Rewriting the Fertility Gradient: The Role of Socio-economic Background in Education and Childbearing

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Abstract

This paper investigates whether the flattening education–fertility gradient increasingly observed in high-income countries reflects a real convergence in preferences or selection effects arising from shifts in who attains higher education. Using population-wide Danish administrative data linking women to their parents, we compare completed fertility across cohorts and educational levels, and introduce paternal income during early adulthood as a time-invariant measure of socioeconomic status (SES). We document that the narrowing education-fertility gradient is driven by women from high-SES backgrounds. For these women, fertility progressively rises with educational attainment. Moreover, the SES–fertility gradient itself depends on education: among low-educated women, fertility declines with SES, whereas among highly educated women, fertility increases with SES. These findings highlight that the observed convergence in fertility across education levels masks persistent disparities in who can combine family and career aspirations.

1 Introduction

Persistently low fertility rates across high-income countries have led many governments to revisit fertility as a matter of public policy. As policy-makers intensify efforts to address this declinine, it becomes increasingly important to understand which segments of the population are driving these changes. In fact, fertility patterns across socioeconomic groups warrant close attention, not only to uncover the causes of declining fertility, but also to anticipate its long-term implications. In fact, unequal fertility responses risk reinforcing existing disparities, with consequences for both population structure and intergenerational inequality.[1]

Against this backdrop, recent studies have documented that the historically negative relationship between education and fertility has flattened, and in some contexts even reversed,[2] challenging long-held assumptions that expanding educational opportunities would inevitably suppress fertility. Two main forces have been identified as drivers of this shift: rising fertility among highly educated women, who disproportionately benefit from policies supporting work–family balance[3], and falling fertility among less educated women, largely due to improved reproductive autonomy and fewer unplanned births.[4]

However, existing research assumes that educational categories are stable over time, overlooking the fact that, as education becomes more accessible, who attains higher degrees has changed substantially across cohorts. Consequently, higher fertility rates among top-educated might reflect a progressive self-selection into higher degrees by women with stronger preferences for childbearing who would have obtained lower de-

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[1]Heterogeneous changes in fertility across the income and education distribution can influence the intergenerational transmission of resources and shape the future composition of the population exacerbating disparities in education, wealth, and income (Esping-Andersen and Billari, 2015).

[2]This consist sis of a defining feature of the "New era of the economic of fertility" (Doepke et al., 2023)

[3]Luci-Greulich and Thévenon (2013) examine how family-friendly policies affect fertility in developed countries finding that improves in work–family balance policies have led to rising fertility, particularly among women with strong labor-force attachment (often the highly educated).

[4]Ciganda et al. (2024); The Economist (May 25th-31st 2024 edition) highlight how the decline in fertility is largely due to fewer unplanned births among poorer, less educated women, the group that historically had the highest fertility rates

grees in the past. This paper is the first to explicitly account for these compositional shifts. Using highly granular Danish administrative data covering the entire population of women, we document substantial cohort changes in educational attainment, with an increasing share of women completing graduate and postgraduate degrees.

To address concerns about interpreting changes in the education-fertility gradient as genuine shifts in behavior rather than in the composition of these groups, we move beyond education as a proxy for socioeconomic status (SES). Specifically, leveraging the intergenerational structure of the data, we compare education-based fertility gradients to those based on paternal income measured during early adulthood. To consistently measure SES across cohorts, we divide the paternal income distribution into quartiles, obtaining a more stable and time-invariant indicator of long-term socioeconomic background than education.

Our analysis shows that the reversal of the education–fertility gradient is concentrated among women from advantaged backgrounds. For these women, fertility has raised alongside education, significantly more than for women from lower-SES backgrounds. In particular, for women at the bottom of the SES distribution, the gradient, although flattening overtime, remains negative. Moreover, we show that the SES–fertility gradient is education-dependent: while low-educated women exhibit a negative relationship between fertility and paternal income quartiles, this relationship flattens, and ultimately becomes positive, as we move up the education distribution. Overall, these results suggest that the narrowing education gradient in fertility is not entirely driven by compositional change. Rather, it reflects the growing concentration of women from advantaged backgrounds among those who are able to pursue higher education while also achieving their fertility goals.

This paper fits into a growing strand of literature investigating what drives the shrinking fertility gradient. Historically, women with higher education have had markedly lower fertility than their less-educated counterpart. This persistent pattern was widely explained by the difficulty of combining motherhood with a career, as well as by the higher opportunity costs and stronger quantity–quality trade-offs faced by more edu-

cated women (Hazan and Zoabi, 2015). In recent decades, however, this negative relationship has substantially weakened across many advanced economies. In some cases, fertility rates among highly educated women have even overtaken those of less-educated women (Kim, 2023). This convergence has spurred a growing literature exploring its underlying causes.

One line of research attributes the shrinking gradient to social and institutional shifts that improve work–family compatibility for educated women . As gender norms become more egalitarian and women's bargaining power in the home rises, men's participation in childcare increases, reducing the motherhood-career conflict for highly educated (Vasireddy et al., 2023). At the same time, family policies, from expanded childcare services to paid parental leave, have lowered the costs of childbearing for working parents, enabling women of all education levels to more easily combine career and family. These developments are thought to flatten educational differences in fertility by alleviating the incompatibilities that historically discouraged childbearing among educated (Kim, 2023).

Another explanation emphasizes economic factors, particularly the marketization of childcare (Bar et al., 2015; Hazan et al., 2021; Hazan and Zoabi, 2015). In particular, Hazan and Zoabi (2015) employ survey/census microdata to document that in the United States the education–fertility gradient became U-shaped in the 2000s: women with advanced degrees came to have higher birth rates than women with intermediate education. The authors attribute this remarkable rise to a decline in the relative cost of childcare for high-income families. In essence, decades of rising income inequality produced a larger supply of affordable domestic services and a class of highly educated women who could outsource childrearing. Consistent with this argument, their analysis finds that in states and years characterized by cheaper childcare (relative to the mother's wage) fertility was significantly higher, and that this factor alone explains roughly one-third of the fertility increase among highly educated women in the U.S.. Thus, economic changes have enabled educated women to more easily combine work and family, weakening the traditional trade-offs that suppressed their fertility.

A different strand of the literature focuses on fertility preferences and intentions. One hypothesis is that the desired family size of highly educated women have converged with those of other groups in modern low-fertility contexts. In fact, some recent studies employing survey data find little to no gap in desired number of children by education, suggesting that higher-educated individuals no longer universally want fewer children (Utomo et al., 2021). However, even without any rise in the fertility aspirations of women with high levels of education, the education gradient can narrow via changes in fertility planning. Ciganda et al. (2024) combine administrative data from Norway with a computational model. They show that as contraceptive use improves and unplanned pregnancies become less frequent, especially among lower-educated women, the negative association between education and completed fertility automatically weakens. Consequently, women's childbearing increasingly reflects their desired family size, and improved reproductive control narrows the education gap in fertility outcomes. This mechanism aligns with empirical evidence that a substantial share of recent fertility declines in developed countries is due to falling unintended birth rates (Kim, 2023).

