Who Gets to Have It All? The Unequal Reversal of the Education–Fertility Gradient *

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November 3, 2026

Abstract

We examine how the reversal of the education–fertility gradient varies with socioeconomic background and which fertility margins drive it. Using Danish registers, we link completed fertility and education to paternal income rank for women born 1958–1977. Completed fertility among highly educated women, once well below that of low-educated women, now exceeds it. The reversal is concentrated among women from the upper half of the paternal-income distribution. In the lowest quartile, the gradient flattens but remains negative. Decompositions show that changes in the socioeconomic composition of education groups do not explain the reversal, which instead occurs within education-by-background groups. The reversal is driven by entry into motherhood. Relative to less-educated women, highly educated women become more likely to have a first child in every background group, especially the advantaged, while their fertility conditional on motherhood declines in less advantaged groups. Combining higher education with motherhood remains unequal across backgrounds.

Keywords: fertility; education; socioeconomic status; completed fertility; intergenerational inequality

JEL codes: J13; I24; J12

*This work has greatly benefited from the feedback of seminar participants at the Gender and Family Workshop 2025 (University of Mannheim), and in particular from insights from the organizer Michele Tertilt. A special thank you to Efi Adamopoulou, Joseph Kopecky, and Astrid Kunze for their useful comments. All errors are our own.

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1 Introduction

Persistently low fertility has become a first-order policy concern across high-income countries. Yet national fertility rates can conceal substantial shifts in who has children. In many countries, the historically negative relationship between women's education and fertility has weakened or even reversed, suggesting that higher education and motherhood have become increasingly compatible. This development has sometimes been interpreted as a hopeful sign that fertility decline may eventually abate (Esping-Andersen and Billari, 2015; Myrskylä et al., 2009). Whether that interpretation is warranted, however, depends on what changes underlie the aggregate shift – a question that matters both for projecting future fertility and for understanding how changes in childbearing are distributed across socioeconomic groups. We show that this apparent compatibility is far from universal. In Denmark, the reversal is concentrated among women from advantaged family backgrounds, for whom higher education and motherhood no longer appear to be competing choices. Moreover, it is driven primarily by changes in who becomes a mother, rather than by changes in family size among mothers.

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[old:]Most of this literature treats education groups as stable social categories, comparing the fertility of, for example, university-educated women across cohorts (Hazan and Zoabi, 2015; Jalovaara et al., 2019; Kravdal and Rindfuss, 2008). As higher education expands, however, the women who make up these groups change as well. In our sample, the share of women aged 45–48 with a graduate degree rose from 2 percent in 1990 to 17 percent in 2022. A weakening education–fertility gradient may therefore reflect not only changes in fertility within education groups, but also changes in who those groups contain. A smaller literature has examined how social origin shapes fertility among women with similar levels of education at a point in time (Adamecz et al., 2025; Mooyaart et al., 2022; Nisén et al., 2014). Here, we focus instead on how these patterns have changed across cohorts. We ask whether the reversal of the education–fertility gradient has been broad-based, or whether it has been concentrated among women from advantaged family backgrounds.

[NEW:]Most of this literature compares fertility across cohorts within the same educational categories, for example, university-educated women (Hazan and Zoabi, 2015; Jalovaara et al., 2019; Kravdal and Rindfuss, 2008). As higher education expands, however, the women who make up these groups change as well. In our sample, the share of women aged 45–48 with a graduate degree rose from 2 percent in 1990 to 17 percent in 2022. A weakening education–fertility gradient may therefore reflect not only changes in fertility within education groups, but also changes in who those groups contain. A smaller literature has examined how family background shapes the education–fertility relationship at a point in time. Among Finnish women born 1940–1950, measured family characteristics and sister fixed effects explain only part of the negative gradient (Nisén et al., 2014), whereas among Swedish women born 1935–1972 most of it disappears within twin pairs (Kramarz et al., 2023). In Britain, first-in-family graduates have lower completed fertility than graduates with university-educated parents, primarily through greater childlessness (Adamecz et al., 2025). Studies that follow social origin across cohorts have focused on early family formation rather than completed fertility (Mooyaart et al., 2022). Here, we focus instead on

how the role of family background in the education–fertility gradient has changed across cohorts. Given the importance of family background for the gradient at a point in time, changes in the social composition of education groups are a natural candidate explanation for its reversal. We ask whether the reversal can be explained by such compositional change, and whether it has been broad-based or concentrated among women from advantaged family backgrounds.

To answer these questions, we use Danish administrative registers covering the universe of women observed at the end of their reproductive lives, at ages 45–48, between 1990 and 2022. Throughout the paper, we label cohorts by the year in which completed fertility is observed: for example, "women in 2006" refers to women observed at ages 45–48 in 2006, not to births occurring in 2006. We link each woman to her father and measure social origin by his position in the income distribution during her early adulthood: fathers are ranked into quartiles within age-specific income distributions. Because this measure is relative, each population quartile identifies the same segment of the age-specific male income distribution across cohorts, even as income levels and inequality change. Paternal income rank therefore provides a consistently defined measure of relative social origin across cohorts, in contrast to education groups, whose size and social composition have changed substantially over time. Because parental links are available only for women born in 1958 or later, the analysis by social origin covers cohorts observed at ages 45–48 from 2006 onward, while the education-based analysis, which does not require parental links, extends back to 1990. This shorter period nevertheless captures the central shift we study: between 2006 and 2022, the education–fertility gradient flattens and reverses.

Our analysis yields three main findings. First, the reversal of the education–fertility gradient is not explained by changes in the socioeconomic composition of education groups. Although higher education has expanded substantially, decompositions show that changing selection into education does not account for the shift and, if anything, works against it. Instead, the change occurs within education-by-background groups.

Second, the reversal is strongly stratified by socioeconomic background. The education–fertility gradient rises across the socioeconomic distribution, but the reversal is concentrated among women from the upper half. Among women from the lowest paternal-income quartile, the gradient flattens over time but remains negative. The aggregate reversal therefore masks substantial differences in the extent to which higher education and motherhood have become compatible across family backgrounds.

Third, the reversal is driven by entry into motherhood rather than by family size among mothers. Highly educated women become increasingly likely to enter motherhood relative to women with low education in all paternal-income groups, particularly

among those from advantaged backgrounds. Among mothers, however, higher education does not become associated with larger families. If anything, the education gradient in family size becomes more negative, particularly among women from lower socioeconomic backgrounds. In the lowest paternal-income quartile, this decline offsets the rise in motherhood, which is why the education gradient in completed fertility remains negative there. The reversal in completed fertility is therefore a story about who becomes a mother, rather than about highly educated mothers having more children.

Higher education and childbearing compete for time over the life course. Longer education postpones family formation, and delayed entry into motherhood has historically translated into greater childlessness among highly educated women. Our findings suggest that the growing compatibility between prolonged education and motherhood has been uneven across socioeconomic backgrounds. Several developments could have made later family formation more feasible, including expansion of market-based childcare and household services (Bar et al., 2018; Hazan and Zoabi, 2015), greater work–family compatibility and changes in household bargaining (Doepke and Kindermann, 2019), and advances in assisted reproduction (Groes et al., 2024). At the same time, the ability to take advantage of these developments may depend on resources that extend beyond a woman's own education: family income, flexible employment, suitable housing, family support, networks, and informal care. Consistent with this interpretation, the growing compatibility between higher education and motherhood is concentrated among women from advantaged family backgrounds. Public childcare reduces many of the costs of childbearing in a Nordic welfare state (Rindfuss et al., 2010), but universal provision need not eliminate inequalities in the private resources that help women combine prolonged education with family formation. Even in Denmark, the ability to combine prolonged education with eventual motherhood remains socially stratified.

The remainder of the paper is organized as follows. Section 2 describes fertility trends, education, and family policy in Denmark. Section 3 presents the data and empirical approach. Section 4 documents the changing education–fertility gradient and the expansion of higher education across socioeconomic backgrounds. Section 5 decomposes changes in fertility within education groups into a composition component and a within-cell component. Section 6 examines heterogeneity across socioeconomic background and education, and Section 7 separates the extensive and intensive margins of fertility. Section 8 concludes.

2 Fertility, Education and Family Policies in Denmark

2.1 Fertility trends

Denmark's period total fertility rate (TFR) has remained below replacement level since 1969. After reaching a historic low of 1.38 in 1983, it recovered to approximately 1.7–1.9 during the 1990s and 2000s, before declining sharply after 2021 to 1.50 in 2023 (Statistics Denmark, 2026b). As in other high-income countries, childbearing has been increasingly postponed. The mean age at first birth rose from about 26.3 years in 1990 to 30.4 years in 2025 (Statistics Denmark, 2026c), while the share of first-time mothers under age 25 fell from 63 percent in 1973 to just 12 percent in 2022 (Danmarks Statistik, 2023). Despite these shifts in the timing of childbearing, completed cohort fertility has remained considerably more stable than the period TFR. It declined modestly from about 1.9 children per woman for the 1950 birth cohort to a low of 1.84 for cohorts born in the mid-1950s, before rising to nearly 2.0 among women born in the late 1960s and early 1970s (Human Fertility Database, 2026).

2.2 Education and gender equality

Denmark ranks among the most highly educated and gender-equal countries in the world (see, e.g., European Institute for Gender Equality, 2025; OECD, 2025). Educational attainment has expanded substantially over recent decades, particularly among women, who overtook men in higher-education attainment during the 1990s and now account for a clear majority of university degree holders (Esteve et al., 2012; Statistics Denmark, 2026d). Access to education entails essentially no direct private cost. Education is tuition-free at all levels, and students in post-secondary education are entitled to a public study grant (SU) to help cover living expenses. From age 20, eligibility for the grant is independent of parental income, although it is conditional on satisfactory study progress and limited to the prescribed duration of the program plus a margin (Nielsen et al., 2010). Alongside high educational attainment, Denmark has one of the highest female labor force participation rates in the OECD, and dual-earner households have been the norm since at least the 1980s (Kleven et al., 2019; OECD, 2025). A substantial share of employed women work in the public sector, where working conditions tend to offer greater flexibility and job security (Kleven et al., 2019; Nielsen et al., 2004; Pertold-Gebicka et al., 2016).

2.3 Family policy and health care

Denmark has one of the most generous family policy systems in the OECD, with public spending on family benefits well above the OECD average and more than half of this spending directed toward services rather than cash transfers (OECD, 2024; Thévenon, 2011). The foundations of this system were established during the 1970s and 1980s, when subsidized public childcare expanded rapidly (Datta Gupta and Simonsen, 2010). Today, around 90 percent of children aged 1–2 are enrolled in childcare (Statistics Denmark, 2026a), and since the mid-2000s, municipalities have been legally required to guarantee a childcare place from the age of 26 weeks until school entry (Børne- og Undervisningsministeriet, 2021). Paid parental leave has also been expanded repeatedly, most notably in 2002, when the total entitlement around childbirth was extended from 32 to 52 weeks (Beuchert et al., 2016). Child benefits were fully universal for most of the period and remain nearly universal, despite the introduction of income-related reductions for high-income families in 2014 (Højbjerre Brauer Schultz, 2017). These family policies are complemented by a universal, tax-financed healthcare system that provides physician and hospital services, including maternity care, free at the point of use, while prescription medications are subject to subsidized co-payments. Publicly funded fertility treatment has also generally been available free of charge to women below an age limit seeking their first child, apart from a brief period of user charges in 2011–12. Since December 2024, coverage has been extended to treatment for a second child (Indenrigs- og Sundhedsministeriet, 2024).

