008)
—Vocational	0.009	***	(0.002)	0.007	***	(0.002)
—Higher	-0.000		(0.003)	-0.021	***	(0.003)
Mother died before BA	0.002		(0.013)	0.026	***	(0.005)
Father died before BA	0.024	***	(0.008)	0.012	***	(0.003)
Constant	1.413	***	(0.051)	1.414	***	(0.034)
Observations	86,297			140,745		
R-squared	0.067			0.121		
Birth year & region FE	YES			YES		

Notes. Samples include individuals of Danish ancestry with at least a BA at age 28; excluded categories are born in the first quarter, mother/father working ≥ 30 hrs/week and mother/father having basic education level. Missing indicators are omitted. Columns (3) and (6) exclude individuals with the same education as either parents. Standard errors corrected for clustering within birth year in parentheses, *** p<0.01, ** p<0.05, * p<0.1