However, because most demographic surveys lack detailed, time-invariant measures of socioeconomic background, researchers have so far treated educational groups as fixed and used education as a proxy for social status, opportunity costs, or women's position in society. As a result, existing studies largely overlook the fact that the composition of education groups has changed substantially over time. As access to higher education has expanded, educational attainment now includes women from increasingly heterogeneous socioeconomic backgrounds. This shift risks conflating genuine behavioral changes in fertility with compositional changes in who attains higher education. Failing to account for this may bias assessments of the effectiveness of family policies, which could appear successful in helping women achieve their desired fertility, even if the observed changes are partly driven by selection.

The contribution of this paper lies in investigating whether the flattening education–fertility gradient reflects genuine changes in behavior or shifts in the composition of education groups. To address this, we introduce a time-invariant measure of socioe-

conomic background that enables us to identify which groups are driving the observed changes. Leveraging high-quality Danish administrative data, we link individuals to their parents and examine fertility trends by socioeconomic status (SES). These are proxied by paternal income in early adulthood, divided into quartiles, a more stable indicator of long-term background than education, enabling us to track how fertility varies across SES groups and cohorts.

We begin by comparing the relationship between completed fertility and education for women aged 45 to 48 across cohorts, spaced four years apart, from 1990 to 2022. In older cohorts, higher education is associated with lower fertility, but this negative gradient weakens over time. In more recent cohorts, highly educated women increasingly match or exceed the fertility levels of the least educated.[5]

Next, we document that the distribution of educational attainment has changed markedly over time. In recent cohorts, fewer women stop their education after completing mandatory schooling, while an increasing number attains graduate and postgraduate degrees. These compositional changes raise concerns about interpreting fertility trends across educational groups purely as shifts in behavior, rather than as the result of a progressive selection into higher education of women with stronger fertility preferences.

Thus, we compare education-based fertility gradients with gradients based on paternal income measured during early adulthood. This approach allows us to isolate the role of changing selection into education in shaping observed fertility trends, thereby offering a clearer perspective on whether fertility preferences are truly shifting, or whether compositional change is driving the observed patterns.

From this analysis, it emerges that the decreasing education gradient in fertility is partly explained by compositional changes in educational attainment, with an increasing share of women, particularly from high-SES backgrounds, pursuing postgraduate degrees. By disentangling education from socioeconomic background, we find that the

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[5]This finding contrasts with (Ciganda et al., 2024), who argue that the flattening of fertility gradients is primarily driven by falling birth rates among low-educated women.

reversal in the education-fertility gradient is concentrated among women from wealthier families. For these women, fertility has risen alongside educational attainment, while for women from lower-SES backgrounds, the gradient narrows only modestly. Moreover, we show that the SES–fertility gradient itself varies by education level. Among low-educated women, the relationship between SES and fertility is negative, and this negative relationship strengthens over time. However, as we move up the education distribution, the gradient reverses. In particular, among highly educated women, fertility increases with SESs.

These findings carry important implications for both policy evaluation and the broader understanding of fertility inequality. First, they show that the narrowing education–fertility gradient is partly driven by changes in the composition of who attains higher education, not solely by the success of policies aimed at reducing unplanned births or improving career–family compatibility. Moreover, the shift is largely concentrated among women from socioeconomically advantaged backgrounds, who are increasingly both more likely to pursue higher education and to have larger families. This indicates that the apparent convergence in fertility across education levels may mask persistent disparities in who is able to combine family and educational aspirations.

The paper proceeds as follows: Section 2 outlines the data and methodology used in the analysis. Section 3 presents the main descriptive evidence of changing patterns in fertility across cohort and education; shifts in educational composition across cohort and SES; and fertility across the paternal income distribution. Section 4 concludes.

2   Data and empirical approach

2.1   Women's education and completed fertility across cohorts

This study uses data from the UDDA Register to collect data on the education of women resident in Denmark. Educational attainment is categorized into four groups:

(1) completed Grundskole, the mandatory level of schooling in Denmark (equivalent to less than 12 years of education); (2) high school degree, corresponding to 12–14 years of education;[6] (4) bachelor's degree, typically corresponding to 15 years of education; and (5) more than a bachelor's degree, defined as 17 or more years of education.

From the population register BEF, we collect information on women's age, migration status (categorized as Danish natives, immigrants, and second-generation immigrants), spaced at four-year intervals from 1990 to 2022, representing seven distinct birth cohorts. In each year, we select women aged 45 to 48 and identify their children using Denmark's unique personal identifiers, which link individuals to their parents. This allows us to compute completed fertility for each woman.

We merge the fertility data with information on educational attainment. As a further step, we aim to rank women by their paternal income (see section 2.2). However, becasue only residents of Denmark are included in the dataset, and thus, fathers residing abroad are not observed. Therefore, to ensure accurate and complete reporting of paternal information, we exclude immigrant women. Non-immigrant women represent 84%–97% of the original sample, resulting in a final analytical sample of 126,366 to 150,091 individuals, depending on the cohort analyzed.

Information on the identity of each woman's father is drawn from the FAIN register, which records paternal identifiers even if the father is deceased, provided he was a resident of Denmark. Restricting the sample to women with a reported father ID still retains between 92% and 99% of the original sample (we show in section 3.3 that the missing data do not alter the patter of fertility across the education distribution).

2.2 Women's social economic status, education and completed fertility across cohorts

In order to isolate the role of changing selection into education in shaping diverging preferences toward fertility across education groups, we compare education gradients

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[6]In Denmark, high school lasts for between 2 and four years

in fertility across cohorts to fertility gradients constructed using an alternative proxy for socioeconomic status. We rely on paternal income 26 years earlier (when the same women were between 19 and 23 years old), and therefore when the income of their father plausibly influenced their decisions about which level of education to pursue. For these reasons, paternal income quartiles should capture long-term socioeconomic status across cohort more consistently compared to education.

We measure paternal income quartiles within an age-specific income distribution and distinguish four quartiles. This provides a cohort-consistent proxy for socioeconomic background that is time-invariant. Therefore, this approach allows for more reliable comparisons of fertility gradients between cohorts. Comparing the changes in education-fertility gradient with those in the SES-fertility gradient, can inform on the role plaid by changes in education composition in shaping diverging trends in the fertility gradient over time.

To construct this measure, we begin by computing the distribution of men's income conditional on age. We use data from the IDAN register, which provides income information for the universe of men residing in Denmark. For each of the relevant observation years— 26 years before the observed fertility years— we collect annual income data. Since IDAN data is only available starting in 1980, we are restricted to observation years from 1980 onward (i.e., 1980, 1984, 1988, 1992, 1996). To improve robustness and reduce the impact of year-to-year fluctuations, we take a five-year moving average of income (1980–1985, 1984–1989, 1988–1993, 1992–1997, 1996–2001).