2.4 Assisted reproduction

Denmark was an early adopter of assisted reproductive technology (ART) and has among the highest utilization rates in the world: by 2007, close to five percent of children born in Denmark were conceived through ART, and the share has risen further since. Throughout most of the period, public fertility clinics offered treatment free of charge for up to three IVF cycles for a first child, subject to an age limit of 40 at public clinics; treatment at private clinics is available at the patient's expense up to age 45. Furthermore, access has significantly broadened over time and from 2007, single women and women in same-sex couples gained access to treatment by physicians, including at public clinics (Indenrigs- og Sundhedsministeriet, 2006). A co-payment for public fertility treatment was introduced in January 2011 and abolished from January 2012 (Ministeriet for Sundhed og Forebyggelse, 2012). Public funding was expanded substantially in 2024: the number of funded attempts for a first child was doubled from three to six, and from December 2024 treatment for a second child also became free of charge. However, even within this universal system, socioeconomic gradients in both

the use of and success with ART persist (Groes et al., 2024).

3 Data and Empirical Approach

Our analysis draws on administrative register data maintained by Statistics Denmark, covering the entire population residing in Denmark. Every resident is assigned a unique personal identifier at birth or immigration, which allows individual records to be linked across registers and over time—and, crucially for our purposes, across generations, since the identifiers of parents are recorded for each individual.[1] We combine information on demographics, completed childbearing, educational attainment, and income. Income is measured as total gross personal income, which includes earnings, public transfers, private pensions, and capital income, before taxes. Because the data are collected for administrative purposes, they are free of the self-reporting error, sampling variation, and selective attrition that affect survey-based fertility measurements. Population coverage is particularly valuable for our design: it allows us to observe completed fertility for entire cohorts of women, to link women to their fathers, and to measure fathers' positions in the full national income distribution.

We construct nine cohorts of women observed at ages 45–48, at four-year intervals from 1990 to 2022. Observing women at these ages means we measure *completed* fertility, capturing the family size women ultimately attain. For brevity, we refer to cohorts by their fertility-observation year. Thus, the "2006 cohort" consists of women aged 45–48 in 2006, whose completed fertility is measured in that year. The women in our earliest cohort, born 1942–1945, largely completed their childbearing during the 1960s–1980s; those in our most recent cohort, born 1974–1977, did so from the 1990s through the early-2020s. The institutional environment described in Section 2 is thus the one these women faced while making their fertility and education decisions.

3.1 Sample

We restrict the analysis to women without an immigrant background. This restriction is necessary for the social-origin analysis because the Danish registers cover only residents of Denmark, and therefore do not consistently observe the identity or income of fathers living abroad. We apply the same restriction throughout so that the education- and social-origin analyses refer to a common population. Women without an immigrant background account for 84–97 percent of each cohort, leaving analytical samples of between 126,366 and 150,091 women per cohort. The restriction is nevertheless

[1] We combine the population registers (BEF and FAIN), which also include parental links, the education register (UDDA), and the income register (IND). Income data are available from 1980 onward.

consequential for the descriptive patterns: women with an immigrant background are disproportionately represented in the lowest education group, and their fertility differs from that of non-immigrant women with similar levels of education. Descriptive checks for the full population, presented in Section 4.1, show that the education–fertility gradient at the bottom of the education distribution is noticeably affected by the inclusion of immigrant women. This further motivates our focus on a consistently defined population across all analyses.

For the socioeconomic analysis, we further restrict to women whose father can be identified in the registers. The parental-link register records paternal identifiers even for deceased fathers, provided the father resided in Denmark. This father-linked sample covers 92–99 percent of the non-immigrant sample across cohorts born in 1958 or later.Appendix Table A.2 reports the number of women in each education-by-paternal-income cell for each observation cohort.

Table 1 summarizes the cohort structure and the timing of fertility and paternal-income measurement. Paternal income is averaged over five consecutive calendar years, beginning 26 years before the fertility observation, when women are aged 19–22, and ending when they are aged 23–26.

Table 1: Cohort structure and timing of fertility and paternal-income measurement

Birth cohort	Fertility measurement year	Share immigrants	Share non-immigrants with paternal income info.	Paternal-income years
1942–1945	1990	0.03	-	-
1946–1949	1994	0.04	-	-
1950–1953	1998	0.05	-	-
1954–1957	2002	0.06	-	-
1958–1961	2006	0.07	0.92	1980–1984
1962–1965	2010	0.08	0.97	1984–1988
1966–1969	2014	0.11	0.98	1988–1992
1970–1973	2018	0.13	0.99	1992–1996
1974–1977	2022	0.16	0.99	1996–2000

Notes: Fertility is measured at ages 45–48. Parental links are available only for women born in 1958 or later; earlier cohorts are used only in the education-based analysis. Data on paternal income are available starting from 1980. Paternal income is averaged over the five-year window shown in the last column, beginning 26 years before the fertility observation, when women are aged 19–22, and ending when they are aged 23–26. The share with paternal income information is the fraction of non-immigrant women for whom paternal income is observed.

3.2 Education

Educational attainment is measured at the time each woman is observed, at ages 45–48, and grouped into four categories: (i) mandatory schooling (*Grundskole*, fewer than

12 years of education); (ii) high school or vocational education (12–14 years); (iii) bachelor/professional education (15 years, corresponding to bachelor and professional degrees)[2]; and (iv) graduate education (more than 16 years, corresponding to master's degrees and above). Two features of the Danish education system are worth noting. First, education is tuition-free at all levels, and students in post-secondary education receive a universal, non-means-tested public study grant (SU), so the direct private cost of education is close to zero. Second, the bachelor/professional category (15 years) includes the large professional-bachelor programs, such as nursing, teaching, and pedagogy.

3.3 Completed fertility

Completed fertility is measured by linking each woman to all children recorded in the population register through the parental identifiers. Because we observe women at ages 45–48, subsequent childbearing is negligible. We study three outcomes: completed fertility (the number of children ever born); the extensive margin (an indicator for having at least one child); and the intensive margin (the number of children conditional on motherhood).

3.4 Measuring socioeconomic origin

We measure a woman's socioeconomic origin using her father's income rank during her early adulthood. To reduce the influence of temporary income fluctuations, we average paternal income over five consecutive calendar years, beginning when women are aged 19–22 and ending when they are aged 23–26. For example, for women whose fertility is observed in 2006, paternal income is averaged over 1980–1984. For the oldest women in the socioeconomic analysis, this is the earliest five-year window available in the income registers. This period overlaps with important educational decisions and, for most women, even in the oldest observation cohort, it precedes entry into motherhood.

We rank fathers into quartiles within age-specific cohort income distributions constructed from all men residing in Denmark in the relevant years. This age adjustment is important because fathers of same-aged daughters may be at very different stages of the earnings life cycle (see Appendix Figure A.4 for the distribution of fathers' age). Without it, differences in income could reflect paternal age rather than socioeconomic position. The resulting measure captures the father's relative income position among

[2]Education groups are based on the level of the highest completed degree, and the years of education are approximate. The bachelor/professional category includes university bachelor's degrees, which typically take three years after upper secondary school, and professional bachelor's degrees, which typically take 3.5 years, with some programs, such as teacher training, taking four years. Very few women have degrees corresponding to exactly 16 years of education.

similarly aged men, for the same cohort of daughters, and therefore provides a consistently defined measure of socioeconomic origin across cohorts. Unlike education groups, whose size and social composition have changed substantially as higher education has expanded, paternal-income quartiles retain the same relative interpretation over time.[3] This allows us to compare fertility gradients across cohorts without conflating changes in fertility with shifts in the boundaries or social meaning of the groups being compared. Using paternal rather than the woman's own income also distinguishes resources in the family of origin from her own economic circumstances, which may reflect her education, family-formation, and labor-market choices.

We interpret paternal income rank as a summary measure of socioeconomic background and refer to it as socioeconomic status (SES) throughout. It is likely to capture economic resources and potential transfers, housing support, networks and information, preferences transmitted within the family, and partner-market advantages. We use paternal rather than maternal or household income because mothers' incomes in the relevant years (1980–2000) largely reflect their labor supply choices and are less comparable across cohorts; ranking by father income follows standard practice in the intergenerational mobility literature.[4]

Because parental links are available only for women born in 1958 or later, paternal income can be constructed only for cohorts observed from 2006 onward. For the oldest observation cohort, whose fertility is measured in 2006, paternal income is averaged over 1980–1984, the earliest five-year window available in the income registers. The socioeconomic analysis therefore covers the five cohorts observed between 2006 and 2022, while the education-based analysis covers all nine cohorts from 1990.

3.5 Empirical approach

The main purpose of our empirical analysis is to distinguish among competing explanations for the reversal of the education–fertility gradient. Because the social composition of education groups has changed substantially as higher education has expanded, we ask whether the reversal reflects changes in who comprises each education group or changes in fertility within education-by-SES cells. We then examine whether these within-group changes are broad-based across social origins or concentrated among particular groups. Finally, we separate the extensive and intensive margins of fertility, asking whether the

[3]Because fathers are ranked within the income distribution of all similarly aged men residing in Denmark, and not only among fathers in our sample, women are not necessarily distributed uniformly across paternal-income quartiles. Fathers of daughters in our sample may differ in income from men without children, and fathers with several daughters in the same cohort are counted more than once. The quartiles nevertheless retain the same relative interpretation across cohorts, since each is defined by the same position in the age-specific income distribution of men.

[4]See, e.g., Landersø and Heckman (2017) for Denmark.

reversal is driven by changes in who becomes a mother or by changes in family size among mothers.

We address these possibilities in several steps. We begin by documenting changes in completed fertility by education across cohorts and comparing the education–fertility gradient with the corresponding gradient by paternal income rank. We then decompose changes in completed fertility within each education group into a component attributable to shifts in its socioeconomic composition and a component attributable to changes in fertility within education-by-SES cells. Next, we examine heterogeneity in both directions, estimating education gradients within paternal-income quartiles and paternal-income gradients within education groups. Finally, we separate the extensive and intensive margins of fertility, asking whether the reversal reflects changes in who becomes a mother or changes in the number of children mothers have.

Together, these analyses identify the groups and demographic margins that generate the aggregate reversal and clarify whether it reflects changing selection into education or changing fertility within groups. The analysis is descriptive rather than causal: we do not estimate the causal effects of education or social origin on fertility, nor do we identify the specific mechanisms underlying the observed changes. Instead, we establish which empirical margins account for the reversal and thereby narrow the set of plausible explanations.

