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Gender Gaps in the Effects of Childhood Family Environment: Do They Persist into Adulthood?

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Abstract

We examine the differential effects of family disadvantage on the education and adult labor market outcomes of men and women using high-quality administrative data on the entire population of Denmark born between 1966 and 1995. We link parental education and family structure during childhood to male-female and brother-sister differences in adolescent outcomes, educational attainment, and adult earnings and employment. Our results are consistent with U.S. findings that boys benefit more from an advantageous family environment than do girls in terms of grade-school outcomes. Father's education, which has not been examined in previous studies, is particularly important for sons. However, we find a very different pattern of parental influence on adult outcomes. Gender gaps in educational attainment, employment, and earnings are increasing in maternal education, benefiting daughters. Paternal education decreases the gender gaps in educational attainment (favoring sons) and labor market outcomes (favoring daughters). We conclude that differences in the behavior of school-aged boys and girls are poor proxies for differences in skills that drive longer-term outcomes.

JEL classification: I20, J1, J2, J3

Keywords: Gender gap, parental education, family structure, education, labor market outcomes.

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1 Introduction

Over the past century, barriers to women's educational and employment opportunities have been dramatically lowered in most of the developed world. Women continue to have lower rates of labor force participation and earn lower pay than men, but new gender gaps that favor women have opened up in education. Young men lag behind young women in academic achievement and contributing factors include less engagement in school, a gap in homework hours and the substitution of time spent playing video games for time spent reading (OECD, 2015). Women are now more likely than men to complete secondary education and to graduate from college in almost all OECD countries. In the United States, 39 percent of women aged 25 to 29 have a Bachelor's degree or more, compared to 32 percent of men (U.S. Census Bureau, 2015).

Recent studies have focused on the behavioral differences between school-aged boys and girls, arguing that a gender gap in "non-cognitive skills" contributes to the scholastic underperformance of boys by increasing the costs of school persistence and performance (Goldin et al., 2006; Becker et al., 2010). Family disadvantage is strongly negatively associated with early social and behavioral skills for both boys and girls, and it has been suggested that trends in family structure, and in particular the increasing prevalence of single parent families, may have a particularly deleterious effect on the skill development of boys (Bertrand and Pan, 2013; Autor and Wasserman, 2013).

Autor et al. (2016) examine this hypothesis using sibling fixed-effects models and a sample of students in Florida, and find that early family structure and mother's education do have significantly larger effects on a variety of school outcomes for boys than for their sisters. However, there is also evidence that the greater impact of family background on boys is most relevant for school-age behavior in the United States, and does not extend to longer-term outcomes such as educational attainment (Lundberg, 2016). With our analysis, we contribute to this literature in three important ways. First, we re-examine and confirm gender differences in the impacts of family envi-

ronment on school-age outcomes for Denmark, another OECD country with different social institutions and lower poverty prevalence, especially among single-parent families. Second, our main contribution is to examine a broad range of adult outcomes for the total population as well as for large samples of full siblings. Third, the richness of the data makes it possible to study potential differences in family environment effects across cohorts. Administrative data on the entire population of Denmark from 1980 to 2015 with cohorts born from 1966 to 1995 enables us to link parental education and family structure during childhood to male-female differences in adolescent outcomes, educational attainment, and adult earnings and employment. A significant advantage of the Danish administrative data is that we are able to add paternal education, which is not available for large subsets of the American samples, to our indicators of family background.

We find, as do Autor et al. (2016) and Lundberg (2016), that adolescent boys appear to be more sensitive than girls to family environment. However, we find a very different pattern of parental influence on adult outcomes such as educational attainment, college graduation, employment, and earnings. Maternal education consistently has a greater impact on the education and employment of daughters relative to sons and this effect is stable across cohorts. Paternal education has some significant, though smaller, effects on the gender education gap that favor sons (and that decline over time). These positive effects of same-sex parental education may reflect role-modelling. Father's education has larger positive effects, however, on the employment and earnings of daughters, which may indicate that female labor market behavior in Denmark is more elastic than men's with respect to early influences. The effects of family structure on adult outcomes vary, and are both small and less consistent across samples than the impacts of parental education. Having married parents at birth tends to increase the relative education and earnings of men, but to reduce their relative probability of college graduation.

Estimates based on the total population are similar to those obtained from a sample of full siblings controlling for family fixed effects. This suggests that the selection of

boys and girls across different family types is not biasing our estimates of the gender gap in the effects of family environment in the full sample.

We conclude that, although there are gender differences in responses to parental resources and family structure, they do not conform to the simple story that the skill development of boys is particularly vulnerable to family disadvantage. Our results are consistent with an alternative hypothesis in which maternal education and other family resources have a strong moderating effect on behavioral problems in school that are much more typical of boys than girls. These parental influences become less important as the children become adults, and we find little support for the hypothesis that these early behavior gaps imply less long-term skill acquisition by boys, relative to girls.

2 Family Background and Child Outcomes: Is There a Gender Dimension?

Boys begin school with less-developed social and behavioral skills than girls, and these gaps persist through elementary school and explain much of the gender differential in early academic outcomes (DiPrete and Jennings, 2012). Girls consistently receive higher grades, are less likely to repeat grades or to be placed in special education classes, and are less likely to get in trouble at school. There are clear behavioral patterns underlying these disparate outcomes—girls spend more time on homework, are more likely to read for pleasure, and exhibit a greater degree of self-discipline in school.[1] Attempts to explain the emergence of a gender gap favoring women in college attendance and completion have appealed to these gender differences in academic achievement and school discipline as evidence of a "non-cognitive skill" deficit that increases the effective costs of attending and succeeding in school for boys (Goldin et al., 2006; Becker et al., 2010).

In addition to this gender skill gap, there are also strong socioeconomic gradients in

[1] Duckworth and Seligman (2006) use several measures of self-discipline to document this gender difference, including self-reports, teacher and parent reports, and a delay of gratification test.

early social skills, attention, and school engagement. These skill differences can explain a portion of the socioeconomic differences in young adult outcomes such as arrests and high school completion (Duncan and Magnuson, 2011). Autor and Wasserman (2013) suggest a new explanation for the trend in the relative educational attainment of men and women based on these socioeconomic skill differentials and trends in family structure. They hypothesize that, as the prevalence of single parent families has increased in the U.S. (and elsewhere), economic stresses have increased for children in lower income households and their access to paternal time and attention has decreased. If the skill development of boys is affected more by father absence or family disadvantage than the skill development of girls, then changes in the living arrangements of children over time may play a role in the growing education gender gap.[2] Bertrand and Pan (2013) provide supportive empirical evidence, showing that living with a single mother or a young mother has a much larger effect on externalizing behavior and school suspensions for boys than for girls. They interpret the negative behavioral impact of father absence and young mothers as evidence that the non-cognitive skills development of boys is particularly sensitive to family disadvantage.

Autor et al. (2016) re-examine this "vulnerable boys" hypothesis using data for a large sample of children in Florida that links birth certificates with academic and health records. Using a variety of measures of family environment (including mother's education, marital status at birth, father presence, and an SES index), neighborhood income and school quality, they find that early family structure and mother's education do have significantly larger effects on a variety of school outcomes for boys than for their sisters, including school suspensions and absences, in both OLS and family fixed effects models. There is a larger payoff for boys to having a college graduate mother

[2]It is not clear what the mechanisms might be that make boys more vulnerable to adverse environments in childhood. One possibility is that gender differences in developmental trajectories may make girls, who enter school more mature in language skills and emotional regulation, inherently more resilient to disadvantage. Alternatively, there may be socioeconomic differences parental investment strategies that lead low-income parents to favor girls. Bertrand and Pan (2013) find that single mothers spend more time with daughters than with sons and report less emotional closeness with sons. Finally, there may be cultural factors that lead boys, in particular, to develop negative attitudes to school in low income or single parent families or that inhibit the educational aspirations of boys relative to girls (DiPrete and Buchmann, 2013).

for a broad set of academic outcomes, including kindergarten readiness and grades. They find similar patterns of differential gender impacts of low-income neighborhoods and poor-quality schools, and conclude that family disadvantage has larger impacts on the outcomes of boys relative to girls throughout school. Though they are unable to examine later outcomes, including college attainment, earnings, and labor force participation, Autor et al. (2016) suggest that early gender differences in behavioral and school outcomes are likely to have implications for adult outcomes.

Other studies cast some doubt on this final speculation, however. Riphahn and Schwientek (2015) find no link between family background and gender differences in educational attainment in German micro-data. Lundberg (2016), using the National Longitudinal Study of Adolescent to Adult Health (Add Health), finds that differential vulnerability to father absence among school-aged boys and girls depends upon the outcome: boys appear more responsive to father absence in externalizing behaviors (problems in school, school suspensions) while girls appear more vulnerable when outcomes are related to internalizing behavior (depression). However, neither of these patterns of adolescent response have any significant implications for educational outcomes: father absence has no differential impact on college graduation rates of men and women in cross-sectional or sibling fixed-effects models.[3] The question of whether gender differences in the effects of childhood environment persist into adulthood has potentially important implications for early childhood and school interventions, which may be designed with a focus on boys or girls.

Using the large samples available in Danish administrative data, we test the hypothesis that males benefit more from mother's and father's education and from having married parents at birth than do females in terms of a broad range of adult outcomes. Denmark has experienced trends in relative male and female educational attainment and single-parent households that are similar to those in the U.S., though the educa-

[3]Fan et al. (2015) take a different approach to the emerging gender gap, postulating that boys may be more adversely affected by mother's employment in childhood. They find evidence for a more positive association between mother's work and girl's education in Norwegian administrative data using family fixed-effect models. They do not, however, control for mother's education, which we find is a stronger predictor of daughters' outcomes than of sons'.

tional and labor market environments are distinct.[4] The more comprehensive social safety net and the well-defined obligations of non-resident parents may moderate the impacts of family disadvantage on child outcomes.[5] Though female labor force participation rates in Denmark are high, women are more likely to work part-time than in the U.S. and also more likely to work in the public sector. On the other hand, we expect that any developmental process that renders boys more vulnerable to adverse family environments should be a very general one that is manifest in diverse institutional environments. Landersø and Heckman (2016), for example, find that despite social policy differences, the influence of family background on educational attainment is similar in Denmark and the U.S.

3 Data

We use Danish administrative data covering the entire population born in Denmark between 1966 and 1995 to examine both outcomes during adolescence and the longer-term consequences of parental resources and family structure in early life. One important feature of this dataset is that we are able to link each child to his or her biological parents (both mother and father) and siblings. Moreover, we observe educational and labor market outcomes for each year, and can track with whom each individual lives.

3.1 Family Childhood Environment

We measure three dimensions of childhood family environment: mother's education, father's education, and marital status at birth. In the administrative data, we observe the father's as well as the mother's education for almost all children, and are able to track family structure from birth through childhood.

We group each parent's education into three categories: less than 12 years of edu-

[4] Appendix Figure A1 shows the growth in non-traditional family structures experienced by Danish children at age 12 and Appendix Figure A2 illustrates the reversal in the gender gap in highest completed education by age 31 for Denmark.

[5] See e.g. Rossin-Slater and Wüst (2014) on child support obligations in Denmark.

cation ($<HS$) corresponding to high school dropouts in the U.S.; high school graduate (HS) which may include some vocational training or two year college; and bachelor's degree graduate or more (BA) corresponding to a degree from a four year college in the U.S. The latter category covers professional bachelor degrees (e.g. school teacher, nursing, physiotherapist, social worker) as well as university and business school degrees.

Our primary measure of family structure is parental marital status at birth. For models using our sample of full siblings, we use parents' marital status at the birth of the youngest of their joint children. We choose this alternative definition of marital status because it is very common in Denmark to marry after the birth of the first child and eventual marital status seems to provide a better indicator of the parental relationship as shared by siblings. As almost all parents with more than one child are either married or cohabiting at the time of the youngest of their joint children, we only distinguish between having married and non-married parents.[6]

For the models of adult outcomes, we consider family structure measured at age 12 as well as parental marital status at birth.[7] For childhood family structure, we distinguish between three types: traditional families where children live with both biological parents (*Trad*), with no distinction between married and cohabiting parents; step-families in which children live with one biological parent and a step-parent (*Step*); and single parent families (*Single*). Using childhood family structure, though it may be endogenous with respect to child outcomes, allows us to include birth cohorts going back to 1966, while marital status at birth is observed only in the medical birth registry which begins in 1973. Family structure at birth and at age 12 are strongly correlated,[8] and results using both measures are quantitatively similar.