We link each man's income data from IDAN with his date of birth from the FAIN register via social security number, allowing us to assign an exact age to each income observation. This enables us to construct an age-conditional income distribution for each year. Given that paternal age at the time we observe their daughter's fertility varies approximately between 40 and 70 years old (as show in the **Appendix 5**), this approach allows for consistent comparison across cohorts and accounts for the life-cycle variation in earnings. For each age group, we divide the income distribution into four quartiles. Each fathers at a given age in a given year is assigned to a specific quartile.

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This yields a robust, age-normalized measure of paternal income rank.

We proceed merging paternal income data with the female fertility dataset by matching women to their fathers using the unique personal identifiers, specifically linking daughters to their father's record from 26 years earlier. Only fathers with a daughter in the primary female sample are retained. Due to the data limitations described above, this matching procedure can only be performed reliably starting with the cohort of women for whom we measure completed fertility in 2006. The final dataset, thus, includes information on women's completed fertility, educational attainment, and their father's income quartile at the time the women were aged 19–23.

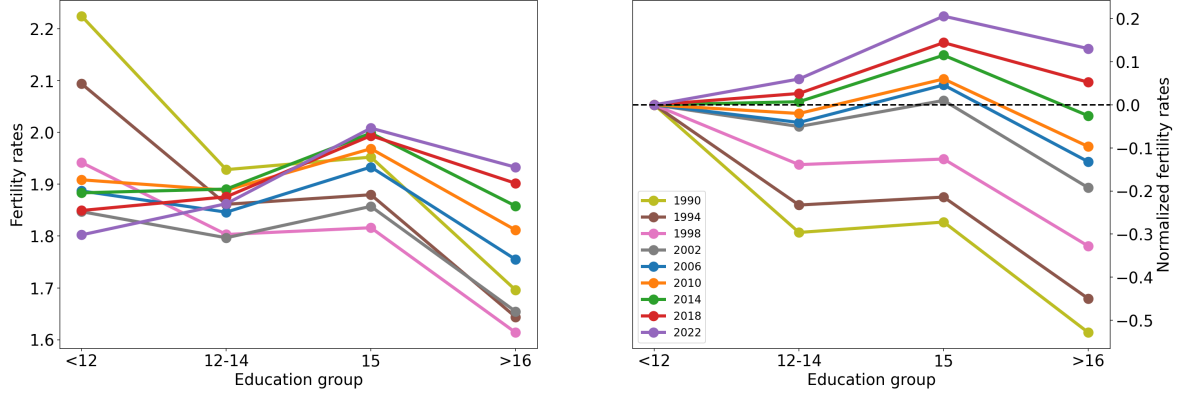# 3 Descriptive patterns in fertility, education, and socioeconomic background across cohorts

3.1 Changes in fertility across education groups and cohorts

The raw relationship between education and fertility across all cohorts included in the analysis is presented in **Figure 1 Panel A**. This figure provides an initial overview of how fertility outcomes vary by education level and how these patterns have evolved over time.

Fertility rates vary systematically across education groups in all cohorts. From **Figure 1 Panel A** it emerges that fertility among the least educated women declines notably in the earlier cohorts—especially between 1990 and 1994 (when fertility among lowest educated women shifts from over 2.22 children on average to 2.09), and again from 1994 to 1998 (from 2.09 to 1.94). However, completed fertility rates among low-educated women remained relatively stable at slightly below 1.9 children per woman in more recent cohorts, particularly those for which we also observe paternal income data (from 2006 onward). In contrast, completed fertility for women at the top of the education distribution staidly grows form 1.69 in 1990 to 1.93 in 2022. Consequently, the flattening of the fertility-education gradient appears primarily driven by rising

fertility among higher-educated women.[7]

Figure 1: Relationship between completed fertility and education across cohorts of women
45 to 48 years old

Note: The figure presents row levels of completed fertility (Panel A) and fertility rates
normalized to the lowest educated (Panel B) across education groups for cohorts of women
aged 45–48 in 2006, 2010, 2014, 2018, and 2022. *Source: author computation using data
from Danish Register*

To better inspect the evolving pattern of the education gradient in fertility, in **Figure 1 Panel B**, we present fertility rates normalized by the average fertility of women
with the lowest level of education in each cohort (following Doepke et al. (2023)). This
figure highlights the evolving education gradient in fertility while facilitating comparisons across groups and cohorts.

Comparing **Panel A and Panel B of Figure 1** it emerges that the gradient
between education and fertility progressively flattens over time, and even reverses in
the most recent cohorts. In particular, women at the top of the education distribution
of the 1990 cohort present significantly lower birth rates than women at the bottom of
the distribution (1.69 children on average versus 2.22), and the gradient is similar for
the 1994 cohort (1.64 children on average versus 2.09). The average completed fertility
among the lowest educated progressively declines, although not always monotonically,
whereas for women at the top of the education distribution it steadily increases moving
from older to more recent cohorts. In particular, in 2018 the highest educated women
present average completed fertility of 1.90, versus 1.85 of the least educated women in
the same cohort. For the 2002 cohort, the difference is even more striking with highest

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[7]This contrasts with Ciganda et al. (2024) who claim that the narrowing education gradient in
fertility is due to declining fertility among women with lower education levels rather than increases
among highly educated

educated women reporting average completed fertility of 1.93 versus least educated for whom this accounts to 1.80. Detailed row and normalized fertility rates are reported in **Table 1** and **Table 2**, respectively.

Table 1: Raw fertility rates across education and cohorts

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 (12–14 years)	1.92	1.86	1.80	1.79	1.85	1.89	1.89	1.87	1.86
Graduate degree (15 years)	1.95	1.88	1.81	1.86	1.93	1.97	2.00	1.99	2.01
Postgraduate (> 16 years)	1.69	1.64	1.61	1.65	1.75	1.81	1.86	1.90	1.93

Note: The table reports row levels of completed fertility across education groups for cohorts of women aged 45–48 in 2006, 2010, 2014, 2018, and 2022. *Source: author computation using data from Danish Register*

Table 2: Fertility rates across education and cohorts, normalized to the least-educated group