4 Main Descriptive Patterns

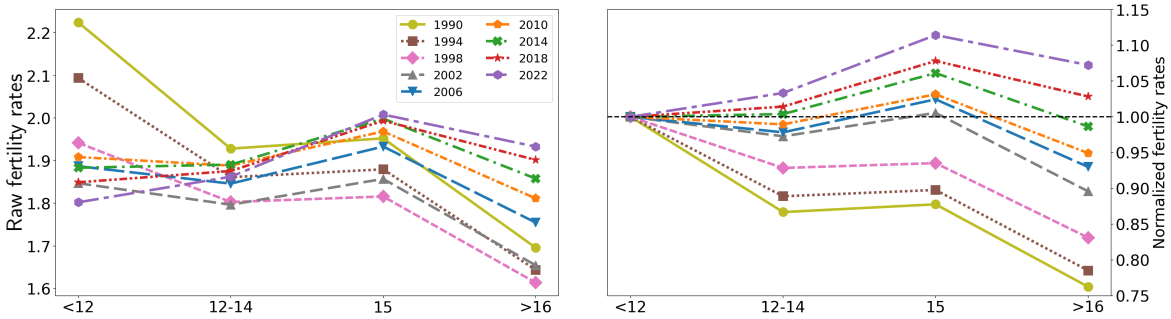
4.1 The changing education–fertility gradient

Figure 1 shows the evolution of completed fertility across education groups and observation cohorts for women without an immigrant background. Panel (a) reports fertility levels, while Panel (b) reports normalized fertility, with fertility among women with mandatory schooling in the same cohort set to one. The historically negative education–fertility gradient weakens substantially over time and eventually reverses. Fertility among women with graduate education rises from 1.69 children in the 1990 observation cohort to 1.93 in the 2022 observation cohort, while fertility among women with mandatory schooling falls from 2.22 to 1.80. By the most recent cohorts, highly educated women have higher completed fertility than women with mandatory schooling in the same observation cohort, reversing the gradient observed in 1990.

Figure 1: Completed fertility by education

(a) Raw fertility rates

(b) Normalized fertility rates



Notes: Panel (a) reports completed fertility by education group and observation cohort. Panel (b) reports completed fertility relative to women with mandatory schooling in the same cohort. The sample consists of women without an immigrant background aged 45–48. Education groups are (i) mandatory schooling (< 12 years), (ii) high school or vocational education (12–14 years), (iii) bachelor/professional education (15 years), and (iv) graduate education (> 16 years). The underlying values are reported in Appendix Table A.1.

The gradient is not monotonic and its shape changes across cohorts. In the earliest cohorts, completed fertility is highest among women with mandatory schooling. From the mid-2000s onward, however, fertility is highest among women in the bachelor/professional (15-year) category, which includes the large professional-bachelor programs in nursing, teaching, and pedagogy. Fertility in this group also increases from the late 1990s onward, but the largest changes occur at the two ends of the education distribution: fertility falls sharply among the least educated, while it rises strongly among women with graduate education. These opposing movements flatten and eventually reverse the overall education–fertility gradient, while the bachelor/professional group remains the peak of the distribution in the more recent cohorts. Appendix Table A.1 reports the underlying levels for all four education groups.

The Danish pattern resembles the changes documented in other high-income countries. In order to compare changes in fertility rates across education groups over time, we follow Doepke et al. (2023) and construct the normalized fertility presented in Figure 1b where cohort fertility rates for all educations are divided by the fertility rate of the mandatory education group in the cohort. Doepke et al. (2023) show that the historically negative education–fertility gradient has weakened across most high-income countries, while typically remaining negative. Denmark appears to be further along this transition. In our sample, the gradient has crossed one, with women at the top of the education distribution now having 7 percent higher completed fertility than women at the bottom. In this sense, Denmark—along with its Nordic neighbors (Jalovaara et al., 2019)—lies at the leading edge of the "new era."

Comparing our results to other countries, we explore how our selection criteria affect the fertility gradient. In the full resident population, including immigrant women,

graduate fertility remains below mandatory-schooling fertility (Appendix Figure A.1) but still flattens over cohorts. Because paternal income cannot be observed consistently for immigrant women, we exclude them from the main analysis and use the same sample throughout the paper. We show in Appendix Figure A.2 that excluding women without a linked father does not change normalized fertility.

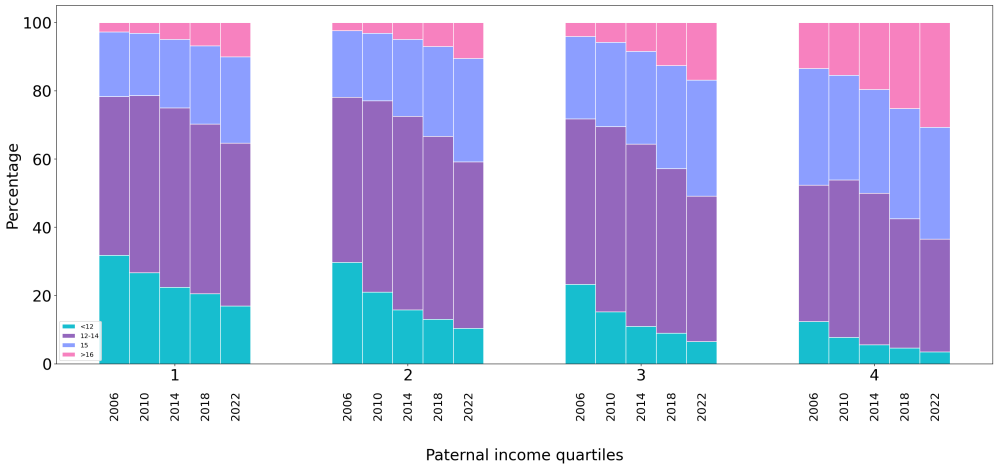
Some differences in the shape of the gradient across countries may also reflect differences in how educational qualifications map across education systems. The Danish gradient is not monotonic, with completed fertility highest among women with professional bachelor's degrees, a group that includes female-dominated, largely public-sector fields such as teaching, nursing, and early-childhood pedagogy. These degrees occupy a different position in the Danish education system than in the United States, where some comparable occupations are spread across associate, bachelor's, and graduate levels.[5]

4.2 Educational expansion across socioeconomic status

Figure 2 documents the large expansion of higher education across observation cohorts, separately by paternal-income quartile. In all quartiles, the share of women with only mandatory schooling declines sharply, while the shares attaining bachelor/professional and graduate education rise. Among women from the lowest paternal-income quartile, the share with only mandatory schooling falls from 32 percent in the 2006 observation cohort to 18 percent in the 2022 observation cohort, while among women from the highest paternal-income quartile it falls from 13 percent to 4 percent. Over the same period, the share attaining graduate education rises in all four groups.

[5]Comparisons with U.S. evidence are not exact. Doepke et al. (2023) report normalized hybrid rather than completed fertility. Moreover, although Danish professional bachelor's degrees and U.S. bachelor's degrees are both classified at ISCED level 6, the occupations they lead to sit at different points of the U.S. education distribution: teaching often requires post-bachelor certification or a master's degree, and physiotherapy a doctorate, whereas registered nurses and early-childhood educators can qualify with an associate degree. The composition of the bachelor-level group therefore differs between the two countries.

Figure 2: Education distribution by paternal-income quartile



Notes: The figure shows the distribution of women across education groups by observation cohort, separately by paternal-income quartile. The sample consists of women without an immigrant background aged 45–48 with paternal income information, observed 2006–2022. Paternal-income quartiles are based on fathers' age-specific income ranks, averaged over five consecutive years, beginning when daughters are aged 19–22. Education groups are defined in Section 3.

The expansion of graduate education is not uniform across social origins. In absolute terms, the increase is largest among women from the most advantaged backgrounds: graduate attainment rises by 16 percentage points in the highest paternal-income quartile, from 14 to 30 percent, compared with 7 points in the lowest quartile, from 3 to 10 percent. Relative growth, however, is strongest in the middle of the distribution, where graduate attainment starts from a much lower base and more than triples. Despite this broad expansion, women from the highest-SES backgrounds remain substantially more likely to attain graduate education throughout the period, and the gap between the top and bottom quartiles widens in percentage points, even as it narrows in relative terms.

These changes illustrate why education cannot be treated as a fixed measure of socioeconomic position across cohorts. As higher education expands, the social composition of each education group changes with it. The evolution of the education–fertility gradient may therefore reflect not only changes in fertility within education groups, but also changes in who selects into each group.

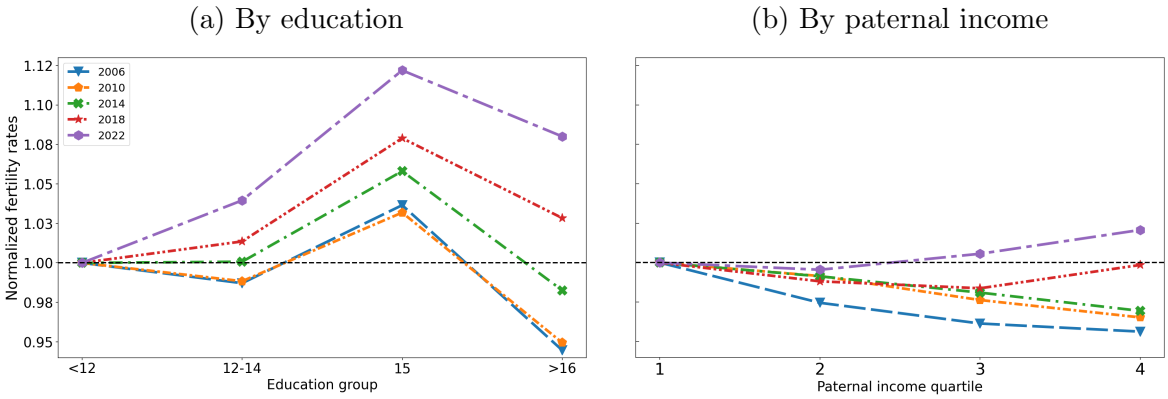
4.3 Education–fertility gradient versus SES–fertility gradient

Figure 3 compares the evolution of completed fertility by women's own educational attainment (Panel (a)) and socioeconomic background, measured by paternal income rank (Panel (b)), for women born between 1958 and 1977. Across these cohorts, the education–fertility gradient changes more sharply than the gradient by socioeconomic background. Among women observed in 2006 (born 1958–1961), those with graduate

education had 0.94 times as many children as women with mandatory schooling; by 2022 (born 1974–1977), the ratio had risen to 1.08. Over the same period, the ratio of completed fertility among women from the highest paternal-income quartile to those from the lowest rose from 0.95 to 1.02.

Thus, the dramatic reversal by education is not mirrored by a comparable reversal across social origins. This rules out a simple interpretation in which education merely proxies for a changing underlying relationship between socioeconomic advantage and fertility. Instead, the contrast suggests that education and social origin matter jointly: the fertility associated with a given level of education may depend on the socioeconomic background from which a woman comes. The analysis that follows first asks whether changing social-origin composition can account mechanically for the changing education gradient, and then examines directly how education–fertility gradients differ across social-origin groups.