[6]Less than two percent of the sibling sample have parents who never cohabit and who are never married at any of the childbirths.

[7]More precisely, family structure at age 12 is measured on January 1^{st} of the year the child turns 13. We also considered family structure at age 16 with very similar results.

[8]Of those last born children who were born to married (non-married) parents, 80.87 (60.71) percent live in a traditional family at age 12, while 7.48 (14.48) percent live in a step family and 11.65 (24.82) percent live with a single parent.

3.2 Outcome Variables: From Adolescence through Adulthood

The outcomes of interest fall into two groups: 1) School outcomes measured in adolescence and 2) Educational attainment and labor market outcomes measured at age 31. Since these outcomes span from age 16 through age 31 (and in some specifications through age 41) and come from several administrative registers, different birth cohorts will be used in analyses of outcomes in adolescence and adulthood; Appendix Table A1 summarizes the cohorts used for each part of the analysis.[9] We have one outcome that is available for all cohorts, completion of grade 9 on time, and we use this outcome to examine whether the gender gap in the effects of family environment has changed over time.

In Denmark, the first nine years of schooling constitute primary school and are mandatory. Children are required to start first grade the year they turn 7, though parents are able to apply for an exemption such that their child starts school a year earlier or later. Boys are about twice as likely to delay school start compared to girls (Dee and Sievertsen, 2015). Grade repetition is very rare; Simonsen et al. (2015) show that on average less than 0.5 percent are retained or delayed for each grade level from grade 1 to 9. Whether the child completes grade 9 on time is a marker of academic achievement that reflects a combination of early school readiness and success in school progression, and is strongly correlated with final educational attainment.

At the end of primary school, students take the final grade 9 exam, which is the same across the country and is required for all students who continue to academic high school.[10] Our second school outcome is the overall GPA obtained at the end of grade 9 (based on all grades received both from teacher assessment and final exams).[11]

[9] When we refer to outcomes at a certain age, we always refer to the age the individual turns during the particular year. Thus, grade 9 outcomes are measured at age 15 for about half of the sample, since the school year ends in June.

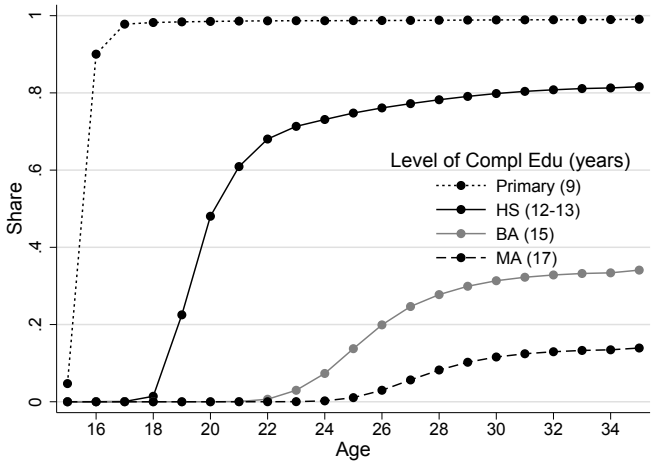
[10] Since 2007, the exam has been mandatory for all students.

[11] Similar results are found if we instead only use the GPA from written national exams in Math and Danish. If we consider the test scores from these exams separately, the differential effects are mainly found for Danish.

Other early outcomes include indicators of having received a diagnosis for behavioral and emotional disorders at a hospital[12] and attending special education during grade 9.[13] Since the administrative data on grade 9 GPA begins in 2002, we consider birth cohorts born from 1986 to 1995 for this part of the analysis.

After primary school, students can choose to continue to academic high school, which takes three years, or vocational training programs of differing lengths (predominantly 4 or 4.5 years). A diploma from the academic high school is necessary to apply for university. A bachelor's degree from university takes three years (i.e. 15 years of completed education) and a master's degree takes two additional years. Instead of university, it is possible for academic high school graduates to take a two year college degree or to enter vocational training.

Figure 1
Educational Attainment in Denmark by Age



Note: Share of individuals (birth cohorts 1973–1984) with the specified educational level or more at each age from 15–35 years. The category *HS* covers academic high school and vocational training with a length of at least 12 years.

[12]This outcome is defined from hospital records in the Danish national patient registry and is based on both inpatient and outpatient hospital records. We require that the person has received at least one diagnosis by age 21; 92 percent of those with a diagnosis by age 21 have received it by age 16. This measure will be incomplete, since psychiatrists working outside the hospital system do not report to the registry; see the discussion in Obel et al. (2015).

[13]Special education is only observed for 2007-2011.

Figure 1 graphs the share of people who have completed certain levels of education at each age from 15 to 35 years. This shows that by age 31 almost everyone has completed their education, and we study educational attainment and labor market outcomes at this age. Educational attainment is measured as highest completed education measured in months or, alternatively, having at least a high school or BA degree.[14] In terms of labor market outcomes, we consider whether the person is employed and the annual labor earnings percentile by year of birth and gender.[15] For the primary analysis of adult outcomes, the sample consists of individuals born between 1973 and 1984, for whom we can observe both parents' marital status at birth and outcomes at age 31.[16]

4 Sample Selection and Empirical Framework

4.1 Summary Statistics

So that we observe the family environment during childhood as well as adult outcomes, we consider individuals born between 1973 and 1995 for the main analysis; for the analysis of educational attainment across cohorts, we include cohorts going back to 1966. We restrict the sample to those for whom we observe all parental variables[17] and include only families without adopted children and only singleton births.[18] For the main analysis, we consider this sample (referred to as the *total population*) as well

[14]Highest completed education is measured in months, as some programs take a non-integer number of years. The category *high school* covers academic high school and vocational training with a length of at least 12 years.

[15]Individuals are defined as being employed if they have any positive labor earnings or have employment as the main source of income, including self-employment. The measure of earnings is the total sum of income earned from wage employment during a particular year.

[16]When we examine whether the gender gaps in family effects have changed over time, we expand the sample to cohorts born between 1966 and 1984.

[17]Since parental education is a key variable for the analysis, we restrict the sample to those families where we observe both parents' education. Mother's (father's) education is missing for 1.28 (2.96) percent of children who would otherwise have been in the total population sample. Results from models including only mother's education are not sensitive to excluding or including the children without information on father's education.

[18]However, as a robustness check, we have also estimated the core models in a sample of gender-discordant twins and get consistent results.

Table 1

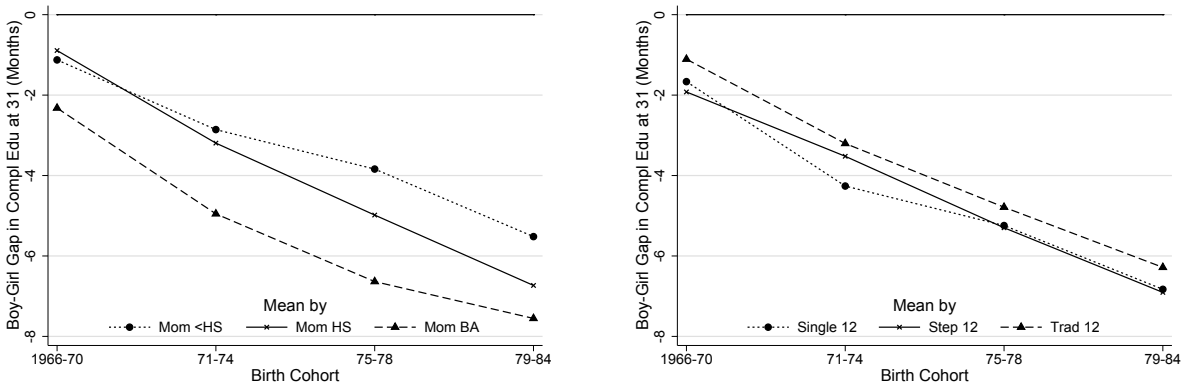
Sample Selection: Averages of Family Environment Variables (Percent)

Samples	*a*) Entire Population	*b*) Total Pop for Estimation	*c*) Sibling Sample
Selection Criteria and Background Information			
Child is male	51.21	51.26	51.38
Child's year of birth	1984	1984	1984
Child is twin	2.23	0.00	0.00
Child is adopted	0.93	0.00	0.00
# of Children in Family	2.61	2.55	2.72
Child's birth order	1.81	1.78	1.84
Mother immigrant	9.36	5.31	5.98
Father immigrant	8.97	5.78	6.35
Mother's age at birth (years)	27.05	27.11	26.97
Parental Education			
Mother <HS	34.76	34.15	32.63
Mother HS	37.83	38.07	37.87
Mother BA	27.41	27.78	29.50
Father <HS	26.81	26.52	24.99
Father HS	52.47	52.79	53.20
Father BA	20.71	20.69	21.81
Marital Status			
Married at own birth	63.04	63.53	68.11
Married at youngest sib birth	70.62	71.48	79.47
Family Structure at Youngest Sib Age 12 (Cohorts 1973-84)			
Traditional family	70.80	75.29	80.75
Step-parent family	9.53	9.78	6.96
Single-parent family	19.67	14.93	12.29
N	1,472,204	1,289,542	888,635

The columns represent three different samples of individuals born between 1973 and 1995 who all have an observation on Grade 9 completion on time: a) the entire population; b) the total population (i.e. individuals who are not twins or adoptees and have an observation on all parental variables); and c) the sibling sample (i.e. those who are observed in (b) and have at least one biological sibling in the sample). Note that the following variables are *not* reported as percent: year of birth, # of children in family, and birth order.

as the subsample of families with at least two full siblings (i.e. children with the same mother and same father; referred to as the *sibling sample*).

Figure 2
Gender Gap in Highest Completed Education (in Months) at Age 31



(a) By Maternal Education **(b)** By Family Structure

Note: Male-female gap in highest completed education at age 31 by maternal education and family structure at age 12, respectively. The gap is calculated as the difference between the raw mean for each gender by birth cohort for the total population.

Table 1 provides descriptive statistics for three different samples of individuals born between 1973 and 1995 who all have an observation on Grade 9 completion on time: a) the entire population[19]; b) the total population sample; and c) the sibling sample. The largest differences between the sibling sample and the other two samples are that, on average, children in the former sample have slightly better educated parents, parents more likely to be married at birth, and slightly larger families. In the total population and the sibling sample, children are less likely to have immigrant parents than in the entire population because some children of immigrant parents are immigrants themselves and therefore not observed at birth.[20]

Figure 2 shows the raw gender gap in educational attainment at age 31 by birth

[19]Not reported, the percent of missing observations for the following variables are: mother's age 0.32, marital status 4.75, father's identity 2.12, mother's education 2.15, and father's education 5.01.

[20]The primary reason for a missing observation on marital status at birth is because the child is not observed in the birth registry (i.e. is born outside Denmark). Appendix Table A2 shows descriptives statistics by cohort for the total population and the sibling sample.

cohort and childhood family environment.[21] Educational attainment was almost equal for men and women born in the first period (1966–1970). For subsequent cohorts, the gender gap has increased such that women born between 1979 and 1984 have attained on average six months more education by age 31 than their male counterparts. The educational gender gap is smallest for the children of less-educated mothers. In contrast, there is little variation in the gender gap by family structure.

4.2 Empirical Framework

Our goal is to identify whether childhood family environment has a differential impact on men's adult outcomes relative to women's to test the "vulnerable boys" hypothesis. The empirical strategy is twofold: First, we compare the male-female differences in adolescent and adult outcomes by family environment (i.e. a difference-in-difference strategy). Second, we focus on differences between brothers and sisters with the same mother and father by family characteristics (i.e. controlling for family fixed effects).