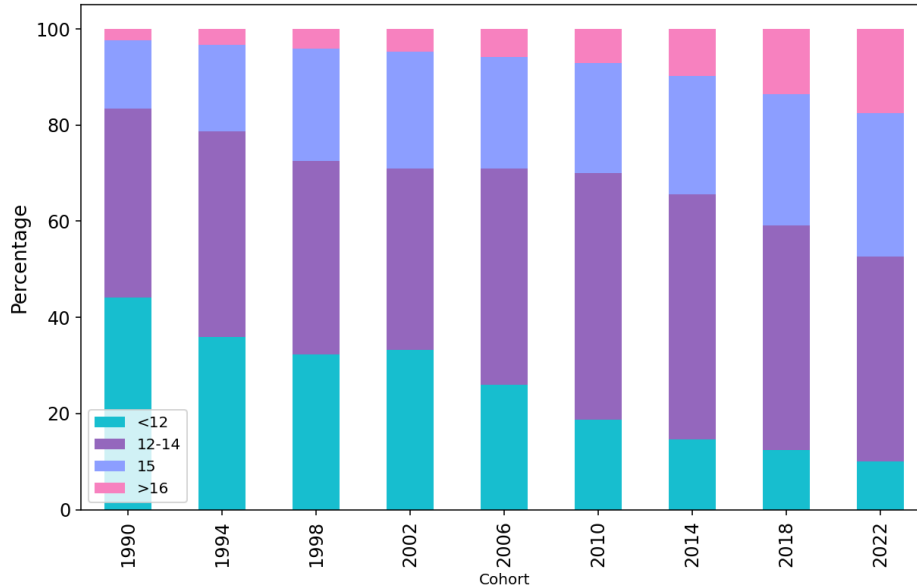| Education Level	1990	1994	1998	2002	2006	2010	2014	2018	2022
High school (12–14 years)	-0.29	-0.23	-0.14	-0.05	-0.04	-0.02	0.01	0.03	0.06
Graduate degree (15 years)	-0.27	-0.21	-0.13	0.01	0.04	0.06	0.12	0.14	0.20
Postgraduate (> 16 years)	-0.53	-0.50	-0.33	-0.19	-0.13	-0.10	-0.03	0.05	0.13

Note: The table reports completed fertility rates normalized to the group of least educated women (omitted in the table as their fertility rates serves as refers, i.e. 0.0) across education groups for cohorts of women aged 45–48 in 2006, 2010, 2014, 2018, and 2022. *Source: author computation using data from Danish Register*

Notably, women with a graduate degree (15 years of education) present higher completed fertility than women with a high-school degree and women with a postgraduate degree in each cohort. This is because this group includes with with a nursery, pedagogy and teacher degree. Presumably, women with stronger preferences for a family would self-select into public-sector jobs which allow for higher flexibility and more generous benefits.

3.2   Changes in education distribution across cohorts

Figure 2 represents how the distribution of education has evolved moving from older cohorts (starting from 1990) to more recent cohorts (until 2022) of women at age of completed fertility (45 to 48 years old). We observe a clear and steady decline in the share of women who complete only mandatory schooling (Grundskole), alongside a substantial rise in the share of bachelor's and postgraduate degree holders. The share of women at the bottom of the eduction distribution progressively declines from 44% among the 1990 cohort to 10% in the 2022 cohort. On the other hand, the share of women with a graduate degree (15 years of education) grows from 14% in 1990 to 30% in 2022. Finally, and most notably, the share of women with post-graduate degree progressively increases from 2% in 1990 to 17% in 2022. This sharp rise indicates that the group experiencing the most pronounced changes in completed fertility is also the one undergoing the greatest expansion in size, increasingly encompassing a broader range of women over time.

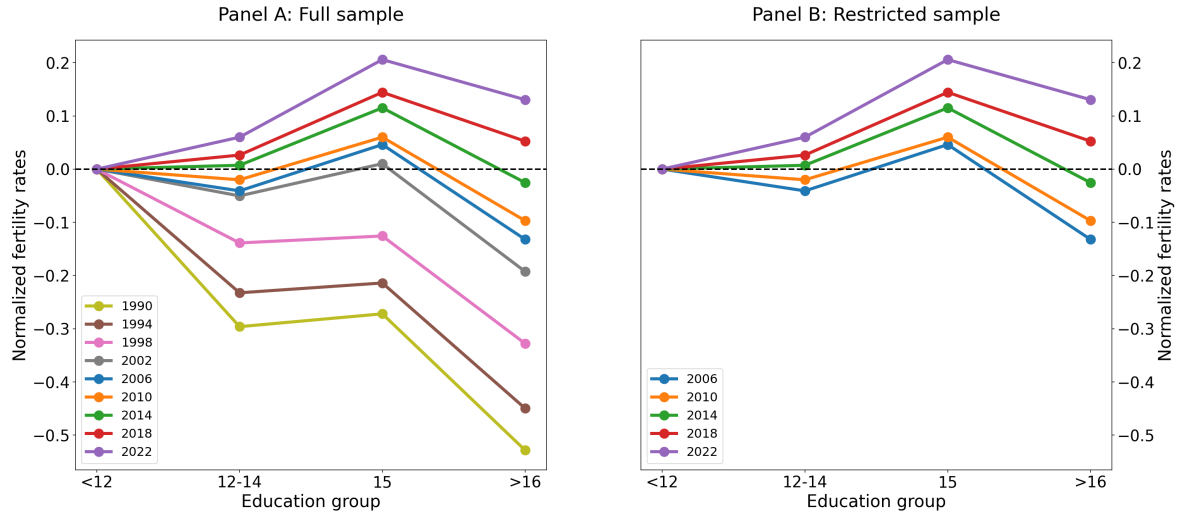Figure 2: Education distribution across cohorts

Note: The figure shows how the distribution of education in cohorts of women at age 45–48 spanning from 1990 to 2022 has changed moving from older to more recent cohorts. *Source: author computation using data from Danish Register*

3.3 Education versus SES gradient in feritlty

To explore how changes in fertility across education levels relate to shifts across socioe-conomic status (SES), this analysis focuses on cohorts for which SES can be measured using information on paternal income 26 years earlier—specifically, cohorts from 2006 onward.

Figure 3 Panel A replicates the analysis of **Figure 1 Panel B**, while **Panel B** restricts the sample to cohorts with available paternal income data (ranging between 92 and 99% of the original sample). The figures show that despite a small percentage of missing observations, the trend in the reduced sample (**Panel B**) is almost identical to the original trends including the entire population of women in their late forties regardless of whether the information on their fathers are available or not.