Figure 3: Completed fertility gradients by education and paternal income



Notes: Panel (a) reports completed fertility by education group, relative to women with mandatory schooling in the same observation cohort. Panel (b) reports completed fertility by paternal-income quartile, relative to women from the lowest quartile in the same cohort. The sample consists of women with paternal income information, observed 2006–2022. Education groups and paternal-income quartiles are defined in Section 3. Raw completed fertility by paternal-income quartile is reported in Appendix Figure A.3.

5 Decomposition

The expansion of higher education documented in Section 4 has changed the SES composition of education groups. Because fertility differs by SES, average fertility within an education group can change simply because the mix of SES backgrounds changes, even if fertility within each education-by-SES cell stays the same. Such compositional shifts could also mechanically alter the education–fertility gradient. To assess how important this channel is, we decompose the change in completed fertility within each education group relative to women observed at ages 45–48 in 2006 (born 1958–1961).

We hold fertility in each education-by-SES cell at its 2006 level and ask how much average fertility in each education group would have changed solely because its SES composition changed.

Let $\bar{y}_{g|e}$ denote average completed fertility among women in cohort g and education group e. Let

$$s_{gk|e} = \Pr(K = k \mid E = e, G = g) \tag{1}$$

denote the share of women from paternal-income quartile k among women in cohort g and education group e, and let

$$\mu_{gk|e} = \mathbb{E}[Y \mid G = g, E = e, K = k] \tag{2}$$

denote average fertility in the corresponding education-by-SES cell.

Average fertility within education group e can then be written as

$$\bar{y}_{g|e} = \sum_k s_{gk|e}\mu_{gk|e}. \tag{3}$$

Consider two cohorts, a baseline cohort, 0, for women observed in 2006 and a later cohort, g. The total change in average fertility for an education group e is

$$\bar{y}_{g|e} - \bar{y}_{0|e}. \tag{4}$$

This change reflects both changes in the SES composition of the education group and changes in fertility within education-by-SES cells. We separate these two components of change by introducing the counterfactual average fertility obtained by applying the later cohort's SES composition to the baseline fertility rates, $\sum_k s_{gk|e}\mu_{0k|e}$. Adding and subtracting this term gives

$$\begin{aligned}\bar{y}_{g|e} - \bar{y}_{0|e} = &\underbrace{\sum_k \left(s_{gk|e} - s_{0k|e}\right)\mu_{0k|e}}_{\text{composition component}} \\ &+ \underbrace{\sum_k s_{gk|e}\left(\mu_{gk|e} - \mu_{0k|e}\right)}_{\text{within-cell fertility component}} \equiv C_{g,e} + W_{g,e}.\end{aligned} \tag{5}$$

The first component, the composition component, captures the change in average fertility that would result from changing only the SES composition of the education group, while keeping fertility within each education-by-SES cell at its baseline level. The second component, the within-cell fertility component, captures changes in fertility

within education-by-SES cells, evaluated using the later cohort's SES composition.[6]

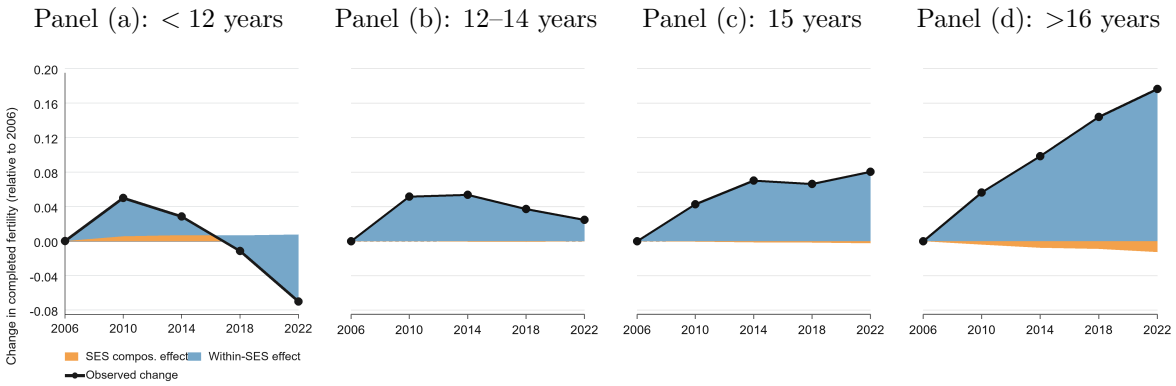
Figure 4 plots the decomposition for each cohort relative to the 2006 cohort of 45–48 year old women. Table 2 reports the decomposition for women observed in 2022 relative to women observed in 2006, and Appendix Table A.3 reports the values for all years. The composition component is small in all education groups. Among women with mandatory schooling, completed fertility falls by 0.070 children. Changes in SES composition would have increased fertility by 0.008 children, while changes within education-by-SES cells account for a decline of 0.078 children. For the two middle education groups, the composition component is effectively zero, and the observed increases occur within education-by-SES cells.

Among women with graduate education, the result is the opposite of that for women with mandatory schooling: completed fertility increases by 0.177 children between 2006 and 2022. The composition component is slightly negative, at −0.013 children. Thus, the changing SES composition of the graduate education group would, by itself, have produced a small decrease in fertility. The observed increase is more than accounted for by a within-cell fertility component of 0.189 children.

Across all four education groups, therefore, changing paternal-income composition does not explain the observed fertility changes between 2006 and 2022. For women with 12–14 years of education, the composition component is effectively zero, and for the other three groups it moves fertility in the opposite direction of the observed change. The main changes occur within education-by-SES cells. The only cases in which the composition component moves fertility in the same direction as the observed change are among women with mandatory schooling in 2010 and 2014, where it accounts for 0.006 and 0.007 children, respectively (Appendix Table A.3). Even in these cases, the composition component is small, and most of the change occurs within education-by-SES cells.

[6]The exact magnitudes of the two components depend on the choice of reference weights. Our substantive conclusion is, however, robust. Using alternative reference weights or later baseline years, changes in SES composition remain small relative to changes in fertility within education-by-SES cells.

Figure 4: Decomposition of changes in completed fertility within education groups



Notes: The figure decomposes changes in completed fertility relative to 2006 within each education group, following equation (5). The black line shows the observed total change. The orange area shows the composition component, due to changes in the paternal-income composition of the education group, and the blue area shows the within-cell component, due to changes in fertility within education-by-SES cells. In the legend, "SES compos. effect" refers to the composition component and "Within-SES effect" to the within-cell component. Education groups and paternal-income quartiles are defined in Section 3. The underlying values are reported in Appendix Table A.3.

The implication for the education–fertility gradient can be shown directly. Let

$$D_g = \bar{y}_{g|H} - \bar{y}_{g|L} \tag{6}$$

denote the completed-fertility difference between women with graduate education, H, and women with mandatory schooling, L. Using equation (5), the change in this gradient is

$$D_g - D_0 = (C_{g,H} - C_{g,L}) + (W_{g,H} - W_{g,L})\,. \tag{7}$$

Comparing women observed in 2006 (born 1958–1961) with those observed in 2022 (born 1974–1977), the fertility difference between women with graduate degrees and women with mandatory schooling increases by approximately 0.247 children (last row of Table 2). Changes in SES composition contribute approximately -0.020 children and therefore move the gradient slightly in the opposite direction. Changes in fertility within education-by-SES cells contribute 0.267 children, more than accounting for the observed change in the education–fertility gradient. Changes in the SES composition of education groups therefore do not explain the shift in the education–fertility gradient. Instead, the change occurs within education-by-SES cells.

Table 2: Decomposition of changes in completed fertility within education groups, 2006–2022

Education group	Total change	Composition	Within-cell
Mandatory (< 12 years)	−0.070	0.008	−0.078
High school/VET (12–14 years)	0.025	0.000	0.025
Bachelor/professional (15 years)	0.080	−0.002	0.083
Graduate (> 16 years)	0.177	−0.013	0.189
Gradient (Graduate − mandatory)	0.247	−0.020	0.267

Notes: The table decomposes changes in completed fertility between women observed in 2006 and women observed in 2022 within each education group, following equation (5). The composition component captures changes due to shifts in the paternal-income-quartile composition of each education group, holding fertility within education-by-SES cells fixed at 2006 levels. The within-cell component captures changes in fertility within education-by-SES cells, evaluated at the 2022 SES composition. The last row decomposes the change in the difference in completed fertility between women with graduate degrees and women with mandatory schooling, following equation (7). Components may not sum exactly to the total because of rounding.

6 Heterogeneity across Socioeconomic Status and Education

The decomposition in Section 5 shows that changes in the SES composition of education groups do not explain the reversal of the education–fertility gradient. Instead, the change occurs within education-by-SES cells. We now examine where these within-cell changes occur. We begin by looking at SES–fertility gradients within education groups. This perspective helps interpret the decomposition by showing how the relationship between paternal income and fertility differs across education levels, and why changing the SES composition of education groups contributes so little to the overall reversal. We then turn to education–fertility gradients within paternal-income groups. This perspective addresses the central question of the paper: whether the reversal is broad-based across socioeconomic backgrounds or concentrated among particular groups.

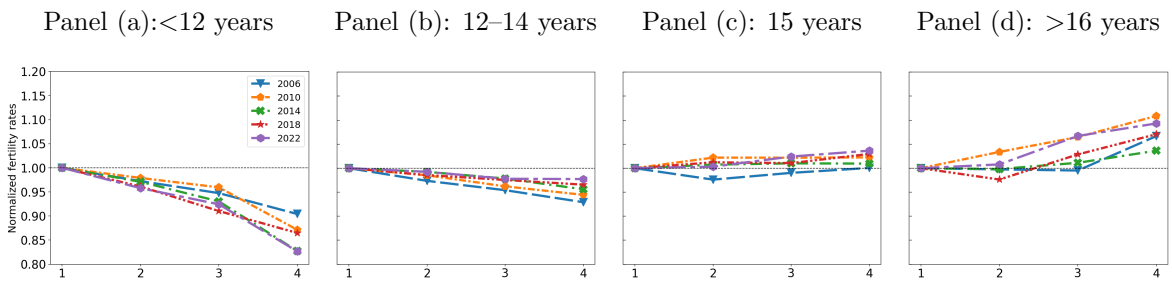
6.1 Paternal-income gradients within education groups

Figure 5 plots completed fertility by paternal-income quartile separately within each education group. Fertility is normalized relative to women from the lowest paternal-income quartile within the same education group and observation cohort. The raw fertility rates are presented in Appendix Figure A.5. The relationship between socioeconomic background and fertility differs markedly across education groups. Among women with mandatory schooling, the gradient is negative and becomes more nega-

tive across cohorts. The ratio of completed fertility among women from the highest paternal-income quartile to women from the lowest quartile falls from approximately 0.90 in 2006 to 0.83 in 2022. Among women with 12–14 years of schooling, the gradient is also negative but flattens, with the ratio rising from 0.92 to 0.98.