We begin by estimating an OLS model of the effect of family environment on outcomes for boys and girls using the total population sample. The outcome Y of individual i in family j exposed to the family environment, *Fam Env*, is given by:

$$Y_{ij} = \beta_0 + \beta_1 Male_i + \beta_2 Fam\ Env_i + \beta_3 Male_i \times Fam\ Env_i + X_i'\theta + \nu_{ij}, \qquad (1)$$

where X_i is a vector of individual controls (year and month of birth, birth order, mother's age at birth, family size, and parental immigrant status)[22] and standard errors, ν_{ij}, are clustered at the family level. For the estimation, we exploit the randomness in child gender; as long as child gender is independent of family environment, β_3 represents the causal effect of family environment on gender differences in adult outcomes.[23]

[21] The raw gender gap by paternal education is very similar to the one observed in Figure 2; the gender gap for the sibling sample is similar as well.

[22] For the adult outcomes, we also include dummies for age at observation if not observed at age 31 (age 29 or 30).

[23] To ease interpretation, we multiply all coefficients on binary variables (as well as the grade 9 GPA and

However, these estimates may be biased if family structure and child gender are not independent. Sex-selective abortion, which might generate a correlation between marital status and child gender, is not expected to be an important consideration in the Danish context, but there is considerable evidence from a number of countries that fathers are more likely to co-reside with, seek custody of, and marry the mothers of their sons rather than daughters (Lundberg and Rose, 2003; Dahl and Moretti, 2008; Lundberg, 2005). There is also increasing evidence that the Trivers-Willard hypothesis, which suggests that females in advantaged circumstances are more likely to bear male offspring, may apply to human populations through the impact of stress on the mortality of male and female fetuses (Almond and Edlund, 2007; Hamoudi and Nobles, 2014; Norberg, 2004; Trivers and Willard, 1973); though the effects of even extreme events are small. If these factors generate systematic selection of boys and girls across family types, cross-sectional models of the effects of family environment will be misleading.

To consider whether selection into specific family types by gender might be a problem, Table 2 considers whether observed family characteristics differ for boys and girls. This is done by regressing an indicator for being male on family characteristics on the total population sample. Men have on average more siblings than women and are more likely to live with both biological parents at age 12. The coefficients on parental education and marital status at birth are not jointly, significantly different from zero ($Prob > F2$), though men are slightly more likely to have BA educated parents.

As an alternative empirical approach, we focus on differences between brothers and sisters with the same mother and father who were raised in the same household:

$$Y_{ij} = \alpha_0 + \alpha_1 Male_i + \alpha_2 Male_i \times Fam\ Env_j + X_i'\gamma + \mu_j + \epsilon_{ij}, \tag{2}$$

where μ_j is a family fixed effect. In this model, α_2 represents the causal effect of family environment on gender differences in adult outcomes as long as we do not omit any

earnings percentile) by 100 such that the interpretation of, for instance, β_3 becomes a change of β_3 percentage points instead of $\beta_3 \times 100$ percentage points.

Table 2
Balancing of Characteristics by Gender

	Dependent Variable: Being Male					
Birth Cohorts	1973–1995				1973–1984	
	(1)		(2)		(3)	
# of Children in Family	0.25***	(0.04)	0.25***	(0.04)	0.24***	(0.06)
Mother's age at birth	-0.01	(0.01)	-0.01	(0.01)	-0.00	(0.01)
Mother immigrant	-0.23	(0.24)	-0.26	(0.24)	0.08	(0.36)
Father immigrant	-0.27	(0.23)	-0.28	(0.23)	-0.29	(0.35)
Mother HS	-0.02	(0.11)	-0.03	(0.11)	-0.02	(0.15)
Mother BA	0.11	(0.13)	0.11	(0.13)	0.35**	(0.18)
Father HS	0.08	(0.11)	0.07	(0.11)	0.22	(0.15)
Father BA	0.25*	(0.14)	0.24*	(0.14)	0.19	(0.20)
Married at own birth	-0.13	(0.10)				
Married at y. sib birth			0.01	(0.10)		
Trad family age 12					0.61***	(0.17)
Step family age 12					0.45*	(0.25)
N	1,289,542		1,289,542		650,633	
Mean of Y	51.26		51.26		51.11	
$Prob > F1$	0.00		0.00		0.00	
$Prob > F2$	0.14		0.24		0.00	

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The sample is the total population. The dependent variable is an indicator for being male. All regressions control for year and month of birth dummies and a constant. $Prob > F1$ is the p-value for a joint F-test of whether all the shown estimates are jointly equal to zero. $Prob > F2$ is the p-value for a joint F-test of whether all estimates of parental education and family structure are jointly equal to zero.

important time-varying variable.[24] This empirical strategy has drawbacks, however. In addition to cutting the sample size in half, it restricts the source of variation to families with at least two gender-discordant siblings. If there are behavioral spillovers between siblings, or if patterns of parental investments are different in only-child families or families with same-sex children, then the estimate of α_2 from the sibling sample may not be representative of the effects of family environment in all families.[25]

To examine whether the gender gaps in the effects of family environment have changed across birth cohorts, we also interact the independent variables of interest with a vector of birth cohort dummies (grouped into intervals), C:

$$Y_{ij} = \delta_0 + (Male_i \times C_i)'\delta_1 + (Male_i \times Fam\ Env_j \times C_i)'\delta_2 + (Fam\ Env_j \times C_i)'\delta_3 + X_i'\eta + \mu_j + \zeta_{ij}. \quad (3)$$

5 Results

5.1 Outcomes in Adolescence

Table 3 reports key coefficients from the models of Grade 9 outcomes, using both the total population and sibling samples. Column (1) shows that, for the total population, boys are 9.3 percentage points less likely to complete grade 9 on time than girls, conditional on year and month of birth, birth order, maternal age at birth, family size, and parental immigrant status.[26] Column (2) adds mother's education and marital status at birth as well as interaction terms between these variables and a male dummy.

[24] As a robustness check (Appendix Table A8), we restrict the sample to only those full siblings who experience the same observable childhood family structure at birth.

[25] Interpreting the coefficients β_3 and α_2 in equations (1) and (2) as indicators of the causal effect of post-natal family environment on child development requires that we assume that parental resources do not affect the endowments of boys and girls at birth differently. Autor et al. (2016) show that this assumption is reasonable for their Florida data; they do not find a sibling gender gap in the effects of family conditions on birth outcomes when controlling for mother fixed effects. In Appendix Table A3, we show that the prenatal inputs and birth outcomes of sisters and brothers are also not differently affected by the family environment in the Danish data.

[26] This number is 8.9 percentage points for the sibling sample without controlling for family fixed effects and 9.1 percentage points with fixed effects, see Columns (3) and (6) in Panel A in Appendix Table A9.

Boys benefit more from having a highly educated mother (HS and BA degree) compared to girls; the male disadvantage is reduced by 0.8 and 1.8 percentage points for boys of HS and BA educated mothers, respectively. Males also benefit from being born to married parents. Column (3) adds father's education and highlights one advantage of our data (i.e. that we observe fathers' characteristics for almost all children): the benefit of mother's education for boys diminishes substantially when father's education is included and father's education further reduces the gender gap. For highly educated fathers, the gender gap is reduced by 2.5 percentage points (22 percent) compared to children with less than HS educated fathers. Column (4) estimates the same model as in Column (3) but on the sibling sample rather than the total population with very similar point estimates and significance levels. Finally, Column (5) includes family fixed effects for the sibling sample, which again give very similar results compared to using the total population without fixed effects.

The gender gap in grade 9 GPA is large —almost 30 percent of a standard deviation [Column (6)]. The results for this outcome are somewhat different from other adolescent outcomes in that some indicators of parental resources increase, rather than decrease, the gender gap and there are some discrepancies between the results from the total and the sibling samples. Paternal college education reduces the gender gap in grade 9 GPA [Columns (8) to (10)]; this is true for all model versions and the effect nearly doubles in the fixed-effect model. However, having married parents at birth increases the gap. Maternal education and father's HS education also increase the gender gap in the OLS estimates, but are insignificant in the fixed effects model. To the extent that parents, particularly mothers, influence their children's grades, there may be equalizing forces within households with gender-discordant siblings that account for these different results.

Table 3

Grade 9 On Time and GPA

	Grade 9 On Time					Grade 9 GPA				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Male	-9.30***	-10.90***	-11.42***	-11.28***	-11.03***	-29.64***	-27.73***	-27.07***	-29.31***	-31.11***
	(0.09)	(0.22)	(0.26)	(0.38)	(0.48)	(0.26)	(0.56)	(0.67)	(1.01)	(1.10)
Male×Mom HS		0.82***	0.56**	0.89***	0.80*		-3.19***	-3.00***	-1.87**	-1.20
		(0.24)	(0.24)	(0.32)	(0.41)		(0.64)	(0.64)	(0.90)	(0.96)
Male×Mom BA		1.78***	0.83***	0.80**	1.07**		-0.81	-2.26***	-0.43	1.28
		(0.25)	(0.27)	(0.35)	(0.45)		(0.67)	(0.72)	(0.98)	(1.06)
Male×Dad HS			0.80***	0.79**	0.65			-1.98***	-1.66*	0.39
			(0.24)	(0.32)	(0.41)			(0.64)	(0.90)	(0.96)
Male×Dad BA			2.53***	2.45***	1.71***			2.32***	2.53**	4.95***
			(0.29)	(0.39)	(0.49)			(0.80)	(1.08)	(1.16)
Male×Married		1.34***	1.22***	1.13***	0.76**		-1.62***	-1.65***	-1.40*	-1.35*
		(0.18)	(0.18)	(0.26)	(0.34)		(0.51)	(0.50)	(0.74)	(0.80)
N	579,049	579,049	579,049	335,241	335,241	524,330	524,330	524,330	288,667	288,667
Mean of Y	82.45	82.45	82.45	83.38	83.38	-1.41	-1.41	-1.41	2.98	2.98
Total Population OLS	X	X	X			X	X	X		
Sibling Sample OLS				X					X	
Sibling Sample FE					X					X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The samples consist of individuals born from 1986–1995. *Grade 9 on time* indicates whether the person completed grade 9 by age 16. *GPA* is an average of all grades given during grade 9 both from teacher assessment and final exams for all subjects and is standardized with mean zero and standard deviation of one by year of grade 9 completion for the entire population. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), and a constant. All OLS models also control for family size dummies, parental immigrant status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

Table 4

Behavioral & Emotional Disorder and Special Education

	Behavioral & Emotional Disorder					Special Education				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Male	0.96***	1.22***	1.40***	1.22***	1.18***	1.36***	2.37***	3.03***	3.55***	3.10***
	(0.03)	(0.08)	(0.10)	(0.14)	(0.18)	(0.05)	(0.16)	(0.19)	(0.34)	(0.45)
Male×Mom HS		-0.03	0.03	0.09	-0.09		-0.82***	-0.64***	-1.00***	-1.06***
		(0.09)	(0.09)	(0.11)	(0.15)		(0.16)	(0.16)	(0.27)	(0.36)
Male×Mom BA		-0.33***	-0.18*	-0.13	-0.20		-1.44***	-1.06***	-1.17***	-1.13***
		(0.09)	(0.10)	(0.12)	(0.16)		(0.16)	(0.16)	(0.27)	(0.37)
Male×Dad HS			-0.30***	-0.29**	-0.18			-1.07***	-1.58***	-1.28***
			(0.09)	(0.12)	(0.15)			(0.16)	(0.27)	(0.35)
Male×Dad BA			-0.44***	-0.44***	-0.36**			-1.32***	-1.89***	-1.58***
			(0.11)	(0.13)	(0.18)			(0.17)	(0.28)	(0.37)
Male×Married		-0.26***	-0.24***	-0.09	-0.07		-0.30***	-0.24**	-0.10	0.23
		(0.07)	(0.07)	(0.09)	(0.13)		(0.10)	(0.10)	(0.18)	(0.25)
N	579,049	579,049	579,049	335,241	335,241	284,769	284,769	284,769	95,126	95,126
Mean of Y	1.63	1.63	1.63	1.45	1.45	1.92	1.92	1.92	1.63	1.63
Total Population OLS	X	X	X			X	X	X		
Sibling Sample OLS				X					X	
Sibling Sample FE					X					X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The samples consist of individuals born from 1986–1995. *Behevioral & Emotional Disorder* indicates whether the person has been diagnosed with ICD-10 codes F90-98 by the age of 21 years at a hospital. *Special education* indicates whether the person attends special education during grade 9 and is only observed for years 2007-2011. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), and a constant. All OLS models also control for family size dummies, parental immigrant status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

Table 4 examines sibling differences in outcomes that reflect a combination of behavioral and developmental problems —diagnosis for behavioral and emotional disorder and attending special education during 9^{th} grade. From Columns (1) and (6), it is clear that these outcomes are more prevalent among boys: 66 percent of those with behavioral and emotional problems and 69 percent of those attending special education are male.[27] The OLS models of behavioral and emotional disorder indicate that higher parental education reduces the gender gap [Columns (2) to (4)] in the total sample. Only father's BA is still significant in the sibling model with fixed effects. However, both maternal and paternal education decrease the probability of attending special education much more for boys than girls [Columns (5) to (6)], and this effect is consistent across samples and models.