Figure 3: Normalized fertility rates across the education distribution: full sample (left) vs. restricted sample (right)

Note: The figure reports normalized fertility rates across the distribution of education in the full sample (**Panel A**) and in the restricted sample (**Panel B**). The full sample includes the universe of Danish women at age 45–48 spanning from 1990 to 2022, the restricted sample limits the anaylis to women who report information on their father in the IDAN and FAIN registers. The latter correspond to 92-99% of the original sample. *Source: author computation using data from Danish Register*
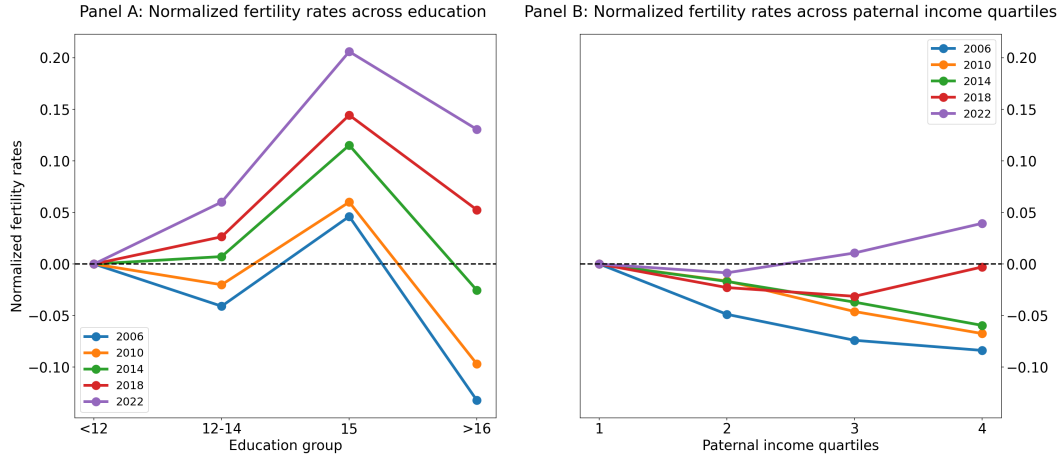
Figure 4 directly compares normalized fertility rates across the education distri-bution (**Panel A**) and across paternal income quartiles (**Panel B**) for the restricted sample of women for whom information on their fathers is available. The correspond-

ing fertility rates displayed in the two charts are reported in **Table 3**. In 2006, women with the highest level of education had, on average, 0.13 fewer children than those with only mandatory schooling. This negative gradient steadily narrows across cohorts and fully reverses with the 2018 cohort and peaks with the 2022 cohort when highly educated women have, on average, 0.13 more children than the least educated, a total shift of 0.26 children.

Panel B shows how the fertility gradient by paternal income evolved for the same sample. While the negative association between paternal income and fertility also weakens over time, the magnitude of this shift is smaller than that observed across education groups. In 2006, women in the highest paternal income quartile had 0.08 fewer children than those from the lowest quartile. By 2022, this gradient reverses to +0.04, indicating that women from higher-SES backgrounds are now having slightly more children than their lower-SES peers.

Although meaningful, the 0.12-child shift of paternal income gradient in fertility is less than half the size of the change observed in the education gradient, suggesting that compositional changes in educational attainment across cohorts may account for a substantial part of the observed reversal in fertility patterns. At the same time, the flattening and eventual reversal of the SES gradient implies that women from more advantaged backgrounds are increasingly choosing to have more children. Therefore, the changes in composition of education does not fully explain the declining education gradient in fertility presented in **Figure 1 Panel B** and in **Figure 4 Panel A**.

Figure 4: Relationship between completed fertility and education (left) and paternal income (right) across cohorts

Panel A: Normalized fertility rates across education   Panel B: Normalized fertility rates across paternal income quartiles

Note: The figure compares the relationship between normalized completed fertility and education (left) and paternal income quartiles (right) across cohorts of women aged 45–48 in 2006, 2010, 2014, 2018, and 2022.

Source: author computation using data from Danish Register

Table 3: Fertility rates across education and cohorts, normalized to the least-educated group

Education Level	2006	2010	2014	2018	2022
High school (12–14 years)	-0.04	-0.02	0.01	0.03	0.06
Graduate degree (15 years)	0.05	0.06	0.12	0.14	0.21
Postgraduate (> 16 years)	-0.13	-0.10	-0.03	0.05	0.13
SES/paternal income quartiles					
2nd paternal income quartile	-0.05	-0.02	0.02	0.02	0.01
3rd paternal income quartile	-0.07	-0.05	-0.04	-0.03	0.01
4th paternal income quartile	-0.08	-0.07	-0.06	0.00	0.04

Note: The table reports completed fertility rates across education groups (Panel A) normalized to the group of least educated women (omitted in the table as their fertility rate serves as reference, i.e., 0.0) and across SES groups (Panel B) normalized to the lowest SES group (also omitted). Data refer to women aged 45–48 in 2006, 2010, 2014, 2018, and 2022.
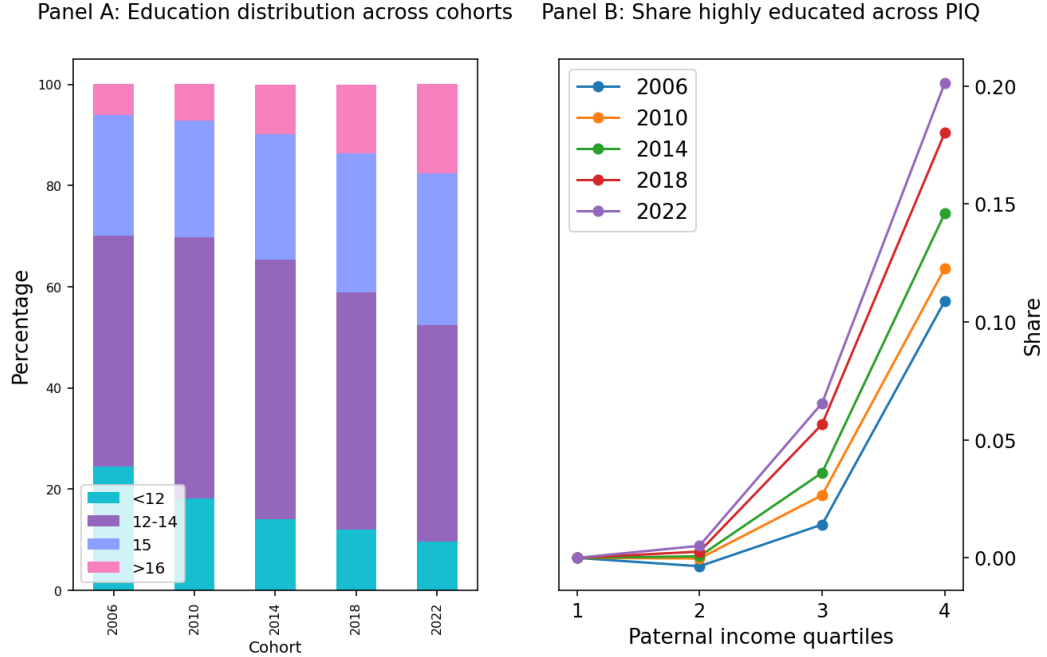
Source: author computation using data from Danish Register

3.4 Share of highly educated across SES and cohorts

To further explore this compositional shift, **Figure 5 Panel A** presents the distribution of education levels for the recent cohorts we selected for the analysis. Consistently with **Figure 2**, we observe a clear and steady decline in the share of women who complete only mandatory schooling (Grundskole), alongside a substantial rise in the share of bachelor's and postgraduate degree holders (from 23% in 2006 to 30% in 2022, and from 6% to 17% in 2022, respectively).