Among women with a bachelor's degree or professional education, the gradient is flat in 2006. It turns positive in later cohorts, reaching 1.04 in 2022. Among women with graduate degrees, it is positive throughout and broadly stable, with a ratio of 1.07 in 2006 and 1.09 in 2022. Thus, the paternal-income gradient in fertility rises with education, from negative among women with mandatory schooling to positive among women with graduate education, and this difference has widened over time, mainly because the gradient has become more negative among women with mandatory schooling.

Figure 5: Completed fertility by paternal-income quartile, within education groups



Notes: The figure shows completed fertility by paternal-income quartile and observation cohort, separately by education group, relative to women from the lowest paternal-income quartile in the same education group and cohort. Education groups and paternal-income quartiles are defined in Section 3. Raw values are reported in Appendix Figure A.5.

These patterns help explain the small composition components in Section 5. A composition component requires both that fertility differs across paternal-income quartiles within an education group and that the paternal-income composition of the group changes over time; if either is absent, the component is close to zero. Among women with graduate education, the paternal-income gradient is already positive for the 2006 cohort, with fertility highest among women from the top paternal-income quartile. As graduate education expands across the paternal-income distribution, the group includes a lower share of women from the top quartile. Given the 2006 fertility profile, this implies a small decline in average fertility, producing the negative composition component of -0.013 children.

For women with mandatory schooling, the opposite pattern applies. Because fertility is higher among women from lower paternal-income backgrounds, the increasing concentration of this education group in the lower part of the paternal-income distribution implies a small increase in fertility, corresponding to the positive composition

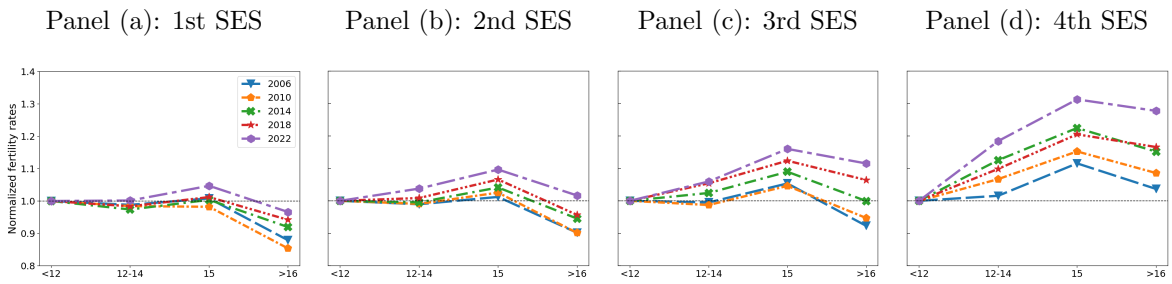
component of 0.008 children. In the two middle education groups, the composition components are close to zero (Table 2).

Importantly, these compositional changes work against, rather than toward, the observed reversal. They slightly reduce fertility among women with graduate education and slightly raise fertility among women with mandatory schooling, while the observed changes go in the opposite direction. The small composition components do not, however, imply that socioeconomic background is unimportant. Rather, family background matters because fertility has evolved differently across paternal-income groups within education groups, not because the socioeconomic composition of education groups has changed over time.

6.2 Education–fertility gradients within paternal-income groups

Figure 6 plots the education–fertility gradient separately within each paternal-income quartile, with fertility normalized relative to women with mandatory schooling in the same observation cohort and paternal-income group. Because these gradients compare education groups within the same paternal-income quartile, they are not affected by changes in the SES composition of education groups. Changes in these gradients over time therefore reflect changes in fertility within education-by-SES cells, which underlie the within-cell component in Section 5. This allows us to ask whether the aggregate reversal of the education–fertility gradient is shared across socioeconomic backgrounds or concentrated among particular groups.

Figure 6: Completed fertility by education, within paternal-income quartiles



Notes: The figure shows completed fertility by education group and observation cohort, separately by paternal-income quartile, relative to women with mandatory schooling in the same paternal-income quartile and cohort. Education groups and paternal-income quartiles are defined in Section 3. Raw values are reported in Appendix Figure A.8.

The education–fertility gradient rises over time in all paternal-income groups, but the extent of the change differs sharply by socioeconomic background. Among women from the lowest paternal-income quartile, women with graduate education have 0.87 times the fertility of women with mandatory schooling in the 2006 observation cohort. By 2022, this ratio has risen to 0.97. The gap therefore narrows substantially, but

the gradient remains negative. As we move up the paternal-income distribution, the education gradient becomes progressively more positive. The reversal is concentrated in the upper half of the distribution and is strongest among women from the most advantaged backgrounds. In the highest paternal-income quartile, women with graduate education already have slightly higher completed fertility than women with mandatory schooling in 2006, with a fertility ratio of 1.03. By 2022, their fertility is 1.28 times as high.

The aggregate reversal therefore masks substantial heterogeneity by family background. Higher education has become increasingly compatible with completed fertility among women from advantaged backgrounds, while the education gradient is much weaker among women from less advantaged backgrounds and remains negative in the lowest paternal-income quartile. The reversal observed in the population as a whole is therefore not a broad-based shift across socioeconomic groups, but is concentrated among women from the upper part of the paternal-income distribution.

The raw cell means in Appendix Figure A.8 help identify the fertility changes underlying these normalized gradients. Completed fertility among women with graduate education rises across cohorts in all paternal-income quartiles, with the largest increase in the third quartile and the highest levels in the fourth quartile. At the other end of the education distribution, fertility among women with mandatory schooling falls most clearly in the upper paternal-income quartiles, while changing much less among women from the lowest paternal-income backgrounds. Weighted by the 2022 SES composition of each education group, these changes in cell-level fertility make up the within-cell component in the decomposition in Section 5.

These patterns show where the education–fertility gradient has changed most strongly across socioeconomic backgrounds. To understand the demographic margin underlying this change, we next decompose completed fertility into entry into motherhood and fertility conditional on motherhood.

7 Extensive and Intensive Margins

Completed fertility combines two margins: whether a woman has any child and how many children mothers have. Figures 7 and 8 show that the reversal of the education–fertility gradient is driven by the extensive margin, not by fertility conditional on motherhood.

Figure 7 shows that the education gradient in motherhood changes substantially between the 2006 and 2022 observation cohorts. Women with graduate education move from being less likely to be mothers than women with mandatory schooling in the same cohort to being more likely to be mothers, a shift of about 15 percentage points. By

contrast, Figure 8, Panel (b) shows that the intensive-margin gradient moves in the opposite direction. Conditional on motherhood, the ratio of fertility among women with graduate education to fertility among women with mandatory schooling falls from 0.99 in the 2006 observation cohort to 0.95 in the 2022 observation cohort.

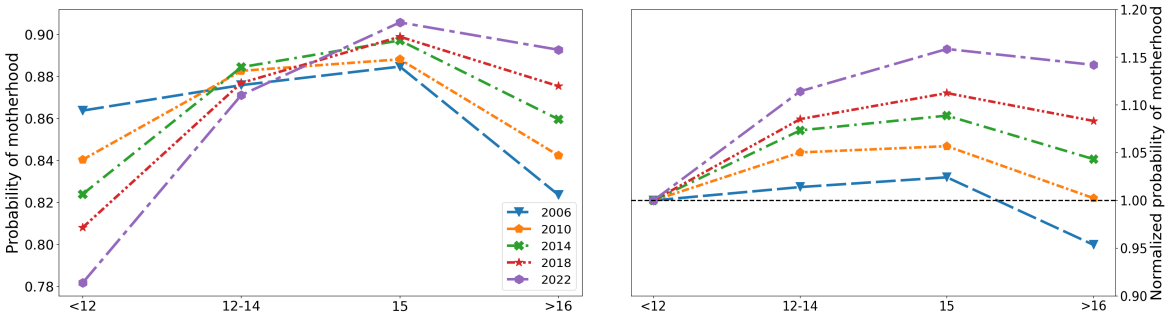
Thus, the narrowing and eventual reversal of the completed-fertility gradient is driven by the growing likelihood that highly educated women enter motherhood, even as their fertility conditional on motherhood declines relative to low-educated mothers.

Figure 7, Panel (a) shows that these changes are concentrated at the two ends of the education distribution: women with mandatory schooling become progressively more likely to remain childless, with the motherhood rate falling from 86 percent in the 2006 observation cohort to 78 percent in the 2022 observation cohort. At the same time, women with graduate education become increasingly likely to enter motherhood, with the motherhood rate rising from 82 percent to over 89 percent.[7]

Figure 7: Motherhood by education

(a) Raw probability of motherhood

(b) Normalized probability of motherhood



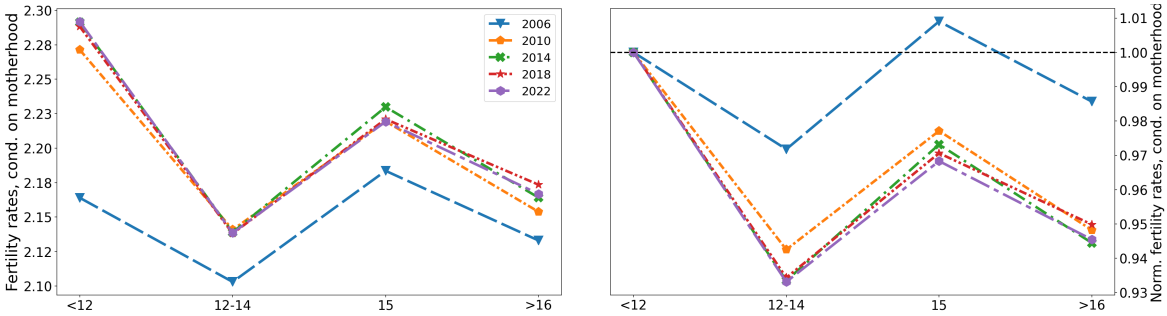
Notes: Panel (a) reports the share of women with at least one child by education group and observation cohort. Panel (b) reports this share relative to women with mandatory schooling in the same cohort. Education groups are defined in Section 3.

[7]For completeness, Appendix Figures A.11 and A.12 compare the education gradients in motherhood and in fertility conditional on motherhood with the corresponding gradients by paternal income. Appendix Figures A.6, A.13, A.7, and A.14 show paternal-income gradients in the two margins within education groups.

Figure 8: Completed fertility conditional on motherhood by education

(a) Raw fertility conditional on motherhood

(b) Normalized fertility conditional on motherhood



Notes: Panel (a) reports completed fertility among women with at least one child by education group and observation cohort. Panel (b) reports this measure relative to mothers with mandatory schooling in the same cohort. Education groups are defined in Section 3.