We observe on-time completion of grade 9 consistently across cohorts, and therefore use this outcome to look at whether the gender gap in the effects of family environment has changed over time. Since we examine adult outcomes as well, we want to know whether any variation in the effects of family background between childhood and adult outcomes are due to different ages at observation or due to different birth cohorts.

Table 5 shows the male-cohort-family environment interactions from estimates of equation (3) with the outcome grade 9 completion on time. The base male-female gap in grade 9 on time has increased modestly over time [Column (1)]; boys in the omitted group (i.e. with low educated, unmarried parents) born from 1973 to 1978 were 8.4 percentage points less likely to complete grade 9 on time compared to girls, and this gap increased to more than 11 percentage points for those born between 1990 and 1995. In contrast, the male premium in the effects of maternal and paternal education has been relatively stable over this time period [Columns (2) to (5)]; the estimated effects do not differ significantly across cohorts. This indicates that the gender gap in the effects of parental education is not a recent phenomenon, but has been relatively constant over more than two decades. This suggests in turn that the effects on adult

[27] Kristoffersen et al. (2015) find a strong association between behavioral problems and school outcomes for Danish children, but the behavioral gender gap explains only a fraction of the gender difference in test scores.

outcomes that we will observe for older cohorts may be predictive of the experiences of more recent cohorts. Meanwhile, the male advantage of being born to married parents has declined and is not significant for the youngest cohort [Column (8)], which may indicate that the role of cohabitation has changed over time as well.

Table 5
Grade 9 On Time by Birth Cohort: Male-Cohort-Family Environment Interactions

	Male	Mom HS	Mom BA	Dad HS	Dad BA	Married
	(1)	(2)	(3)	(4)	(5)	(6)
Male×1973-78	-8.42***	1.54***	2.08***	0.84**	1.64***	1.93***
	(0.68)	(0.38)	(0.45)	(0.40)	(0.50)	(0.63)
Male×1979-84	-9.18***	0.71*	1.28***	0.67	2.29***	2.04***
	(0.54)	(0.39)	(0.43)	(0.41)	(0.51)	(0.46)
Male×1985-89	-10.92***	1.11**	1.69***	0.81*	2.20***	1.07**
	(0.56)	(0.46)	(0.50)	(0.48)	(0.57)	(0.43)
Male×1990-95	-11.22***	1.00**	1.33**	0.67	1.63***	0.66
	(0.57)	(0.49)	(0.53)	(0.49)	(0.59)	(0.41)
$Prob > F1$	0.00	0.50	0.58	0.99	0.72	0.10
$Prob > F2$	0.00	0.39	0.29	0.79	1.00	0.09

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The sample used for estimation is the sibling sample with individuals born from 1973–1995. $N = 888,635$. The outcome is Grade 9 on time with a mean of 86.68 percent. All estimates come from one regression as specified in equation (3), i.e. a regression interacting the male-family environment interactions as well as the family environment variables with birth cohort dummies. The model also controls for family fixed effects, year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), and a constant. $Prob > F1$ reports the p-value from a joint F-test of whether all the estimates in the particular column are equal. $Prob > F2$ reports the p-value from a joint F-test of whether the estimates for the earliest and the last cohorts in the particular column are equal.

In general, our results on school and behavioral outcomes in adolescence are consistent with previous studies finding that boys benefit more from a good family background than girls in terms of outcomes indicative of learning and developmental problems (Bedard and Witman, 2015; Bertrand and Pan, 2013; Autor et al., 2016). Using Danish data, we are able to support the overall finding for the U.S. that boys seem more vulnerable to a disadvantageous family environment than their sisters when looking at adolescent outcomes. Notably, we find that boys benefit differentially from high paternal education, and that the effects of parental education have been relatively stable

over time.

5.2 Adult Outcomes

When we turn to educational attainment, employment, and earnings at age 31 we find, in contrast to school-age outcomes, that women benefit more from higher maternal education than men. This is true for both samples and is robust to the inclusion of family fixed effects. For the total population, men complete less education than women with a raw gender gap of 5.4 months [Table 6, Column (1)]. This gap is strongly increasing in maternal education [Column (2)]. The gender gap in educational attainment rises from 4.9 months for children of less than HS mothers to 6.0 and 7.7 months for children with, respectively, HS and BA educated mothers [Column (2)], holding marital status constant. Column (3) adds father's education and its interaction with the male dummy instead of mother's education. These results suggest that women benefit more from father's BA education than men. However, when including both parents' education in Column (4), it becomes clear that men benefit more than women from paternal education while the opposite is true for maternal education. These results are insensitive to the inclusion of family fixed effects [Column (6)]. For the sibling sample controlling for family fixed effects, the results show that having a HS or BA educated father reduces the gender gap by 0.8 and 1.5 months, respectively, while having a HS or BA educated mother increases the gender gap by 1.1 and 2.8 months.[28] For the total population, having married parents at birth decreases the gender gap by 0.7 months. In contrast, neither marital status at birth nor childhood family structure significantly affect the gender gap in educational attainment for the sibling sample. Overall, these results do not provide much support for the hypothesis that men are more vulnerable to a disadvantageous family background than women.

[28] In results not reported here, we have also considered the natural logarithm of educational attainment to examine whether we would find a similar pattern when looking at relative instead of absolute differences. Those results are in line with the ones reported here on educational attainment.

Table 6

Educational Attainment at Age 31: Highest Completed Education (Months)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Male	-5.40***	-4.86***	-5.79***	-5.09***	-5.16***	-4.98***	-5.05***
	(0.07)	(0.15)	(0.16)	(0.17)	(0.30)	(0.36)	(0.36)
Male×Mom HS		-1.17***		-1.30***	-1.36***	-1.11***	-1.13***
		(0.15)		(0.15)	(0.21)	(0.25)	(0.25)
Male×Mom BA		-2.62***		-3.00***	-2.98***	-2.82***	-2.83***
		(0.17)		(0.19)	(0.25)	(0.30)	(0.30)
Male×Dad HS			-0.05	0.33**	0.70***	0.79***	0.77***
			(0.16)	(0.16)	(0.21)	(0.25)	(0.25)
Male×Dad BA			-0.43**	1.04***	1.23***	1.52***	1.50***
			(0.20)	(0.22)	(0.29)	(0.34)	(0.34)
Male×Married		0.69***	0.66***	0.66***	0.43	0.20	
		(0.15)	(0.15)	(0.15)	(0.28)	(0.34)	
Male×Trad 12							0.37
							(0.34)
Male×Step 12							-0.23
							(0.49)
N	632,508	632,508	632,508	632,508	355,090	355,090	355,090
Mean of Y	162.97	162.97	162.97	162.97	164.14	164.14	164.14
Total Pop. OLS	X	X	X	X			
Sibling Sample OLS					X		
Sibling Sample FE						X	X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The samples consist of individuals born from 1973–1984. *Highest completed education* measures the length of highest completed education in months. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant. All OLS models also control for family size dummies, parental immigration status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

Table 7

Level of Educational Attainment at Age 31: Having at least a HS and BA Degree

	HS Degree or more					BA Degree or more				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Male	-1.97***	-1.96***	-1.99***	-1.81***	-2.34***	-16.36***	-12.75***	-12.37***	-12.03***	-10.92***
	(0.09)	(0.28)	(0.49)	(0.60)	(0.59)	(0.12)	(0.25)	(0.45)	(0.57)	(0.55)
Male×Mom HS		-1.30***	-1.41***	-1.41***	-1.47***		-3.41***	-3.56***	-2.96***	-2.87***
		(0.23)	(0.30)	(0.37)	(0.37)		(0.26)	(0.35)	(0.43)	(0.43)
Male×Mom BA		-2.07***	-1.98***	-2.02***	-2.05***		-7.17***	-7.26***	-7.03***	-6.97***
		(0.25)	(0.32)	(0.40)	(0.40)		(0.33)	(0.44)	(0.54)	(0.54)
Male×Dad HS		0.88***	1.25***	1.63***	1.58***		-2.15***	-1.92***	-2.09***	-2.00***
		(0.24)	(0.32)	(0.40)	(0.40)		(0.25)	(0.34)	(0.42)	(0.42)
Male×Dad BA		0.61**	0.58	1.02**	0.95**		3.04***	3.32***	3.41***	3.54***
		(0.28)	(0.36)	(0.45)	(0.45)		(0.37)	(0.50)	(0.61)	(0.61)
Male×Married		0.47**	0.55	0.20			-0.26	-1.28***	-1.47***	
		(0.22)	(0.42)	(0.53)			(0.24)	(0.45)	(0.56)	
Male×Trad 12					1.01*					-3.17***
					(0.52)					(0.53)
Male×Step 12					-0.33					-0.42
					(0.80)					(0.76)
N	632,508	632,508	355,090	355,090	355,090	632,508	632,508	355,090	355,090	355,090
Mean of Y	82.17	82.17	83.49	83.49	83.49	35.04	35.04	36.58	36.58	36.58
Total Population OLS	X	X				X	X			
Sibling Sample OLS			X					X		
Sibling Sample FE				X	X				X	X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The samples consist of individuals born from 1973–1984. *HS Degree* is an indicator for whether the individual has completed at least 12 years of education. *BA graduate* indicates whether the person has at least a BA degree. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant. All OLS models also control for family size dummies, parental immigration status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

Table 8

Labor Market Outcomes at Age 31

	Employed					Earnings Percentile by Birth Cohort and Gender				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Male	2.86***	4.79***	4.76***	5.49***	5.64***	-0.44***	0.67***	0.86***	1.23***	1.00***
	(0.08)	(0.22)	(0.39)	(0.51)	(0.50)	(0.07)	(0.17)	(0.30)	(0.39)	(0.38)
Male×Mom HS		-1.48***	-1.70***	-1.80***	-1.76***		-0.97***	-0.90***	-1.22***	-1.23***
		(0.18)	(0.23)	(0.30)	(0.30)		(0.16)	(0.21)	(0.27)	(0.27)
Male×Mom BA		-1.75***	-1.80***	-1.96***	-1.95***		-1.99***	-2.15***	-2.44***	-2.46***
		(0.22)	(0.28)	(0.36)	(0.36)		(0.20)	(0.26)	(0.33)	(0.33)
Male×Dad HS		-1.39***	-1.50***	-2.19***	-2.16***		-0.74***	-0.80***	-1.19***	-1.22***
		(0.19)	(0.24)	(0.32)	(0.32)		(0.16)	(0.21)	(0.27)	(0.27)
Male×Dad BA		-2.08***	-2.28***	-2.30***	-2.27***		-2.50***	-2.54***	-2.58***	-2.62***
		(0.25)	(0.32)	(0.42)	(0.42)		(0.23)	(0.30)	(0.38)	(0.38)
Male×Married		0.21	0.40	0.25			0.81***	1.02***	1.25***	
		(0.18)	(0.35)	(0.46)			(0.15)	(0.29)	(0.36)	
Male×Trad 12					-0.04					1.67***
					(0.44)					(0.35)
Male×Step 12					0.80					0.65
					(0.67)					(0.52)
N	643,219	643,219	365,676	365,676	365,676	643,219	643,219	365,676	365,676	365,676
Mean of Y	89.54	89.54	90.18	90.18	90.18	53.99	53.99	54.64	54.64	54.64
Total Population OLS	X	X				X	X			
Sibling Sample OLS			X					X		
Sibling Sample FE				X	X				X	X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The samples consist of individuals born from 1973–1984. *Employed* takes the value one if the person has positive labor earnings or have employment as the main source of income including self-employment and zero otherwise. *Earnings percentile* measures the annual earnings percentile by gender and year of birth. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant. All OLS models also control for family size dummies, parental immigration status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

Turning to the binary outcomes of having received a HS or BA degree by age 31, we find results quite similar to those in the educational attainment model, with two exceptions for the probability of receiving a BA degree. First, women of HS educated fathers benefit more than their brothers, though boys benefit more from a college-educated father. Second, women in the sibling sample also benefit more than their brothers from having parents who were married at the youngest sibling's birth [Columns (8) to (9)] and living in a traditional family during childhood [Column (10)]. These results are sharply at odds with those we saw for school outcomes at age 16: on most dimensions, women benefit more from a favorable childhood family environment than their brothers in terms of higher educational attainment in adulthood.