Figure 5 Panel B focuses on the latter group, plotting the share of women with a postgraduate degree across cohorts within each paternal income quartile—normalized to the share in the lowest quartile. While the share of postgraduates increases over time in all income groups, the gradient across income quartiles also steepens. Women in the highest paternal income quartile exhibit the most pronounced increase in postgraduate attainment over time. Specifically, the share of top educated women in the second lowest paternal income quartile is stable across cohorts and negligible. For women in the third paternal income quartile, it grows from 1.4% for the 2006 cohort to 6.5% for the 2022 cohort. Lastly, among women at the top of the paternal income distribution, the share postgraduates grows from 11% to 20% between the 2006 and the 2022 cohort.

Figure 5: Distribution of education across cohorts (left) and share of highly educated across SES and cohorts (right)
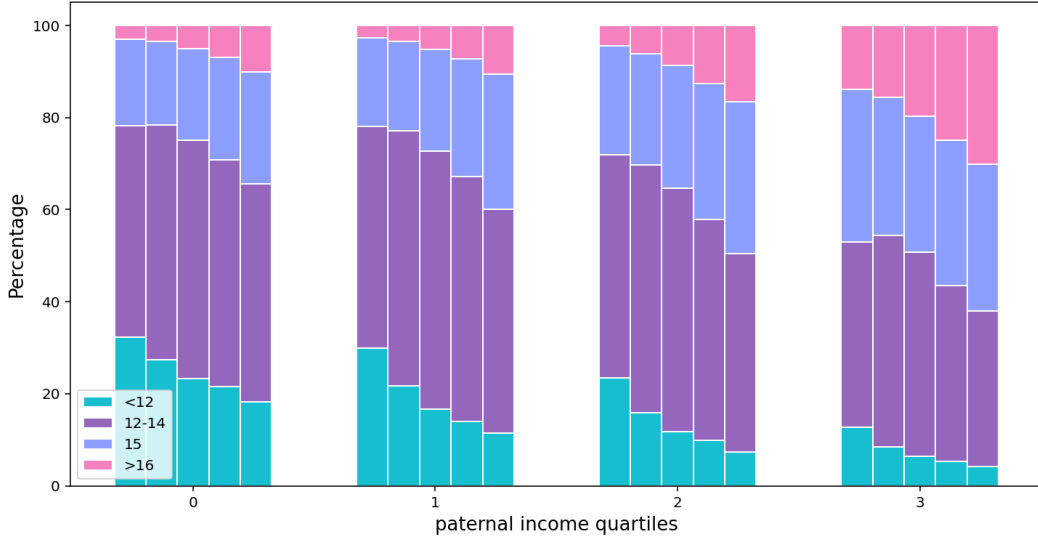

Note: Panel A shows how the distribution of education for women aged 45–48 in 2006, 2010, 2014, 2018, and 2022 changes moving from older to more recent cohorts. Panel B presents the share of women in the highest education group across paternal income quartiles and cohorts. *Source: author computation using data from Danish Register*

We complement this analysis displaying the progressive shift in the educational distribution across socioeconomic status (SES), proxied by paternal income quartiles, from older to younger cohorts is shown in **Figure 6**. A clear pattern emerges: across all SES groups, the share of women with only mandatory education (fewer than 12 years) steadily declines over time, while the shares of women with graduate (15 years) and postgraduate education (more than 16 years) increase consistently across successive cohorts. The figure also highlights the persistent association between education and socioeconomic background. Among women in the lowest paternal income quartile, the proportion with only mandatory schooling decreases from 32% in the 2006 cohort to 18% in the 2022 cohort. In contrast, for women in the highest SES group, this share falls from 13% to just 4% over the same period. At the top end of the distribution, the proportion of women with postgraduate degrees ranges from 14% to 30% across cohorts in the highest income quartile, while it remains much lower—between 3% and

18

10%—for women from the lowest SES background.

Figure 6: Education distribution across SES and cohorts

3.5 Heterogeneity analysis: changes in education gradient across SES

To explore how changes in the education-fertility gradient vary by socioeconomic background, **Figure 7** plots normalized fertility rates by education level separately for each paternal income quartile. This allows us to assess how the relationship between education and fertility evolves within distinct paternal income brackets over time.

It is immediately noticeable that the heterogeneity in education gradient across cohorts is not limited to temporal trends. In fact, at any given cohort, the education-fertility gradient varies substantially across SES groups: it is most negative among low-SES women, flattens for those in the middle, and is consistently positive for those from high-SES backgrounds, even in the earliest cohorts. This pattern suggests that the relationship between education and fertility is fundamentally stratified by socioeconomic background, with distinct gradients emerging across SES groups.

Breaking down how the education gradient in fertility evolves across cohorts within

each paternal income quartile, the figure shows that the gradient flattens, and in some cases reverses, between 2006 and 2022. However, the magnitude and direction of change vary systematically by SES. Among women in the lowest paternal income quartile (**Panel A**), fertility rates remain largely flat across education levels, with only modest variation over time (from –0.23 children in the 2006 cohort to –0.06 in 2022). The gradient is consistently negative, and even in 2022, fertility remains lowest among women with postgraduate degrees.

For women in the second paternal income quartile (**Panel B**), a more notable change occurs. The education-fertility gradient becomes increasingly positive across cohorts, with highly educated women showing progressively higher fertility relative to their less educated peers (from –0.29 in 2006 to +0.03 in 2022). As the gradient turns positive for the 2018 and 2022 cohorts, this pattern suggests a weakening trade-off between education and fertility for middle-SES women.
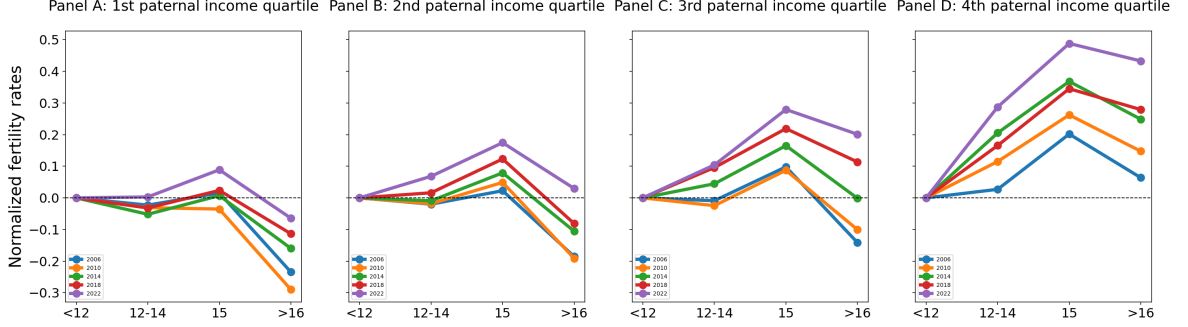
Among women in the third paternal income quartile (**Panel C**), the reversal of the education gradient becomes even more evident. Fertility differences by education level evolve from a slightly negative gradient in 2006 (–0.04) to a clearly positive one by 2022 (+0.20). Both the 2018 and 2022 cohorts show a positive association between education and fertility, while the 2014 cohort appears near flat.

