Parental Separations: Developments, Causes and Consequences

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Abstract

Parental separation is a common event in childhood, yet the developments and consequences remain poorly understood. In this paper, we use data on residential co-location to identify all parental separation events among children born in Sweden between 1952 and 2007. While high-SES households are as stable today as in the 1960s, household stability declined sharply among low-SES households since the 1970s. Restricting attention to divorce severely understates the SES gradient and changes over time. Turning to children's outcomes, we find little evidence that parental separations have a long-run impact on learning outcomes as measured by national test scores. In contrast, parental separations significantly reduce teacher-assigned grades, and consequently, academic track enrollment in high school. The findings suggest that school-based interventions, rather than household interventions, may be key to supporting children following separations.

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1 Introduction

Despite the rising rates of parental separations and single-parent households observed in many countries, the developments and consequences of parental separation events remain poorly understood. In this study, we use administrative data from Sweden to study parental separations for children born between 1952 and 2007. A key novelty is that we identify parental separations based on the residential colocation of parents on a 100x100 meter grid. As such, we do not rely on divorce to identify separation events, which as we will show, has become increasingly unrepresentative due to changing selection into marriage. Furthermore, the availability of data on national standardized tests and other educational outcomes enables us to study the effects of parental separation in significantly more detail compared to previous studies.

To understand the developments in parental separations and who is affected by parental separations, we start by providing a set of four novel descriptive facts. We first focus on the changing nature of the SES gradient in parental separations. Prior to the 1970 birth cohort, there was a positive relationship between parental separation rates and SES. This relationship changed permanently around 1970. Among recent cohorts, an additional year of maternal education is associated with a 4 pp reduction in the parental separation probability. Children born to high-SES families today are as likely to experience a parental separation event as those born in the 1960s. Consequently, the entire increase in parental separations over the last decades in Sweden has been driven by a decline in family stability among low-SES households.

Second, we provide novel evidence regarding the type of parental separation events. The majority of parental separations within all groups are driven by separations that occur during childhood, rather than single parenthood at birth. As such, the higher rates of single parenthood among low-SES household predominantly reflect higher separation rates throughout childhood, rather than a difference in the likelihood of single-parenting at birth. Parental separation rates are monotonically decreasing with SES in every single age during childhood. Interestingly, whereas separation rates fall with children's age among low-SES households, separation

rates increase with age among children in high-SES households.

Third, we show that the distinction between divorce and parental separation is critical for establishing the descriptive facts. Fewer than 40% of parental separation events among recent birth cohorts involve a divorce, which means that the median parental separation event no longer involves a divorce. Since the selection of low-SES households into marriage has become increasingly selective over recent decades, relying on divorce underestimates the SES-gradient in parental separations by 50%. Furthermore, the monotonically increasing SES-gradient in parental separations during the last decades is virtually invisible when restricting attention to divorce. As such, divorce has become a poor indicator to study developments in parental separation events in recent decades.

Fourth, we show large spatial heterogeneity in parental separation probabilities. Whereas parental separations were concentrated around urban centers between 1950 - 1970, the gravity of parental separations events has shifted towards smaller, formerly industrial, towns. In the most affected parts of Sweden, over half of children born in recent cohorts experience a childhood separation event. Differences in observable parental characteristics can explain less than a third of the spatial variation, suggesting that the local environment and community may play an important role in explaining the prevalence of parental separation events.

Next, we study why family stability has diverged across socioeconomic groups. Using the variation across space and time, we show that the changes in household stability are strongly related to changes in the economic position of parents, in particular among groups with a historical employment in the manufacturing industry. Changes in assortative matching and the improvements specifically in female labor market prospects appear to be less important in explaining the developments. There is also evidence that changes in social norms can play a role. Stronger declines in religiosity, as measured by Sunday mass attendance, are associated with larger declines in parental cohabitation.

Beyond studying the differences in separation probabilities at the group level, we also study heterogeneity in the parental separation probability at the individual level. To predict separation events, we train a generalized random forest model

(Athey, Tibshirani and Wager, 2019) based on the universe of at-birth characteristics observed in the administrative data for each parent and the match. The model performs well out of sample and predicts parental separation probabilities ranging from 15% to 75%, highlighting that parental separation probabilities widely vary between households. At the same time, even children born into the most economically and demographically favorable families face a relatively high baseline separation risk, which appears difficult to isolate from based on economic and demographic household characteristics.

Finally, we study the effects of parental separation on the educational outcomes of children. We use the variation in the timing of parental separation events between siblings to estimate the effect of parental separations. We find limited effects of parental separations on the grade 3, 6, and 9 national test scores, despite these test scores being highly predictive of future educational outcomes. Parental separation events have the strongest impact when they occur shortly before the test takes place, which suggests disruption effects, rather than a persistent effect on learning outcomes. The within-household estimates are closely in line with cross-sectional estimates, with children whose parents separated prior to the national tests performing 0.03 - 0.07 SD worse compared to non-separated parents conditional on SES. In comparison, a one year increase in maternal education is associated with a 0.10 - 0.17 SD increase in test scores. As such, parental separation events appear to have a limited impact on the learning outcomes as measured by national test scores.