Table 8 presents results for labor market outcomes at age 31. Column (1) shows that men are 2.9 percentage points more likely to be employed than women. However, we again see the pattern that women benefit more than their brothers from having parents with at least HS education, with the effects of paternal education slightly larger than those for maternal education. Parental education also differentially increases the earnings percentile of women relative to their brothers. Women whose parents have at least a HS degree earn more than their brothers relative to their birth cohort and gender, and the effects of maternal and paternal college education are particularly strong (2.3 and 2.7 percentage points). We find no gender gap in the effects of childhood family structure on employment, but men of married parents at birth benefit more than their sisters in terms of earnings.

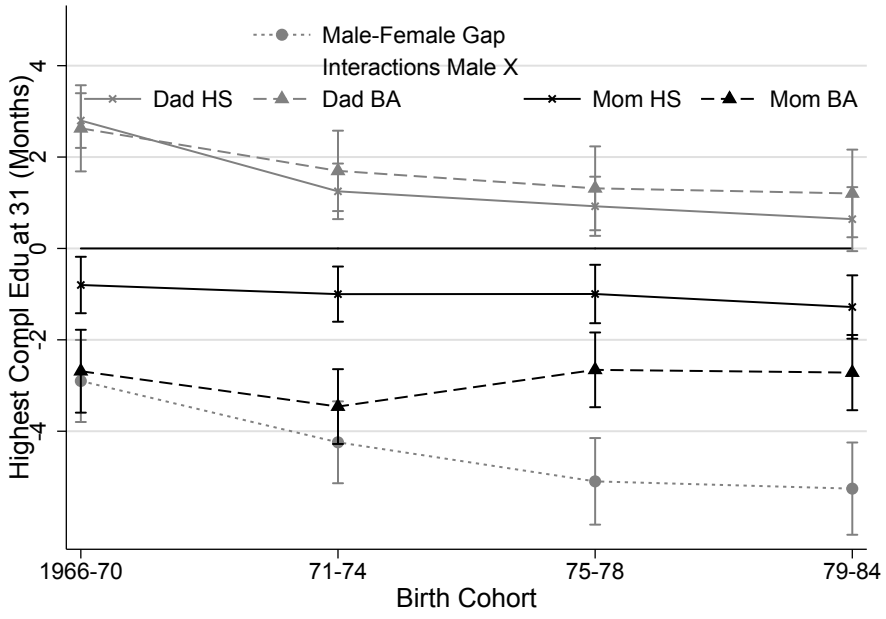
Finally, Appendix Table A4 examines whether the gender gap in the effects of childhood family environment on labor market outcomes vary across ages (26, 31, 36, and 41) by using the sibling sample of individuals born between 1966 and 1971. The results across these four ages show that the differential effects of mother's education on women's employment persist as they age. The age pattern of parental education effects on the earnings percentile is different. At age 26 and 31, both maternal and paternal education have more positive effects on women's earnings. By age 36, parental education no longer has a differential effect on sons and daughters. This change may

reflect the different career lifecycles of men and women, especially related to childbirth and household responsibilities (Kleven et al., 2015). Moreover, the male earnings boost from having lived in a traditional family at age 12 grows with age in these older cohorts.

5.3 Educational Attainment Across Cohorts

We have found that women consistently benefit more from high maternal education than their brothers in terms of adult outcomes at age 31. In this subsection, we examine whether these gender differences in the effects of parental education on educational attainment have changed across cohorts.

Figure 3
Highest Completed Education (in Months) at Age 31 by Birth Cohort
Male-Mother's and Male-Father's Education Interaction



Note: The whiskers represent the 95 percent confidence interval. The sample is the sibling sample with individuals born from 1966–1984. All estimates come from one regression interacting the male-family environment interactions as well as the family environment variables with birth cohort dummies. Appendix Table A5 displays all the male-cohort-family environment interaction estimates. The model also controls for family fixed effects, year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant.

Figure 3 plots the estimates from an educational attainment regression that now

includes interactions between the male dummy, family environment, and cohort dummies. From this, we get two important insights. First, it is evident that earlier cohorts of men benefited more from high paternal education than women but that the gender difference in the effect of father's education has diminished substantially and is only borderline significant for recent cohorts. Results reported in the Appendix show a similar pattern of results for receiving a HS and BA degree and also show that the impacts of family structure have been reasonably consistent over time [Appendix Table A5].[29] Family structure has no consistent effect on the gender gap in educational attainment, though living in a traditional family during childhood strongly favors women in all cohorts in terms of the likelihood of receiving a BA. Consequently, this evidence does not support the hypothesis that the increasing prevalence of non-traditional family arrangements explain the growing education gap in favor of girls.

The results in this section show that gender differences in the effects of parental education have been fairly constant across cohorts in terms of educational attainment with one exception: the differentially positive effect of father's education on boys has decreased over time. The same is true of labor market outcomes: the gender specific responses to childhood family environment have been consistent across cohorts, though the more positive effects of both maternal and paternal education on women's employment and earnings tends to diminish with age.

5.4 Sensitivity Analyses

In this subsection, we study the robustness of our findings in three different ways. First, we examine whether different aspects of childhood family environment interact in important ways by gender. Second, we check the robustness of our measure of childhood family structure. Since the main results were quite similar for the different models, we perform these two robustness analyses on the sibling sample including family fixed

[29] The results in Figure 3 are basically identical when only considering traditional families. Though we do not report the results here, if we exclude the male-paternal education interactions, the gender gap in the effects of maternal education appear to be increasing over time, generating a spurious trend in the impact of mother's education.

effects. Third, we compare our main results (estimated on the total population and the sibling sample) to the estimated effects for one-child families and subsamples of the sibling sample divided by the gender composition of the siblings in the sample without family fixed effects.

Appendix Table A6 includes interactions between mother's and father's education in several key models of school and adult outcomes.[30] We find some heterogeneity in the effects of parents' education on educational attainment at age 31.[31] The results suggest that in families where both parents have BA education, men do not benefit more than their sisters from mother's BA education in terms of completed education. For college graduation, the excess female advantage from parental BA education is smaller in families where one parent has BA education and the other has at least HS education. Appendix Table A7 expands the main model by interacting the family environment-male interactions with marital status at birth, but we find little evidence of heterogeneity.

Appendix Table A8 tests the sensitivity of our definition of childhood family structure for the sibling sample, which is based on the experience of the youngest sibling. The results are very robust to using family structure defined for the oldest sibling instead. Alternatively, we restrict the sample to those families with children with the same observed family structure at age 12; the results are again very similar to the main results.

Finally, Appendix Tables A9 and A10 compare OLS models of key outcomes for alternative samples—the total population, children from one-child families, and the samples of full siblings, same-sex siblings and mixed-sex siblings. Overall, the estimates for the different subsamples and for the total population and the sibling sample without fixed effects are similar (both in terms of magnitude and significance), though fewer estimates are significant in smaller samples.

[30]The correlation between mother's and father's length of education is around 0.41 and 52 percent of parents have the same educational level.

[31]Formally, we test this with an F-test of whether the additional Male×Mom Edu×Dad Edu interaction terms are jointly equal to zero.

6 Conclusion

Motivated by previous findings showing that school-aged boys appear more vulnerable to family disadvantage than school-aged girls, we examine whether such differences persist into adulthood. We use Danish administrative register data, allowing us to examine a broad range of school and adult outcomes for complete cohorts, as well as large samples of full siblings. An advantage compared to previous studies is that we observe both mother's and father's education as well as family structure at birth and during childhood.

In line with findings from the U.S. (Autor et al., 2016; Lundberg, 2016), we first show that in the Danish context boys also appear to be generally more sensitive than girls to family environment in terms of observable outcomes during school. We find the opposite for adult outcomes, including educational attainment, college graduation, employment, and earnings. Women consistently benefit more from maternal education relative to their brothers in terms of education and employment. Paternal education decreases the gender gap in education (favoring sons), though the impact is small. In contrast, paternal education has larger positive effects on the employment and earnings of daughters. Gender gaps in the effects of family structure vary across outcomes, with married parents having significant effects in some samples on college graduation (favoring women) and on high school graduation and earnings percentile (favoring men). Similar results in OLS models using the entire population and family fixed-effect models using a sample of full siblings indicate that selection of boys and girls across family types is not a serious source of bias. These results fail to support any gender targeting in programs designed to assist students from disadvantaged families.

Moreover, we show the gender gap in the effects of parental education on completing grade 9 on time has been relatively constant over more than two decades. This indicates that the gender difference in the effects of maternal education on primary school completion is not a recent phenomenon. In terms of educational attainment in adulthood, we find that men used to benefit more from paternal education than

women but that the gender difference in the effect of father's education disappeared for cohorts born after the mid-1970s. The female premium in the effects of mother's education has been constant for all cohorts.

Although boys respond differently to parental resources and family structure than do girls, the evidence shows that such gender differences do not conform to the simple story that the skill development of boys is particularly sensitive to family environment. Neither can the changes in family structure, in the Danish context, explain the growing education gap in favor of girls. Our findings are compatible with a story in which parental education and other family resources have a strong moderating effect on behavioral problems in school that are much more typical of boys than girls. These controlling forces may become less effective as the children become adults, and the results show no indication that long-term skill acquisition, and therefore educational attainment or adult earnings, is affected by these early deficits.

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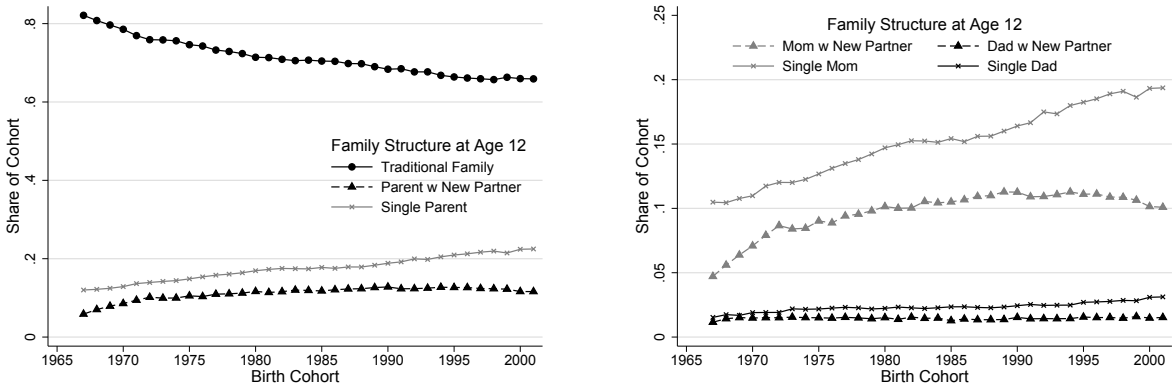
A Appendix

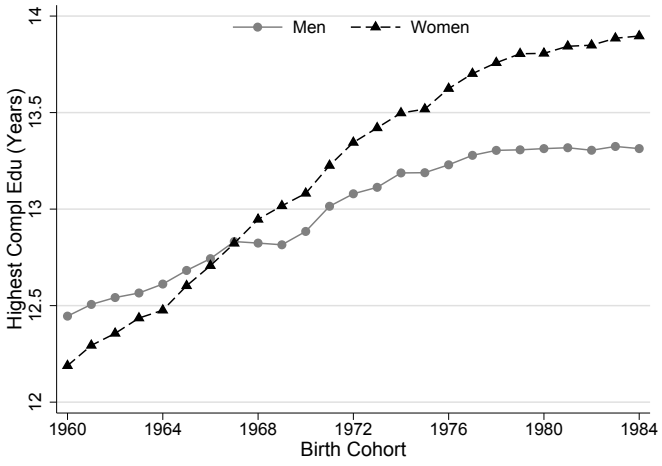
Figure A1
Family Structure at Age 12 (Birth Cohorts 1967–2001)



(a) Traditional, Single, and Step Families **(b)** Non-Traditional Families: Mother vs Father

Note: Family structure as measured on January 1^{st} at age 12 (the year the child turns 13 years). The sample consists of all children living in Denmark at age 12. *Traditional* refers to families in which children live with both biological parents, *Single* refers to families in which children live with only one parent without a new partner, and *Parent w New Partner* refers to families in which children live with one parent and this parent's new partner.