7.1 Education–motherhood gradients within paternal-income groups (extensive margin)

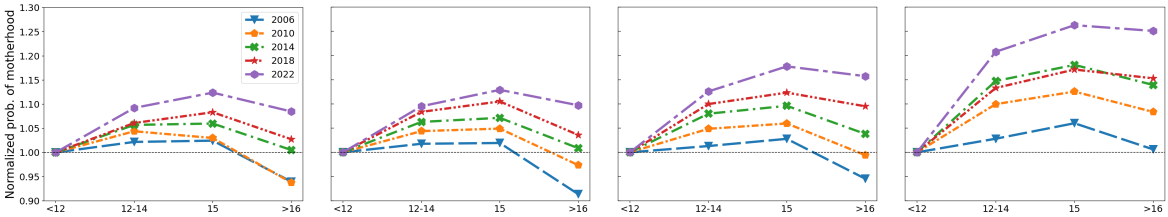
Figure 9: Motherhood by education, within paternal-income quartiles

Panel (a): 1st SES

Panel (b): 2nd SES

Panel (c): 3rd SES

Panel (d): 4th SES



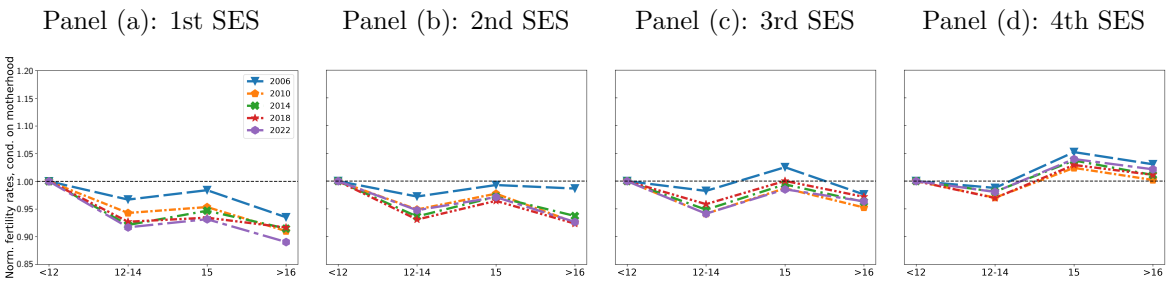
Notes: The figure shows the share of women with at least one child by education group and observation cohort, separately by paternal-income quartile, relative to women with mandatory schooling in the same paternal-income quartile and cohort. Education groups and paternal-income quartiles are defined in Section 3. Raw values are reported in Appendix Figure A.9.

Figure 9 plots normalized motherhood rates by education, separately by paternal-income quartile. The education gradient in motherhood becomes increasingly positive as we move up the paternal-income distribution. Among women in the lowest paternal-income quartile, highly educated women are about 0.94 times as likely as women with mandatory schooling to be mothers in the 2006 observation cohort (women born 1958–1961), rising to about 1.08 in the 2022 observation cohort (women born 1974–1977). In the second quartile, the ratio rises from about 0.92 to 1.10, and in the third quartile from about 0.95 to 1.16. In the highest paternal-income quartile, highly educated women are already about as likely as women with mandatory schooling to be mothers in 2006 (about 1.01), and the gradient rises to about 1.25 in 2022.

Thus, the education gradient in motherhood turns positive in all paternal-income quartiles, but the shift is largest among women from more advantaged backgrounds. Notably, in the lowest paternal-income quartile, highly educated women become more likely than women with mandatory schooling to enter motherhood, even though their completed fertility remains lower (Section 6.2). As we show next, this is because highly educated mothers from this background have fewer children conditional on motherhood.

7.2 Education–fertility gradients within paternal-income groups, conditional on motherhood (intensive margin)

Figure 10: Completed fertility conditional on motherhood by education, within paternal-income quartiles



Notes: The figure shows completed fertility among women with at least one child by education group and observation cohort, separately by paternal-income quartile, relative to mothers with mandatory schooling in the same paternal-income quartile and cohort. Education groups and paternal-income quartiles are defined in Section 3. Raw values are reported in Appendix Figure A.10.

Figure 10 shows the corresponding education gradients in fertility conditional on motherhood. The pattern differs markedly from the extensive margin. In none of the paternal-income groups does the education gradient become more positive from the 2006 to the 2022 observation cohorts. Among mothers from the first three paternal-income quartiles, women with graduate education have fewer children than women with mandatory schooling, and these differences generally widen over time. In the lowest quartile, the ratio of conditional fertility among women with graduate education to women with mandatory schooling falls from 0.94 in the 2006 observation cohort (women born 1958–1961) to 0.89 in the 2022 observation cohort (women born 1974–1977). In the second quartile, the ratio falls from 0.99 to 0.93, while in the third quartile it declines more modestly, from 0.98 to 0.96. In the highest paternal-income quartile, conditional fertility is slightly higher among women with graduate education, but the ratio falls from 1.03 to 1.02. The changes are not fully monotonic across the intermediate cohorts, but the overall pattern is one of a stable or increasingly negative education gradient in family size conditional on motherhood.

The intensive margin therefore does not account for the reversal in completed fertility. Across the lower three paternal-income groups, it moves in the opposite direction, as highly educated mothers have relatively fewer children over time. In the lowest paternal-income quartile, this decline offsets the rise in entry into motherhood among highly educated women, which is why the education gradient in completed fertility remains negative in this group. Even in the highest paternal-income quartile, where highly educated mothers have slightly more children conditional on motherhood, this advantage does not increase across cohorts. The reversal in completed fertility is therefore driven by changes in entry into motherhood rather than by changes in family size among mothers.

8 Conclusion

This paper documents a reversal of the education–fertility gradient in Denmark and shows that it is strongly stratified by socioeconomic background. Completed fertility among highly educated women has risen relative to that of women with lower education, but this shift is far from uniform across family backgrounds. Among women from the lowest paternal-income quartile, the education gradient in completed fertility has flattened substantially but remains negative. The reversal is concentrated among women from the upper half of the paternal-income distribution.

The decomposition shows that the reversal is not explained by changes in the socioeconomic composition of education groups. Although higher education expanded substantially across cohorts, changes in paternal-income background do not account for the observed fertility shifts and, if anything, work against them. Instead, the change occurs within education-by-background groups. This does not mean that socioeconomic background is unimportant. Rather, its relationship with fertility depends on education. Higher paternal income is associated with lower fertility among the least-educated women but with higher fertility among the most-educated, and this difference has widened over time.

The reversal is driven primarily by changes in entry into motherhood. Highly educated women become increasingly likely to enter motherhood relative to women with low education in all paternal-income groups, and this shift is strongest among women from more advantaged backgrounds. Conditional on motherhood, the pattern is quite different. The education gradient in family size does not become more positive in any paternal-income group. Among women from the lower three quartiles, it generally becomes more negative, while in the highest quartile it remains slightly positive but does not increase over time. The reversal in completed fertility therefore reflects changes in who becomes a mother rather than highly educated mothers having increasingly larger

families.

These findings qualify the interpretation of the weakening education–fertility gradient as evidence of a broad-based increase in the compatibility between higher education and family formation. Even in Denmark's universal welfare-state setting, this development has been uneven across socioeconomic backgrounds. Highly educated women from less advantaged backgrounds have become more likely to enter motherhood, but much less so than those from advantaged backgrounds, and they have fewer children once they do. We do not identify the mechanisms behind these differences, but family resources, housing, partnership trajectories, networks, informal support, and access to services that facilitate later family formation may all play a role. Universal family policies can reduce many of the constraints surrounding childbearing without eliminating differences in the resources available to women from different family backgrounds.

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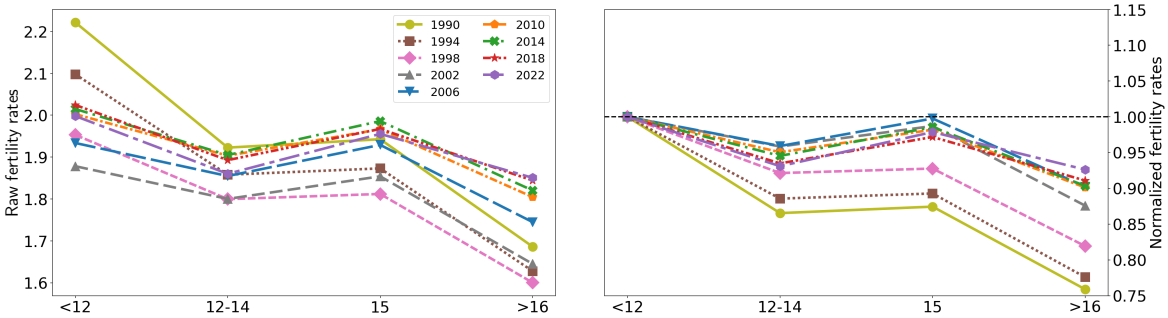
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Appendix

A Additional Tables and Figures

Figure A.1: Completed fertility by education, including immigrant women

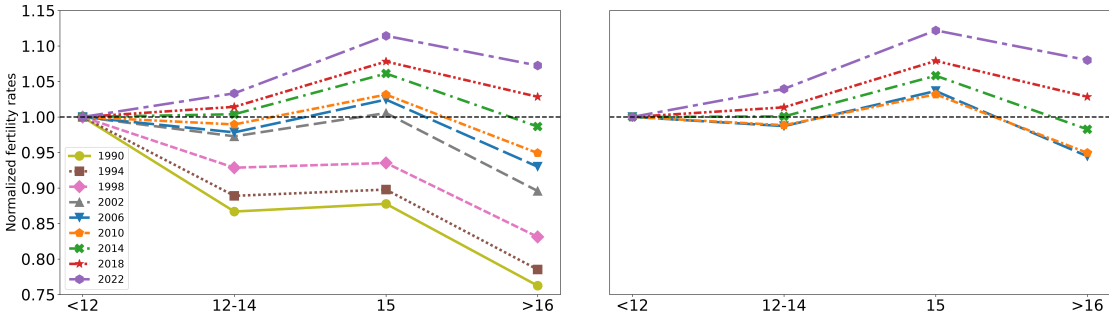
(a) Raw rates (b) Normalized



Notes: Panel (a) reports completed fertility by education group and observation cohort for all women aged 45–48 residing in Denmark, including women with an immigrant background. Panel (b) reports completed fertility relative to women with mandatory schooling in the same cohort. Education groups are defined in Section 3.