The most striking reversal is observed in the highest paternal income quartile (**Panel D**). Already in 2006, the fertility gradient is upward sloping, with more educated women having more children on average. This trend intensifies over time: by 2022, fertility is highest among women with a postgraduate degree. The gradient becomes steeper while remaining consistently positive—rising from a difference of 0.06 children between the highest and lowest education levels in 2006 to 0.43 in 2022. This indicates that for high-SES women, higher education is increasingly associated with higher fertility.

Overall, this figure shows that the flattening and reversal of the education-fertility gradient is not uniform across SES groups. Rather, it is largely driven by women from higher socioeconomic backgrounds, who experience the most pronounced increases in

fertility at higher levels of education. Meanwhile, among low-SES women, the negative gradient remains relatively more stable, suggesting persistent constraints or trade-offs between education and childbearing.

Figure 7: Heterogeneous Changes in the Education Gradient in Fertility Across SES

Note: The figure shows how the relationship between normalized completed fertility and education varies across cohorts of women aged 45–48, separately by socioeconomic status (SES), measured using paternal income quartiles. Panel A corresponds to the lowest quartile, Panel B to the second, Panel C to the third, and Panel D to the highest quartile.

Source: author computation using data from Danish Register

3.6 Heterogeneity analysis: changes in SES gradient across education groups

As a complementary analysis, we examine how the relationship between paternal income and fertility varies across educational groups and how it has evolved over time.

Figure 8 displays normalized fertility rates by paternal income quartile for each education category: **Panel A** shows women with fewer than 12 years of education, **Panel B** shows those with 12–14 years, **Panel C** shows those with 15 years, and **Panel D** covers postgraduate women with more than 16 years of education.
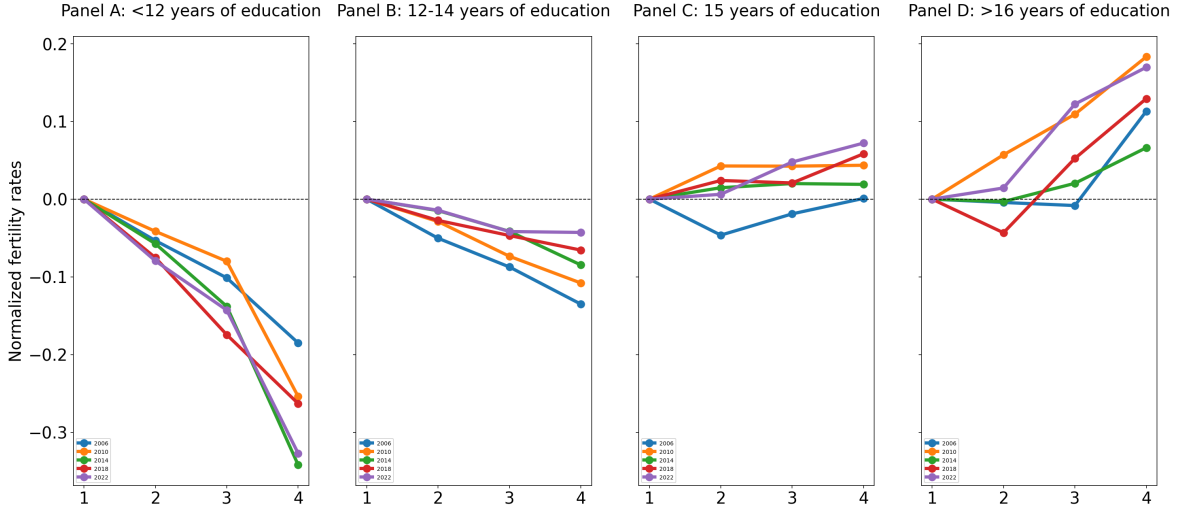
The figure reveals a progressively reversing SES gradient across education groups. Among women with lower levels of education (**Panel A** and **B**), the relationship between paternal income and fertility is negative, while for more highly educated women (**Panels C** and **D**), the relationship becomes increasingly positive. This shift suggests that socioeconomic background plays a different role in shaping fertility depending on women's level of education.

Notably, for women with the lowest education (< 12 years), the SES gradient remains consistently negative and even becomes more pronounced over time, declining from –0.19 in the 2006 cohort to –0.33 in 2022. Among high school graduates (12–14 years), the gradient is also negative but flattens steadily across cohorts, from –0.13 in 2006 to –0.04 in 2022.

In contrast, for college-educated women (15 years), the SES gradient is approximately flat in 2006 and becomes increasingly positive over time, reaching 0.07 by 2022. The most substantial positive gradient is observed among postgraduate women (> 16 years), where the SES gradient rises from 0.11 in 2006 to 0.17 in 2022, although the increase is not strictly monotonic across all cohorts.

These results indicate that the relationship between fertility and socioeconomic background is strongly conditioned by educational attainment. While fertility among low-educated women remains inversely associated with SES, for highly educated women, especially postgraduates, coming from a higher-SES background is increasingly associated with higher fertility. This pattern reinforces the notion that high-SES women are better able to reconcile higher education and family formation, particularly in recent cohorts.

Figure 8: Heterogeneous Changes in the SES gradient in fertility across education groups

Note: The figure shows how the relationship between normalized completed fertility and SES varies across cohorts of women aged 45–48, separately by education group. Panel A corresponds to the lowest education, < 12 years, i.e. mandatory schooling; Panel B to 12−14 years of educations, i.e. high school degree; Panel C to 15 years of education, i.e. bachelor degree; and Panel D to 17 year of education, i.e. postgraduate degree. *Source: author computation using data from Danish Register*

4   Conclusions

Using administrative data from the Danish register, this paper documents the evolution of the education-fertility gradient across nine cohorts of women aged 45–48, demonstrating that highly educated women increasingly match or exceed the fertility of their less educated peers.

We begin by showing that the narrowing gradient is the result of two simultaneous trends: (1) declining fertility among low-educated women in recent cohorts compared to earlier ones, and (2) rising completed fertility among highly educated women over time. At the same time, the educational composition of cohorts has shifted dramatically. In particular, the share of women with only compulsory education has shrunk, while the share attaining graduate and postgraduate degrees has risen steeply.