Figure A2
Highest Completed Education (Years) at Age 31 by Gender in Denmark



Note: Highest completed education in years by birth cohort (1960–1984) and gender for people living in Denmark.

Table A1
Overview of Samples and Outcomes

	Main Analysis	Across Cohorts/Ages
Outcomes in Adolescence		
Grade 9 On Time	1986–1995	1973–1995
Grade 9 GPA	1986–1995	
Behavioral & Emotional Disorder	1986–1995	
Special Education	1991–1995	
Outcomes in Adolthood		
Education age 31	1973–1984	1966–1984
Employment/Earnings age 31	1973–1984	
Employment/Earnings age 26, 31, 36 & 41		1966–1971

The table summarizes the birth cohorts used for each outcome. See section 3 for more detail.

Table A2
Averages of Family Environment (Percent) by Cohort

Sample	Total Population			Sibling Sample		
Birth Cohorts	1966–1972	1973–1984	1985–1995	1966–1972	1973–1984	1985–1995
Background Information						
Child is male	51.19	51.19	51.34	51.27	51.20	51.48
Child's year of birth	1969	1978	1990	1969	1978	1990
# of Children in Family	2.63	2.51	2.59	2.78	2.66	2.77
Child's birth order	1.80	1.79	1.78	1.71	1.86	1.96
Mother immigrant	2.77	4.14	6.54	2.83	4.43	7.08
Father immigrant	2.56	4.37	7.26	2.67	4.52	7.70
Mother's age at birth (years)	25.34	26.30	27.97	24.44	26.28	28.20
Parental Education						
Mother <HS	50.75	39.76	28.24	48.83	38.64	27.74
Mother HS	33.66	35.56	40.71	34.38	35.99	40.29
Mother BA	15.59	24.68	31.05	16.79	25.37	31.97
Father <HS	36.58	28.85	24.08	35.46	27.74	23.07
Father HS	47.40	51.45	54.20	47.67	51.88	54.34
Father BA	16.02	19.71	21.72	16.87	20.38	22.59
Marital Status (Cohorts 1973-95) and Immigrant Background						
Married at own birth		72.29	54.32		77.69	62.30
Married at youngest sib birth		80.79	61.68		88.14	72.48
Family Structure at Youngest Sib Age 12						
Traditional family	79.89	71.78	67.73	82.00	77.79	73.43
Step-parent family	7.63	11.54	12.92	6.58	8.47	10.05
Single-parent family	12.48	16.67	19.35	11.42	13.74	16.52
N	424,597	661,024	628,518	301,270	531,497	446,864

The columns present averages by the two samples used for the analysis on educational attainment at age 31 and grade 9 completion on time (the total population and the sibling sample) for individuals born between 1966 and 1995. Note that the following variables are *not* reported as percent: year of birth, # of children in family, and birth order.

Table A3

Prenatal Inputs and Birth Outcomes

	Total Population OLS						Sibling Sample FE					
	Check-ups	Pregn. Comp.	Smoke	Pre-term	log(BW)	Low Apgar	Check-ups	Pregn. Comp.	Smoke	Pre-term	log(BW)	Low Apgar
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A												
Male	-0.09***	0.14***	-0.05	0.83***	3.37***	0.15***	-0.08***	0.09	0.33	0.60***	3.76***	0.10**
	(0.01)	(0.04)	(0.17)	(0.05)	(0.04)	(0.02)	(0.01)	(0.06)	(0.22)	(0.07)	(0.05)	(0.04)
Panel B												
Male	-0.08***	0.17	-0.07	0.94***	3.13***	0.23***	-0.08***	0.11	0.07	0.76***	3.70***	0.21*
	(0.02)	(0.11)	(0.46)	(0.13)	(0.11)	(0.06)	(0.03)	(0.17)	(0.65)	(0.21)	(0.15)	(0.11)
Male×Mom HS	-0.01	-0.01	-0.34	0.02	0.03	0.01	-0.02	-0.12	0.46	-0.05	0.07	0.08
	(0.02)	(0.11)	(0.45)	(0.12)	(0.10)	(0.06)	(0.02)	(0.15)	(0.59)	(0.18)	(0.13)	(0.10)
Male×Mom BA	0.00	-0.07	0.13	-0.32**	0.12	-0.02	0.01	-0.23	0.47	-0.34*	0.27*	0.01
	(0.02)	(0.12)	(0.49)	(0.13)	(0.11)	(0.06)	(0.03)	(0.17)	(0.66)	(0.19)	(0.15)	(0.10)
Male×Dad HS	-0.03*	0.10	-0.03	0.07	0.03	-0.04	0.02	0.12	-0.48	0.18	-0.21*	-0.14
	(0.02)	(0.11)	(0.44)	(0.12)	(0.10)	(0.06)	(0.02)	(0.16)	(0.58)	(0.18)	(0.13)	(0.10)
Male×Dad BA	-0.01	0.10	-0.11	0.16	0.06	0.01	-0.00	0.19	-0.81	0.25	-0.18	0.01
	(0.02)	(0.14)	(0.52)	(0.15)	(0.13)	(0.07)	(0.03)	(0.19)	(0.71)	(0.22)	(0.17)	(0.12)
Male×Married	0.01	-0.15*	0.33	-0.18*	0.30***	-0.11**	0.00	0.00	0.52	-0.25	0.15	-0.10
	(0.01)	(0.09)	(0.33)	(0.09)	(0.08)	(0.05)	(0.02)	(0.14)	(0.50)	(0.16)	(0.12)	(0.09)
N	874,850	874,850	291,211	855,825	853,686	865,474	564,826	564,826	95,936	549,545	547,422	554,777
Mean of Y	10.757	4.393	30.647	4.737	813.046	1.112	10.834	3.985	27.086	4.346	813.883	1.104
$Prob > F$	0.296	0.876	0.797	0.039	0.665	0.887	0.718	0.837	0.768	0.219	0.159	0.403

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. F-test of whether all the male-interaction terms are equal to zero. All estimates, except for those in Columns (1) and (7), are multiplied by 100. The samples consist of individuals born from 1980–1995. Estimates from each column in each panel come from separate regressions. *Check-ups* measures the total number of check-ups at general practitioner, midwife, and specialist during pregnancy. *Pregnancy complications* is a binary indicator taking the value 1 if the mother is diagnosed with preeclampsia, gestational hypertension, or gestational diabetes mellitus during pregnancy. *Smoke* indicates whether the mother smoked during pregnancy and is observed for birth cohorts 1991–1995. *Preterm* indicates whether the child was born before 37 weeks of gestation. *Log(BW)* represents the natural logarithm of birth weight. *Low Apgar* indicates whether the child had a five minutes Apgar score below 7, which is medically considered a low score. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), and a constant. All OLS models additionally control for family size dummies, parental immigration status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

Table A4

Labor Market Outcomes Across Ages (Birth Cohorts 1966–71)

	Employed				Earnings Percentile by Birth Cohort and Gender			
Age	26	31	36	41	26	31	36	41
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A								
Male	4.18***	4.30***	2.90***	1.38***	0.79***	0.58***	0.43**	0.05
	(0.18)	(0.17)	(0.18)	(0.19)	(0.18)	(0.18)	(0.18)	(0.18)
Panel B								
Male	6.89***	6.35***	4.32***	1.08	3.88***	1.13*	-1.16**	-2.16***
	(0.71)	(0.71)	(0.73)	(0.78)	(0.60)	(0.59)	(0.59)	(0.59)
Male×Mom HS	-2.30***	-2.29***	-1.41***	-1.56***	-4.16***	-1.41***	-0.42	-0.47
	(0.43)	(0.40)	(0.42)	(0.44)	(0.44)	(0.43)	(0.43)	(0.43)
Male×Mom BA	-1.53**	-2.10***	-1.19**	-1.38**	-4.86***	-1.46**	-0.82	-0.78
	(0.64)	(0.58)	(0.59)	(0.60)	(0.60)	(0.62)	(0.62)	(0.62)
Male×Dad HS	-0.95**	-0.76*	-0.41	-0.63	-1.95***	-0.93**	0.03	0.25
	(0.41)	(0.40)	(0.42)	(0.44)	(0.41)	(0.40)	(0.40)	(0.40)
Male×Dad BA	-1.13*	-0.47	-1.78***	-0.34	-6.39***	-2.61***	-0.58	-0.03
	(0.67)	(0.60)	(0.61)	(0.63)	(0.63)	(0.65)	(0.64)	(0.64)
Male×Trad 12	-1.41**	-0.72	-0.35	1.53**	0.87	1.15**	2.30***	2.77***
	(0.68)	(0.68)	(0.69)	(0.75)	(0.59)	(0.58)	(0.58)	(0.58)
Male×Step 12	-0.14	-0.31	-0.75	0.96	1.38	-0.45	0.32	1.25
	(1.08)	(1.07)	(1.13)	(1.19)	(0.92)	(0.92)	(0.92)	(0.91)
N	157,905	157,905	157,905	157,905	157,905	157,905	157,905	157,905
Mean of Y	91.89	92.83	92.17	91.08	53.22	53.61	53.33	52.99

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The sample is the subsample of sibling sample with individuals born from 1966-71. Estimates in each column in each panel come from separate regressions. *Employed* takes the value one if the person has positive wage earnings or have employment as the main source of income including self-employment and zero otherwise. *Earnings percentile* measures the annual earnings percentile by gender and year of birth. All models control for family fixed effects, year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at the specified age, and a constant.