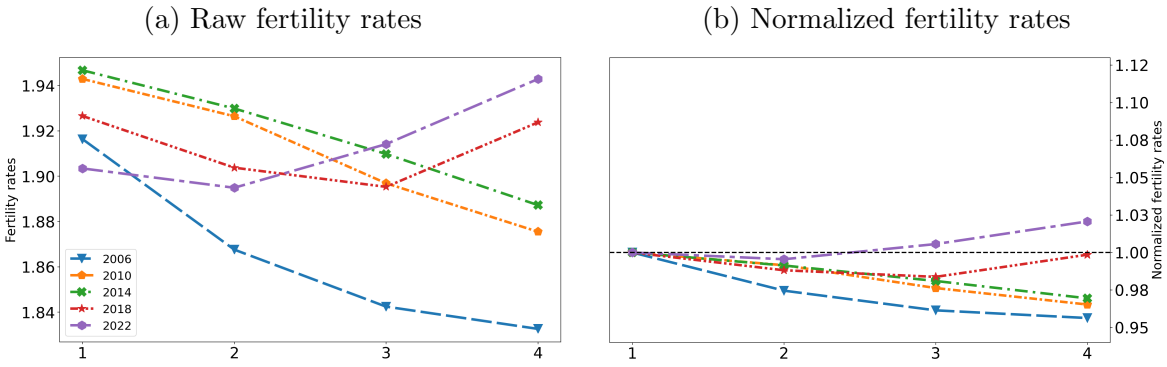
Figure A.2: Completed fertility by education, non-immigrant and father-linked samples

(a) Non-immigrant sample (b) Father-linked sample



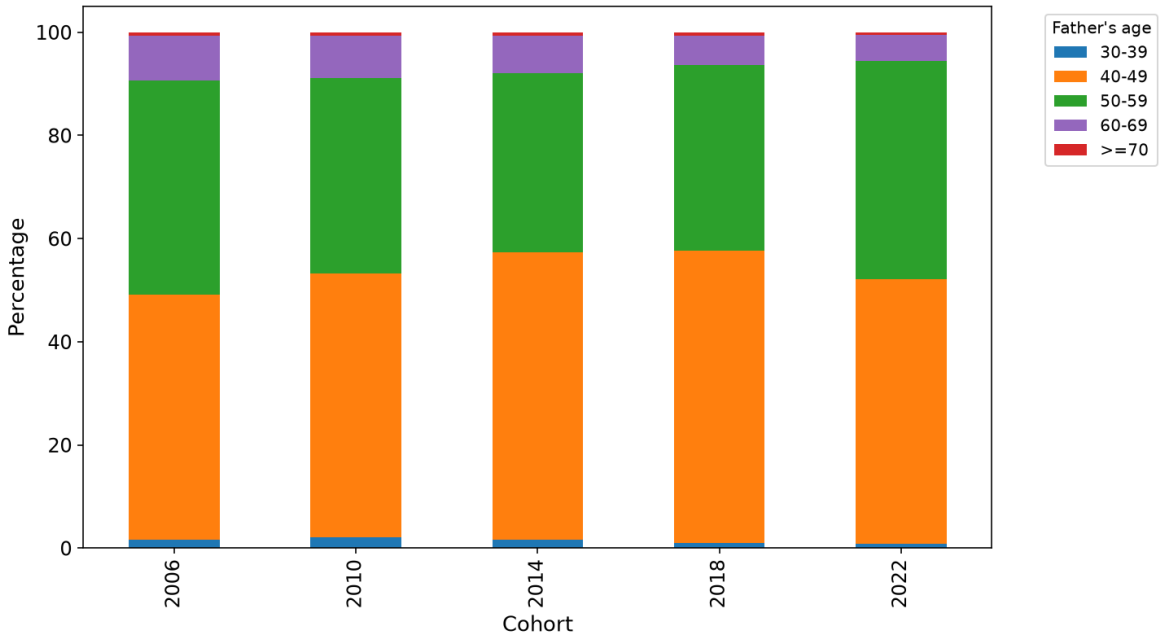
Notes: The figure shows completed fertility by education group, relative to women with mandatory schooling in the same observation cohort. Panel (a) reports all women without an immigrant background, observed 1990–2022. Panel (b) reports the father-linked sample, observed 2006–2022, which covers 92–99 percent of the non-immigrant sample in these cohorts. Education groups are defined in Section 3.

Figure A.3: Completed fertility by paternal-income quartile



Notes: Panel (a) reports completed fertility by paternal-income quartile and observation cohort. Panel (b) reports completed fertility relative to women from the lowest paternal-income quartile in the same cohort. Paternal-income quartiles are defined in Section 3.

Figure A.4: Distribution of fathers' age when paternal income is measured



Notes: The figure shows the distribution of fathers' age, in ten-year age groups, at the time paternal income is measured, by observation cohort of the daughters.

Table A.1: Completed fertility by education and cohort

Education Level	1990	1994	1998	2002	2006	2010	2014	2018	2022
Mandatory school (< 12 years)	2.22	2.09	1.94	1.85	1.89	1.91	1.88	1.85	1.80
High school/VET (12–14 years)	1.92	1.86	1.80	1.79	1.85	1.89	1.89	1.87	1.86
Bachelor/professional (15 years)	1.95	1.88	1.81	1.86	1.93	1.97	2.00	1.99	2.01
Graduate (> 16 years)	1.69	1.64	1.61	1.65	1.75	1.81	1.86	1.90	1.93

Notes: The table reports completed fertility by education group and observation cohort for women without an immigrant background aged 45–48. Education groups are defined in Section 3.

Table A.2: Numbers of women by education, paternal-income quartile, and observation cohort

Education	SES quartile	2006	2010	2014	2018	2022
Mandatory schooling	1	8,516	8,414	6,666	5,482	4,250
	2	9,306	7,589	5,649	4,432	3,400
	3	7,062	5,460	4,022	3,293	2,332
	4	3,825	2,897	2,190	1,839	1,383
High school/vocational	1	12,158	15,634	14,774	12,522	10,983
	2	14,908	19,447	19,075	16,785	14,512
	3	14,503	18,595	18,137	16,024	13,586
	4	12,018	15,712	15,239	13,282	11,091
Bachelor/professional	1	4,961	5,610	5,638	5,660	5,650
	2	6,007	6,832	7,535	8,094	8,738
	3	7,133	8,368	9,104	9,818	10,358
	4	9,941	10,218	10,142	10,981	10,491
Graduate	1	791	1,052	1,462	1,781	2,335
	2	819	1,192	1,766	2,296	3,149
	3	1,322	2,099	2,991	4,224	5,236
	4	4,153	5,364	6,770	8,704	9,925
Total		117,423	134,483	131,160	125,217	117,419

Notes: Counts refer to the sample used in the decomposition. Cohorts are labelled by the year in which women are observed at ages 45–48. Paternal-income quartile 1 is the lowest and quartile 4 the highest.

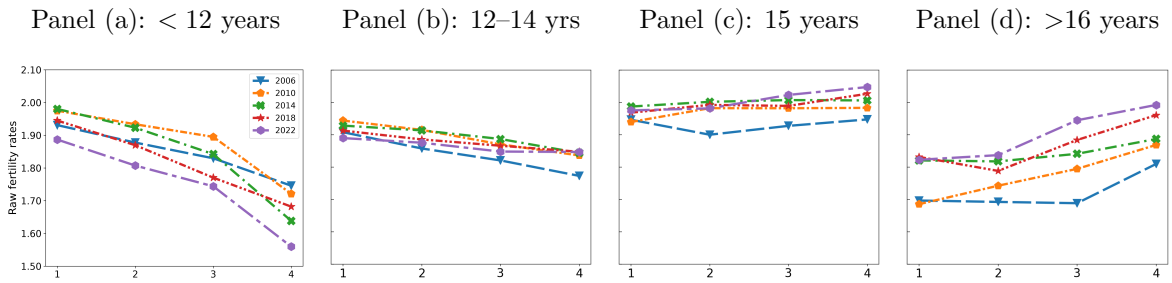
Table A.3: Values underlying the decomposition of changes in completed fertility

Year	Total change	Composition	Within-cell
Mandatory			
< 12 years			
2010	0.050	0.006	0.044
2014	0.028	0.007	0.022
2018	-0.012	0.006	-0.018
2022	-0.070	0.008	-0.078
High school/VET			
12–14 years			
2010	0.052	0.000	0.052
2014	0.054	-0.001	0.054
2018	0.037	-0.001	0.038
2022	0.025	0.000	0.025
Bachelor/professional			
15 years			
2010	0.043	-0.001	0.043
2014	0.070	-0.001	0.072
2018	0.066	-0.002	0.068
2022	0.080	-0.002	0.083
Graduate			
> 16 years			
2010	0.056	-0.004	0.060
2014	0.099	-0.008	0.106
2018	0.144	-0.009	0.153
2022	0.177	-0.013	0.189

Notes: The table reports the values underlying Figure 4. Each entry is measured relative to the 2006 cohort within the same education group. The composition component captures changes due to shifts in the paternal-income composition of each education group, holding fertility within education-by-SES cells fixed at 2006 levels. The within-cell component captures changes in fertility within education-by-SES cells, evaluated at the later year's SES composition. Components may not sum exactly to the total because of rounding.

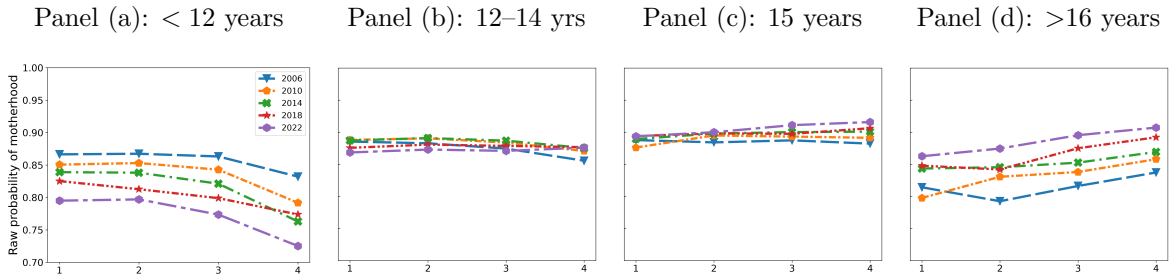
A.1 Paternal-income gradients within education groups

Figure A.5: Raw completed fertility by paternal-income quartile, within education groups



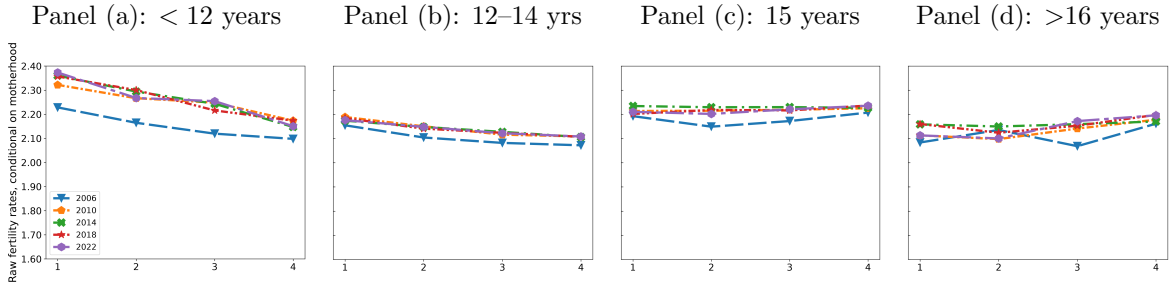
Notes: The figure shows raw completed fertility by paternal-income quartile and observation cohort, separately by education group. Education groups and paternal-income quartiles are defined in Section 3.