Given these compositional shifts, we investigate whether the observed changes in fertility reflect true behavioral change or selection into education. Our analysis com-

pares the education-fertility gradient to the fertility gradient by socioeconomic status (SES), proxied by paternal income at ages 19–23. Although the SES gradient in fertility also weakens and reverses slightly over time, the shift is only half as large as that seen in the education gradient. This suggests that changes in education composition explain part, but not all, of the reversal in fertility patterns. Notably, women from high-SES backgrounds increasingly combine higher education with higher fertility.

We further show that the rise in postgraduate attainment is especially concentrated among women from high-SES families. This selective expansion of the highly educated group is critical for understanding the fertility dynamics within it. Disaggregated analyses reveal that among women with postgraduate degrees, it is mostly those from high-SES backgrounds to exhibit rising fertility. Although positive, the increase is significantly less pronounced for highly educated women from lower SES.

This stratified pattern is reinforced when examining SES gradients within education groups: while low-educated women consistently show a negative relationship between SES and fertility, the gradient flattens and eventually becomes positive as we move up the education ladder. Importantly, among low educated women, the negative SES gradient in fertility strengthens over time.

These findings point to a progressive rise in college attendance across all SES groups and a concurrent increase in fertility among highly educated women, regardless of socioeconomic background. At the same time, there is evidence of growing bifurcation in the ability to reconcile education and family life: women from high-SES backgrounds are not only more likely to attain postgraduate degrees, but also more likely to maintain or increase their fertility while doing so. In contrast, low-SES women, particularly those who attain higher education, appear to face greater constraints or trade-offs.

These results have important policy implications. First, as the education-fertility gradient appears to be driven largely by privileged women, universal policies may not be enough. While Nordic countries like Denmark offer generous family benefits, the uneven fertility responses across SES groups suggest that these policies may disproportionately benefit high-SES women.

This points to an increasing need for targeted interventions to encourage women to pursue high education while reducing fertility disparities across SES. Policies specifically designed to support low-SES women pursuing higher education—such as conditional cash transfers (CCTs), housing assistance, or subsidized childcare tied to university enrollment—may help relax their financial constraints which plausibly generate higher trade-offs between career and family.

Support for multigenerational care responsibilities could also play a role. Lower-SES women may face greater pressure to provide unpaid elder care due to limited family resources, exacerbating the perceived cost of having children. Addressing the the economic constraints associated with raising children for these women may improve their ability to pursue both education and family goals.

Our findings raise important questions about the mechanisms underlying fertility divergence among highly educated women. A key direction for future research is to explore why high-SES women are increasingly able to combine higher education with family formation, while their low-SES counterparts continue to face structural constraints. One possible explanation is that women from more advantaged backgrounds are better positioned to benefit from family-friendly policies (Luci-Greulich and Thévenon, 2013), as they are more likely to access secure or flexible employment, often facilitated by stronger family networks and intergenerational support.

Another contributing factor may be assortative mating: higher-SES women are more likely to marry wealthier partners, reinforcing intergenerational advantages. These additional household resources improve their ability to afford expensive childcare and other costs associated with childrearing (Albertini et al., 2024).

Moreover, high-SES women often face fewer binding financial constraints. Support from parents, whether in the form of direct financial transfers or access to family, owned housing, can significantly reduce the economic burden of childbearing, particularly in contexts of rising housing prices and high opportunity costs of early parenthood. Previous studies have shown that housing affordability plays a crucial role in shaping fertility decisions, especially for younger adults in urban areas (Tocchioni et al., 2021;

Washbrook, 2013).

Another important avenue for future work is to disentangle the causal relationship between education and fertility decisions. While the economic theory traditionally assumes that educational attainment precedes and shapes fertility behavior, it is also plausible that women's desired family size influences their educational choices (Jones and Tertilt, 2008). Theory-driven research and longitudinal data could help assess whether women with strong fertility preferences are more or less likely to pursue advanced degrees, and how this interplay varies across socioeconomic backgrounds.
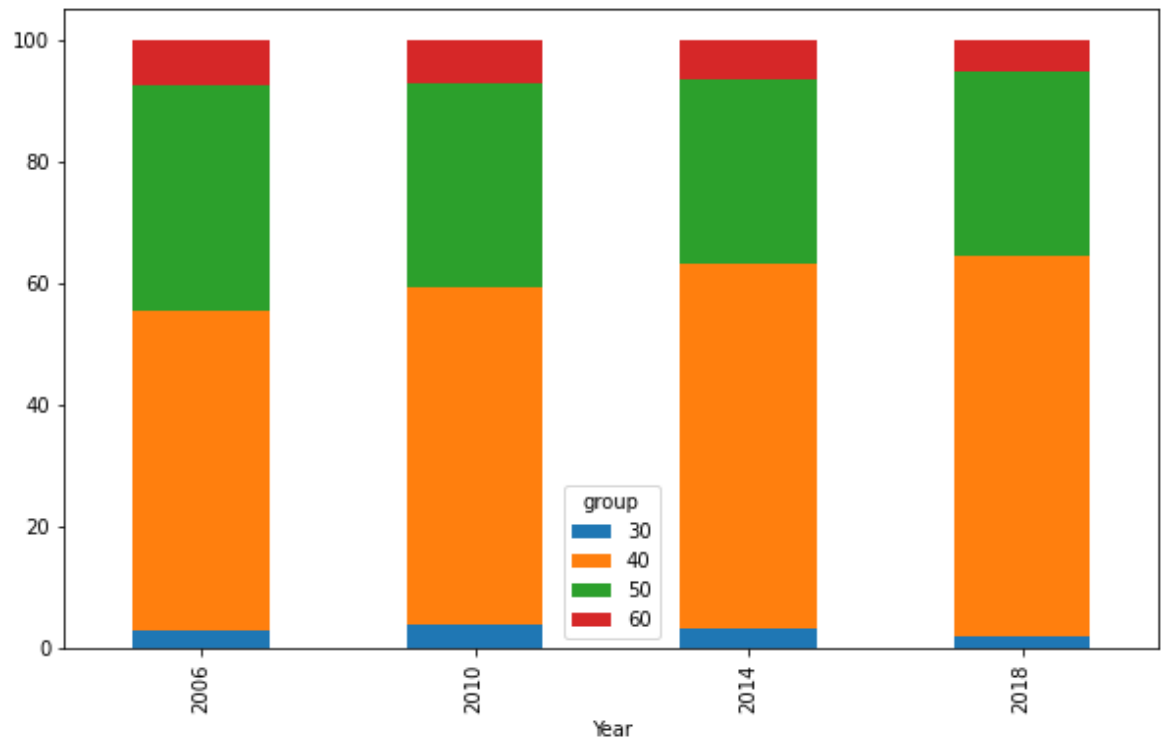
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5 Additional figures

Figure 9: Heterogeneous Changes in the SES gradient in fertility across education groups

Note: The figure shows the distribution of fathers' age across cohorts of women at the time their paternal income is measured.
Source: author computation using data from Danish Register