Table A5

Educational Attainment at Age 31 by Cohort: Male-Cohort-Family Environment Interactions

	Male	Mom HS	Mom BA	Dad HS	Dad BA	Trad 12	Step 12
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Highest Completed Education (Months)							
Male×1966-70	-2.90***	-0.80**	-2.69***	2.80***	2.63***	0.62	-0.18
	(0.46)	(0.32)	(0.46)	(0.31)	(0.48)	(0.45)	(0.71)
Male×1971-74	-4.24***	-1.00***	-3.46***	1.25***	1.70***	1.32***	0.52
	(0.46)	(0.31)	(0.42)	(0.31)	(0.45)	(0.44)	(0.67)
Male×1975-78	-5.10***	-1.00***	-2.66***	0.92***	1.32***	0.74	-0.48
	(0.48)	(0.33)	(0.42)	(0.33)	(0.47)	(0.45)	(0.69)
Male×1979-84	-5.26***	-1.28***	-2.72***	0.64*	1.20**	-0.36	-0.32
	(0.52)	(0.35)	(0.42)	(0.36)	(0.49)	(0.48)	(0.71)
$Prob > F1$	0.00	0.79	0.46	0.00	0.14	0.07	0.74
$Prob > F2$	0.00	0.31	0.96	0.00	0.04	0.13	0.89
Panel B: At least HS Degree							
Male×1966-70	-2.44***	-2.31***	-2.60***	3.26***	2.29***	0.51	1.25
	(0.79)	(0.51)	(0.61)	(0.53)	(0.64)	(0.75)	(1.24)
Male×1971-74	-3.28***	-2.39***	-2.27***	1.19**	1.14*	2.43***	1.94*
	(0.77)	(0.49)	(0.56)	(0.52)	(0.59)	(0.70)	(1.12)
Male×1975-78	-2.31***	-1.10**	-1.98***	1.45***	0.49	0.94	-0.40
	(0.80)	(0.51)	(0.56)	(0.54)	(0.61)	(0.72)	(1.14)
Male×1979-84	-2.01**	-0.91*	-1.83***	1.78***	1.21*	-0.10	-1.49
	(0.84)	(0.53)	(0.56)	(0.57)	(0.64)	(0.74)	(1.14)
$Prob > F1$	0.70	0.07	0.80	0.02	0.23	0.07	0.13
$Prob > F2$	0.71	0.06	0.35	0.05	0.23	0.56	0.10
Panel C: BA Degree							
Male×1966-70	-6.09***	-1.12**	-6.64***	1.08**	3.05***	-2.70***	-0.88
	(0.63)	(0.52)	(0.82)	(0.47)	(0.85)	(0.64)	(0.98)
Male×1971-74	-7.78***	-2.52***	-9.30***	-0.17	3.67***	-2.81***	-1.06
	(0.65)	(0.52)	(0.75)	(0.50)	(0.80)	(0.65)	(0.97)
Male×1975-78	-11.24***	-2.33***	-6.66***	-1.36**	3.09***	-2.48***	-1.70
	(0.73)	(0.57)	(0.75)	(0.55)	(0.84)	(0.71)	(1.05)
Male×1979-84	-11.80***	-3.76***	-6.30***	-1.98***	3.41***	-3.87***	0.80
	(0.77)	(0.61)	(0.75)	(0.59)	(0.85)	(0.75)	(1.09)
$Prob > F1$	0.00	0.01	0.02	0.00	0.94	0.54	0.39
$Prob > F2$	0.00	0.00	0.76	0.00	0.76	0.24	0.25

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates for HS and BA degree are multiplied by 100. The sample is the sibling sample with individuals born from 1966–1984. $N = 755,850$. For each panel, all estimates come from one regression as specified in equation (3), i.e. a regression interacting the male-family environment interactions as well as the family environment variables with birth cohort dummies. The models control additionally for family fixed effects, year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant. The outcome in Panel A is highest completed education (in months) at age 31 with a mean of 160.80 months; the outcome in Panel B is *HS graduate or more*, indicating whether the person has at least 12 years of education by age 31 with a mean of 81.11 percent; the outcome in Panel C is *BA graduate*, indicating whether the person has at least a BA degree by age 31 with a mean of 31.54 percent. $Prob > F1$ reports the p-value from a joint F-test of whether all the estimates in the particular column are equal. $Prob > F2$ reports the p-value from a joint F-test of whether the estimates for the earliest and the last cohorts in the particular column are equal.

Table A6
Interactions between Mother's and Father's Education

	– Grade 9 –		– Age 31 –			
	On Time	GPA	Highest Edu	BA	Em-ployed	Earnings Pct.
	(1)	(2)	(3)	(4)	(5)	(6)
Male	-10.86***	-30.30***	-5.01***	-11.40***	5.59***	1.31***
	(0.60)	(1.38)	(0.39)	(0.59)	(0.55)	(0.41)
Male×Mom HS	0.70	-2.04	-0.95**	-3.73***	-2.18***	-1.50***
	(0.77)	(1.78)	(0.44)	(0.73)	(0.58)	(0.48)
Male×Mom BA	0.22	-1.44	-3.10***	-10.96***	-2.51***	-2.79***
	(0.98)	(2.32)	(0.65)	(1.14)	(0.81)	(0.70)
Male×Dad HS	0.48	-0.84	1.05***	-2.82***	-2.37***	-1.40***
	(0.71)	(1.66)	(0.35)	(0.54)	(0.47)	(0.37)
Male×Dad BA	0.61	3.41	-0.44	-1.84	-3.61***	-2.83***
	(1.32)	(3.01)	(0.77)	(1.33)	(0.99)	(0.83)
Male×Married	0.76**	-1.36*	0.23	-1.39**	0.29	1.27***
	(0.34)	(0.80)	(0.34)	(0.56)	(0.46)	(0.37)
Parental Education-Interactions:						
Male×Mom HS*Dad HS	0.03	0.94	-0.37	1.08	0.39	0.43
	(0.93)	(2.17)	(0.54)	(0.92)	(0.70)	(0.59)
Male×Mom HS*Dad BA	1.34	3.19	1.44	4.19**	2.31*	0.66
	(1.55)	(3.55)	(0.97)	(1.72)	(1.21)	(1.07)
Male×Mom BA*Dad HS	1.02	4.16	-0.55	3.35**	0.65	0.50
	(1.14)	(2.70)	(0.77)	(1.36)	(0.95)	(0.83)
Male×Mom BA*Dad BA	1.79	2.96	2.77***	9.72***	1.63	0.46
	(1.58)	(3.67)	(1.02)	(1.79)	(1.27)	(1.10)
N	335,241	288,667	355,090	355,090	365,676	365,676
Mean of Y	83.38	2.98	164.14	36.58	90.18	54.64
$Prob > F$	0.75	0.32	0.00	0.00	0.38	0.93

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates except for highest educational attainment are multiplied by 100. F-test of whether the additional Male×Mom Edu×Dad Edu interaction terms are jointly equal to zero. The sample consists of the sibling sample born from 1986–1995 for the two grade 9 outcomes and from 1973–1984 for the four age 31 outcomes. *Grade 9 on time* indicates whether the person completed grade 9 by age 16. *GPA* is an average of all grades given during grade 9 both from teacher assessment and final exams for all subjects and is standardized with mean zero and standard deviation of one by year of grade 9 completion for the total population. *Highest completed education* measures the length of highest completed education in months. *BA graduate* indicates whether the person has at least a BA degree. *Employed* takes the value one if the person has positive wage earnings or have employment as the main source of income including self-employment and zero otherwise. *Earnings percentile* measures the annual earnings percentile by gender and year of birth. All models control for family fixed effects, year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), a constant, and dummies for age at observation if not observed at age 31 for the adult outcomes.

Table A7

Interactions between Family Environment and Marital Status at birth

	– Grade 9 –		– Age 31 –			
	On Time	GPA	Highest Edu	BA	Em-ployed	Earnings Pct.
	(1)	(2)	(3)	(4)	(5)	(6)
Male	-10.84***	-31.03***	-3.73***	-8.94***	6.92***	1.65***
	(0.73)	(1.65)	(0.58)	(0.79)	(0.89)	(0.61)
Male×Mom HS	0.94	-1.09	-2.64***	-4.62***	-4.53***	-2.55***
	(0.76)	(1.75)	(0.81)	(1.31)	(1.11)	(0.87)
Male×Mom BA	1.46*	2.11	-4.20***	-9.30***	-3.20***	-2.59***
	(0.83)	(1.96)	(0.94)	(1.57)	(1.21)	(0.98)
Male×Dad HS	-0.18	0.04	0.16	-5.24***	-2.90***	-1.64**
	(0.74)	(1.69)	(0.74)	(1.13)	(1.05)	(0.78)
Male×Dad BA	2.12**	3.95*	0.52	0.21	-3.10**	-2.08*
	(0.94)	(2.19)	(1.10)	(1.86)	(1.41)	(1.16)
Male×Married	0.46	-1.48	-1.25**	-5.10***	-1.49	0.72
	(0.89)	(2.05)	(0.63)	(0.87)	(0.95)	(0.66)
Marital Status at Birth-Interactions:						
Male×Mom HS*Married	-0.23	-0.19	1.71**	1.89	3.11***	1.50*
	(0.90)	(2.10)	(0.85)	(1.39)	(1.15)	(0.91)
Male×Mom BA*Married	-0.59	-1.15	1.60	2.64	1.37	0.12
	(0.98)	(2.33)	(0.99)	(1.67)	(1.27)	(1.04)
Male×Dad HS*Married	1.21	0.52	0.74	3.63***	0.85	0.51
	(0.89)	(2.05)	(0.79)	(1.21)	(1.10)	(0.83)
Male×Dad BA*Married	-0.43	1.37	1.16	3.69*	1.00	-0.50
	(1.10)	(2.59)	(1.16)	(1.97)	(1.48)	(1.23)
N	335,241	288,667	355,090	355,090	365,676	365,676
Mean of Y	83.38	2.98	164.14	36.58	90.18	54.64
$Prob > F$	0.21	0.98	0.04	0.00	0.06	0.33

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates except for highest educational attainment are multiplied by 100. F-test of whether the additional Male×Family Environment×Married interaction terms are jointly equal to zero. The sample consists of the sibling sample born from 1986–1995 for the two grade 9 outcomes and from 1973–1984 for the four age 31 outcomes. *Grade 9 on time* indicates whether the person completed grade 9 by age 16. *GPA* is an average of all grades given during grade 9 both from teacher assessment and final exams for all subjects and is standardized with mean zero and standard deviation of one by year of grade 9 completion for the total population. *Highest completed education* measures the length of highest completed education in months. *BA graduate* indicates whether the person has at least a BA degree. *Employed* takes the value one if the person has positive wage earnings or have employment as the main source of income including self-employment and zero otherwise. *Earnings percentile* measures the annual earnings percentile by gender and year of birth. All models control for family fixed effects, year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), a constant, and dummies for age at observation if not observed at age 31 for the adult outcomes.

Table A8

Robustness of Family Structure: Education and Labor Market Outcomes at Age 31

	Compl Edu		BA		Employed	
	(1)	(2)	(3)	(4)	(5)	(6)
Male	-4.57***	-4.63***	-10.13***	-10.34***	6.01***	5.32***
	(0.40)	(0.47)	(0.60)	(0.71)	(0.56)	(0.65)
Male×Mom HS	-1.11***	-1.05***	-2.88***	-2.66***	-1.76***	-1.65***
	(0.25)	(0.26)	(0.43)	(0.46)	(0.30)	(0.32)
Male×Mom BA	-2.83***	-2.77***	-6.99***	-6.88***	-1.95***	-1.78***
	(0.30)	(0.31)	(0.54)	(0.57)	(0.36)	(0.38)
Male×Dad HS	0.80***	0.61**	-1.99***	-2.09***	-2.16***	-2.09***
	(0.25)	(0.26)	(0.42)	(0.45)	(0.32)	(0.33)
Male×Dad BA	1.53***	1.49***	3.55***	3.97***	-2.27***	-2.22***
	(0.34)	(0.36)	(0.61)	(0.65)	(0.42)	(0.44)
Male×Trad 12	-0.20		-3.83***		-0.40	
Oldest	(0.38)		(0.58)		(0.51)	
Male×Step 12	-0.87		-1.52*		0.05	
Oldest	(0.58)		(0.87)		(0.79)	
Male×Trad 12		0.00		-3.93***		0.14
		(0.45)		(0.69)		(0.61)
Male×Step 12		-0.93		-2.05**		0.80
		(0.68)		(1.04)		(0.93)
N	355,090	317,649	355,090	317,649	365,676	327,055
Mean of Y	164.14	165.05	36.58	37.52	90.18	90.65
Sample:						
All Siblings	X		X		X	
Only Same FS12		X		X		X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates except for highest educational attainment are multiplied by 100. The sample consists of the sibling sample born from 1973–1984. The *All Siblings* sample tests the robustness of the main results by using family structure at age 12 of the oldest child instead of the youngest. The sample of *Only Same FS12* tests the robustness of the main results by only using the sample of families in which children experience the same family structure at age 12. *Highest completed education* measures the length of highest completed education in months. *BA graduate* indicates whether the person has at least a BA degree. *Employed* takes the value one if the person has positive wage earnings or have employment as the main source of income including self-employment and zero otherwise. *Earnings percentile* measures the annual earnings percentile by gender and year of birth. All models control for family fixed effects, year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant.