Figure A.6: Raw probability of motherhood by paternal-income quartile, within education groups



Notes: The figure shows the raw share of women with at least one child by paternal-income quartile and observation cohort, separately by education group. Education groups and paternal-income quartiles are defined in Section 3.

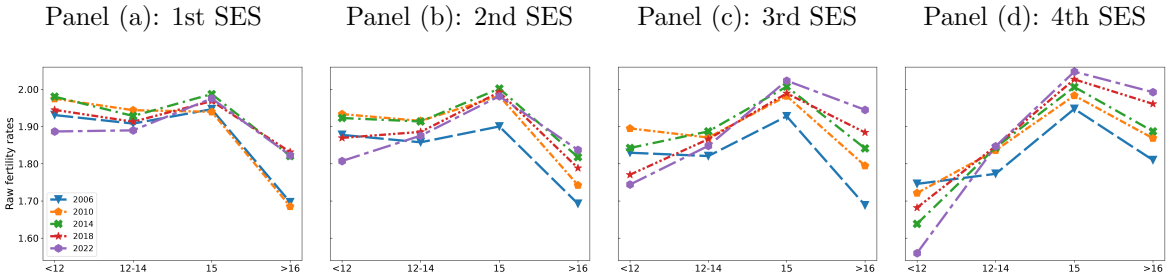
Figure A.7: Raw completed fertility conditional on motherhood by paternal-income quartile, within education groups



Notes: The figure shows raw completed fertility among women with at least one child by paternal-income quartile and observation cohort, separately by education group. Education groups and paternal-income quartiles are defined in Section 3.

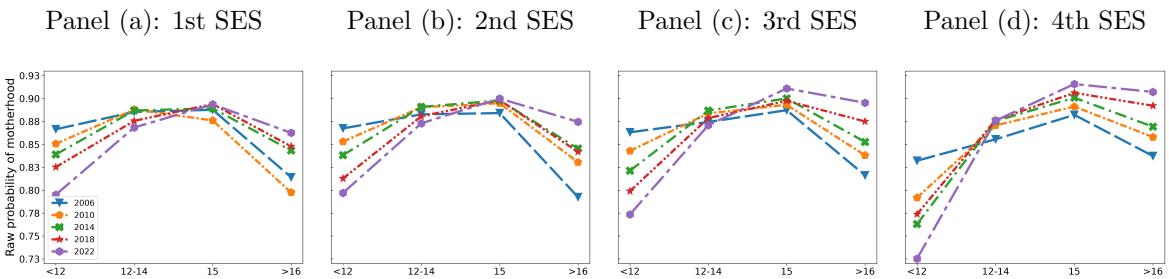
A.2 Education gradients within paternal-income quartiles

Figure A.8: Raw completed fertility by education, within paternal-income quartiles



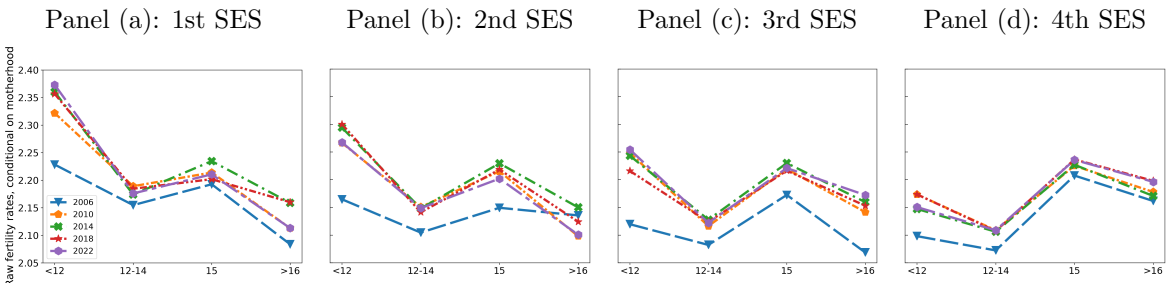
Notes: The figure shows raw completed fertility by education group and observation cohort, separately by paternal-income quartile. Education groups and paternal-income quartiles are defined in Section 3.

Figure A.9: Raw probability of motherhood by education, within paternal-income quartiles



Notes: The figure shows the raw share of women with at least one child by education group and observation cohort, separately by paternal-income quartile. Education groups and paternal-income quartiles are defined in Section 3.

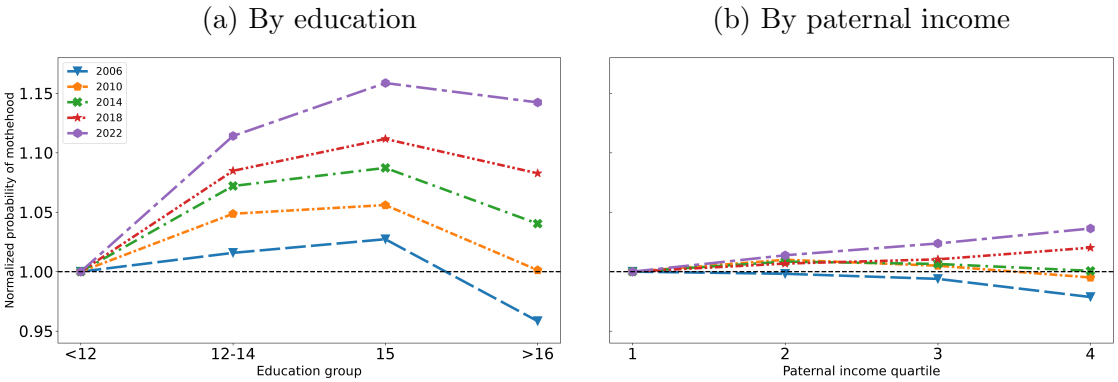
Figure A.10: Raw completed fertility conditional on motherhood by education, within paternal-income quartiles



Notes: The figure shows raw completed fertility among women with at least one child by education group and observation cohort, separately by paternal-income quartile. Education groups and paternal-income quartiles are defined in Section 3.

A.3 Comparison of education and paternal-income gradients

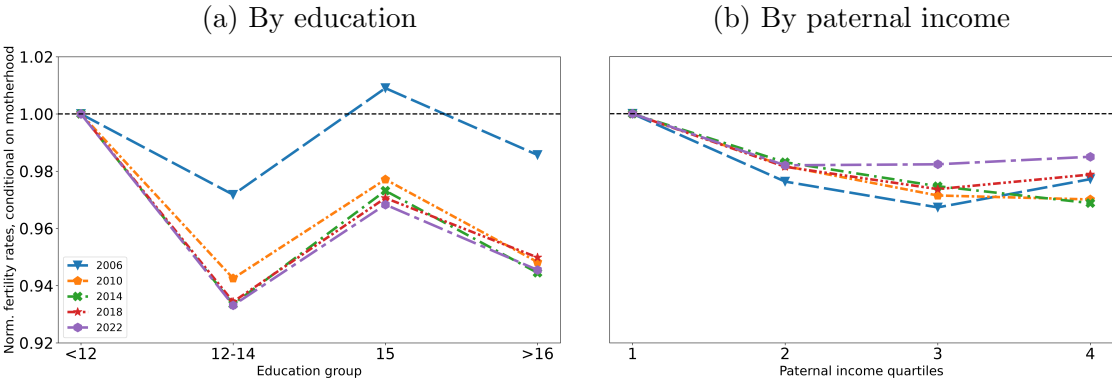
Figure A.11: Motherhood gradients by education and paternal income



Notes: Panel (a) reports the share of women with at least one child by education group, relative to women with mandatory schooling in the same observation cohort. Panel (b) reports this share by paternal-income quartile, relative to women from the lowest quartile in the same cohort. The sample consists of women with paternal income information, observed 2006–2022. Education groups and paternal-income quartiles are defined in Section 3.

A.4 Comparison of education and paternal-income gradients, conditional on motherhood

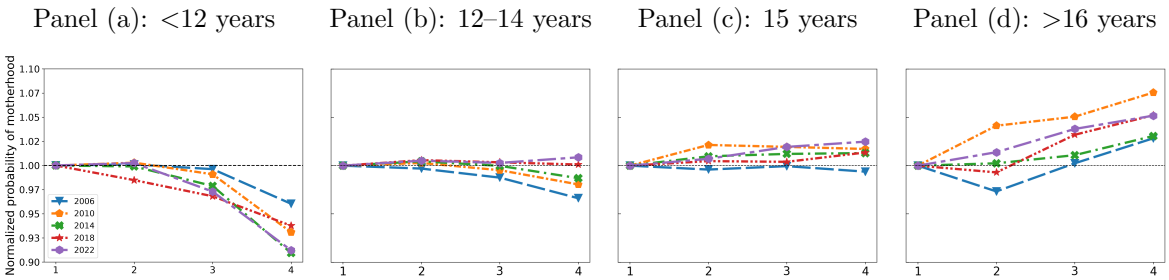
Figure A.12: Completed fertility gradients conditional on motherhood by education and paternal income



Notes: Panel (a) reports completed fertility among women with at least one child by education group, relative to mothers with mandatory schooling in the same observation cohort. Panel (b) reports this measure by paternal-income quartile, relative to mothers from the lowest quartile in the same cohort. The sample consists of women with paternal income information, observed 2006–2022. Education groups and paternal-income quartiles are defined in Section 3.

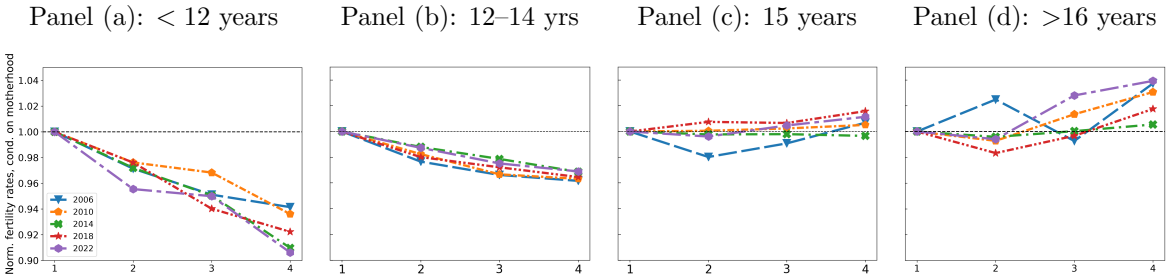
A.5 Normalized paternal-income gradients in the two margins within education groups

Figure A.13: Motherhood by paternal-income quartile, within education groups



Notes: The figure shows the share of women with at least one child by paternal-income quartile and observation cohort, separately by education group, relative to women from the lowest paternal-income quartile in the same education group and cohort. Education groups and paternal-income quartiles are defined in Section 3.

Figure A.14: Completed fertility conditional on motherhood by paternal-income quartile, within education groups



Notes: The figure shows completed fertility among women with at least one child by paternal-income quartile and observation cohort, separately by education group, relative to mothers from the lowest paternal-income quartile in the same education group and cohort. Education groups and paternal-income quartiles are defined in Section 3.