Table A9

Total Population vs Siblings: Grade 9

Dependent Var.	Grade 9 On Time						GPA					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A												
Male	-9.30***	-9.82***	-8.86***	-8.71***	-8.97***	-9.07***	-29.64***	-30.05***	-30.93***	-31.57***	-30.41***	-30.76***
	(0.09)	(0.35)	(0.12)	(0.19)	(0.15)	(0.15)	(0.26)	(0.98)	(0.35)	(0.66)	(0.37)	(0.36)
Panel B												
Male	-11.42***	-10.88***	-11.28***	-11.61***	-11.05***	-11.03***	-27.07***	-25.50***	-29.31***	-28.63***	-29.86***	-31.11***
	(0.26)	(0.84)	(0.38)	(0.61)	(0.47)	(0.48)	(0.67)	(2.33)	(1.01)	(1.82)	(1.12)	(1.10)
Male×Mom HS	0.56**	-0.55	0.89***	0.78	0.94**	0.80*	-3.00***	-4.72**	-1.87**	-1.68	-1.87*	-1.20
	(0.24)	(0.86)	(0.32)	(0.54)	(0.40)	(0.41)	(0.64)	(2.31)	(0.90)	(1.65)	(0.99)	(0.96)
Male×Mom BA	0.83***	0.26	0.80**	0.32	1.20***	1.07**	-2.26***	-6.27**	-0.43	-1.45	0.45	1.28
	(0.27)	(0.98)	(0.35)	(0.58)	(0.43)	(0.45)	(0.72)	(2.62)	(0.98)	(1.81)	(1.09)	(1.06)
Male×Dad HS	0.80***	0.28	0.79**	1.00*	0.65	0.65	-1.98***	-1.34	-1.66*	-3.24**	-0.45	0.39
	(0.24)	(0.83)	(0.32)	(0.54)	(0.40)	(0.41)	(0.64)	(2.24)	(0.90)	(1.65)	(0.98)	(0.96)
Male×Dad BA	2.53***	2.84***	2.45***	3.35***	1.75***	1.71***	2.32***	4.53	2.53**	0.90	3.87***	4.95***
	(0.29)	(1.10)	(0.39)	(0.63)	(0.48)	(0.49)	(0.80)	(2.92)	(1.08)	(1.98)	(1.20)	(1.16)
Male×Married	1.22***	1.44**	1.13***	1.66***	0.77**	0.76**	-1.65***	-3.19*	-1.40*	-2.04	-1.06	-1.35*
	(0.18)	(0.72)	(0.26)	(0.42)	(0.34)	(0.34)	(0.50)	(1.90)	(0.74)	(1.31)	(0.82)	(0.80)
N	579,049	42,836	335,241	143,083	192,158	335,241	524,330	38,431	288,667	123,252	165,415	288,667
Mean of Y	82.45	80.59	83.38	83.48	83.31	83.38	-1.41	4.18	2.98	4.63	1.74	2.98
Sample:												
Total Population	X						X					
One-Child Families		X						X				
Sibling Sample:												
All Sibs			X			X			X			X
Same Sex Sibs				X						X		
Mixed Sex Sibs					X						X	
Estimation:												
OLS	X	X	X	X	X		X	X	X	X	X	
FE						X						X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. All samples consist of children born from 1986–1995. Estimates from each column in each panel come from separate regressions. *Grade 9 on time* indicates whether the person completed grade 9 by age 16. *GPA* is an average of all grades given during grade 9 both from teacher assessment and final exams for all subjects and is standardized with mean zero and standard deviation of 1 by year of grade 9 completion for the total population. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), and a constant. All OLS models additionally control for family size dummies, parental immigrant status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

Table A10

Total Population vs Siblings: Age 31

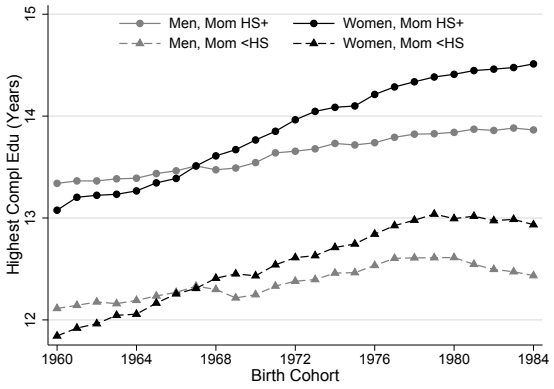
Dependent Var.	Highest Compl Edu (Months)						Employed					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A												
Male	-5.37***	-5.78***	-5.37***	-5.51***	-5.25***	-5.20***	2.86***	1.84***	2.79***	2.55***	2.96***	2.95***
	(0.07)	(0.24)	(0.09)	(0.16)	(0.11)	(0.10)	(0.08)	(0.27)	(0.10)	(0.15)	(0.13)	(0.13)
Panel B												
Male	-5.08***	-4.63***	-5.16***	-5.62***	-4.78***	-4.98***	4.79***	2.75***	4.76***	3.58***	5.64***	5.49***
	(0.17)	(0.53)	(0.30)	(0.52)	(0.36)	(0.36)	(0.22)	(0.63)	(0.39)	(0.61)	(0.50)	(0.51)
Male×Mom HS	-1.29***	-1.31**	-1.36***	-1.47***	-1.27***	-1.11***	-1.48***	-0.40	-1.70***	-1.60***	-1.76***	-1.80***
	(0.15)	(0.54)	(0.21)	(0.35)	(0.25)	(0.25)	(0.18)	(0.64)	(0.23)	(0.36)	(0.30)	(0.30)
Male×Mom BA	-3.00***	-2.87***	-2.98***	-2.94***	-3.00***	-2.82***	-1.75***	-1.24	-1.80***	-1.66***	-1.88***	-1.96***
	(0.19)	(0.65)	(0.25)	(0.44)	(0.30)	(0.30)	(0.22)	(0.77)	(0.28)	(0.44)	(0.35)	(0.36)
Male×Dad HS	0.34**	-0.51	0.71***	0.68*	0.74***	0.79***	-1.39***	0.32	-1.50***	-0.63	-2.11***	-2.19***
	(0.16)	(0.54)	(0.21)	(0.37)	(0.25)	(0.25)	(0.19)	(0.64)	(0.24)	(0.39)	(0.31)	(0.32)
Male×Dad BA	1.05***	0.07	1.24***	0.79	1.56***	1.53***	-2.08***	-1.81**	-2.28***	-2.21***	-2.30***	-2.30***
	(0.22)	(0.73)	(0.29)	(0.50)	(0.35)	(0.34)	(0.25)	(0.86)	(0.32)	(0.51)	(0.41)	(0.42)
Male×Married	0.66***	0.46	0.44	0.92*	0.03	0.21	0.21	-0.42	0.40	0.89	-0.02	0.25
	(0.15)	(0.46)	(0.28)	(0.48)	(0.34)	(0.34)	(0.18)	(0.55)	(0.35)	(0.54)	(0.45)	(0.46)
N	632,508	54,627	355,090	148,725	206,365	355,090	643,219	55,619	365,676	153,201	212,475	365,676
Mean of Y	162.97	163.61	164.14	164.54	163.86	164.14	89.54	88.09	90.18	90.67	89.84	90.18
Sample:												
Total Population	X						X					
One-Child Families		X						X				
Sibling Sample:												
All Sibs			X			X			X			X
Same Sex Sibs				X						X		
Mixed Sex Sibs					X						X	
Estimation:												
OLS	X	X	X	X	X		X	X	X	X	X	
FE						X						X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates for employment are multiplied by 100. All samples consist of children born from 1973–1984. Estimates from each column in each panel come from separate regressions. *Highest completed education* measures the length of highest completed education in months. *Employed* takes the value one if the person has positive wage earnings or have employment as the main source of income including self-employment and zero otherwise. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant. All OLS models additionally control for family size dummies, parental immigrant status, and those variables of family environment that are interacted with the male dummy, and the FE models control for family fixed effects.

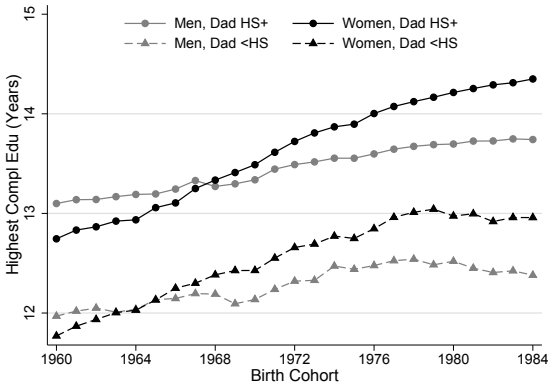
B Not for Publication

Figure B1
Highest Completed Education (Years) at age 31 by Gender and Parental Education in Denmark

(a) By Mother's Education

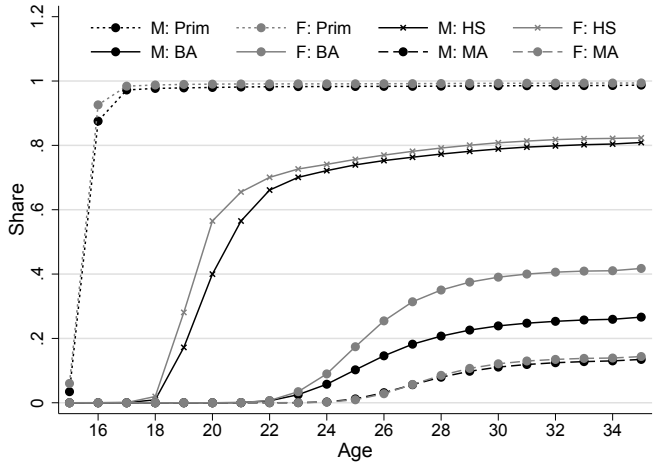


(b) By Father's Education



Note: Highest completed education in years by birth cohort (1960–1984) and gender for people living in Denmark. Parental education is grouped as having less than 12 years of education ($< HS$) or more ($HS+$)

Figure B2
Educational Attainment in Denmark by Age and Gender



Note: Share of individuals (birth cohorts 1973–1984) with the specified educational level or more to each age from 15–35 years. The category *HS* covers academic high school and vocational training with a length of at least 12 years.

Table B1

SES Index: Educational Attainment at age 31

	(1)	(2)	(3)
Male	-5.44***	-5.40***	-5.19***
	(0.07)	(0.09)	(0.10)
Male×SES	-0.50***	-0.44***	-0.30***
	(0.07)	(0.09)	(0.10)
N	632508	355090	355090
Mean of Y	162.97	164.14	164.14
Sample:			
Total Population OLS	X		
Sibling Sample OLS		X	
Sibling Sample FE			X

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The sample consists of individuals born from 1973–1984. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), dummies for age at observation if not observed at age 31, and a constant. All OLS models additionally control for family size dummies, parental immigrant status, and the SES index, and the FE model control for family fixed effects. The SES index is the first component from a principal components analysis of length of maternal (load 0.70) and paternal education (load 0.70) and marital status (load 0.16) at birth with eigenvalue 1.42; it is standardized with mean zero and standard deviation of one.

Table B2

Family Income: Grade 9 Outcomes

	Grade 9 On Time			Grade 9 GPA		
	(1)	(2)	(3)	(4)	(5)	(6)
Male	-8.99***	-15.82***	-15.43***	-30.60***	-37.58***	-36.64***
	(0.16)	(4.35)	(4.37)	(0.37)	(10.32)	(10.32)
Male×Log(Income)		0.55	0.38		0.56	0.45
		(0.35)	(0.35)		(0.83)	(0.83)
Male×Mom HS			0.51			-1.11
			(0.44)			(1.02)
Male×Mom BA			1.05**			1.64
			(0.47)			(1.12)
Male×Dad HS			0.49			-0.10
			(0.43)			(1.00)
Male×Dad BA			1.52***			4.51***
			(0.51)			(1.21)
Male×Married			0.77**			-0.99
			(0.36)			(0.83)
N	306,070	306,070	306,070	265,651	265,651	265,651
Mean of Y	83.88	83.88	83.88	5.70	5.70	5.70

Standard errors in parentheses, clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All estimates are multiplied by 100. The sample is the sibling sample with individuals born from 1986–1995. *Grade 9 on time* indicates whether the person completed grade 9 by age 16. *GPA* is an average of all grades given during grade 9 both from teacher assessment and final exams for all subjects and is standardized with mean zero and standard deviation of one by year of grade 9 completion for the entire population. All models control for year of birth dummies, month of birth dummies, birth order dummies, maternal age at birth (linear, squared, and cubed), a constant, and family fixed effects. *Log(Income)* is the natural logarithm of the sum of the mother's and father's disposable income the year before the birth of their first child.