However, the impact of parental separations significantly changes when we focus on teacher-assigned grades. Children whose parents separated at any point prior to age 15 score 0.10 - 0.15 SD worse on the compulsory school GPA compared to their siblings who completed compulsory school at the time of the separation. The cross-sectional difference in teacher-assigned GPA is similarly three times larger than the difference in national test scores, despite the fact that the compulsory school GPA and the grade 9 national test score are available for the same children, for the same subjects, and are determined very close in time.

Given that compulsory school GPA is the sole criterion for secondary school track

admissions, the negative effect on teacher-assigned GPA directly affects subsequent educational possibilities. Children whose parents separated prior to age 16 are 2 - 3 pp less likely to enroll in the academic track compared to their siblings who were slightly older at the time of the separation. These estimates are similar to the findings by Hertegård (2025*a*) based on a Swedish divorce law reform in 1974. The decline in academic track enrollment can be fully explained by the lower primary school GPA, with no evidence that parental separations affect high school track choices conditional on GPA. As such, it is the effect on teacher-assigned grades, rather than the effect on learning outcomes as measured by standardized tests or changes in educational choices, that explains the lower levels of educational attainment among children whose parents separated during childhood.

Our paper contributes to three strands of literature. First of all, we contribute to the literature on the prevalence and impact of parental separations. We extend the literature by using administrative data which includes parental residential location over a 70-year period, which enables us to move beyond studying parental divorces as is typical in the literature (Persson, 2020; Frimmel, Halla and Winter-Ebmer, 2024; Hertegård, 2025*a*; Brown, Flinn and Mullins, 2025). We show that using parental divorce as a proxy for all parental separations can lead to misleading conclusions regarding the incidence and developments in parental separations. We also contribute to the literature on the impact of parental separations (Gruber, 2004; Hertegård, 2025*b*; Johnston, Jones and Pope, 2025) by providing evidence on how parental separation shapes the human capital outcomes of children. Our results highlight that parental separation events have little impact on learning outcomes as measured by test scores, but much larger effects on teacher-assigned grades. This suggests that school-based interventions, rather than household interventions, may be most successful in mediating the effects of a parental separation event on children's educational outcomes.

Second, we contribute to research on the determinants of inequality of opportunity. Previous studies show the impact of a variety of factors in shaping equality of opportunity, such as place of residence (Chetty and Hendren, 2018; Chyn, Collinson and Sandler, 2025), local school financing (Biasi, Lafortune and Schönholzer,

2025), and early educational opportunities (Cornelissen et al., 2018; Gray-Lobe, Pathak and Walters, 2023). Recent studies also highlight the impact of various childhood shocks that are typically more common among low-SES households, such as evictions (Collinson et al., 2025), out-of-home placements (Helénsdotter, 2025), and parental deaths (Daly et al., 2024). In this paper, we highlight the role of a different childhood shock: parental separations. The results suggest that changes in household stability over recent decades are an important factor to explain the enduring educational disadvantage experienced by children from low-SES backgrounds, as recently highlighted by Chetty et al. (2026).

Third, we contribute to a literature that attempts to more generally understand changes in family formation and separation events (Reynoso, 2024; Dias et al., 2025) by studying the determinants of parental separations at both the individual and group level. Using rich administrative data, we shed light on the factors that explain the deterioration in the stability of low-SES families over time, while leaving the stability of high-SES families virtually unaffected. Our findings support the notion of Autor, Dorn and Hanson (2019) in the European context, namely that changes in economic conditions among low-SES males are an important factor in explaining the changes in family stability. Finally, beyond highlighting the individual level predictors of separation events, our prediction model shows a high baseline separation probability even among families with the most favorable economic and demographic characteristics. This suggests that idiosyncratic relationship factors remain an important driver of separation events in addition to the structural factors related to demographic and economic changes.

The remainder of this paper proceeds as follows. Section 2 discusses the data and methodology. Section 3 provides descriptive evidence regarding the developments in parental separations and its relationship with SES. Section 4 presents a model of parental separations to explain the observed facts. Section 5 presents the results of the generalized random forest to highlight the predictors of separation at the individual level, whereas section 6 estimates the effects of parental separations on educational outcomes. Section 7 discusses implications and concludes.

2 Data and sample selection

We use administrative data from Statistics Sweden that cover the period between 1968 - 2023. The data cover the full Swedish population, and include information on educational attainment, income, residential location, migration background, as well as other various characteristics. We are also able to link parents to children across multiple generations.

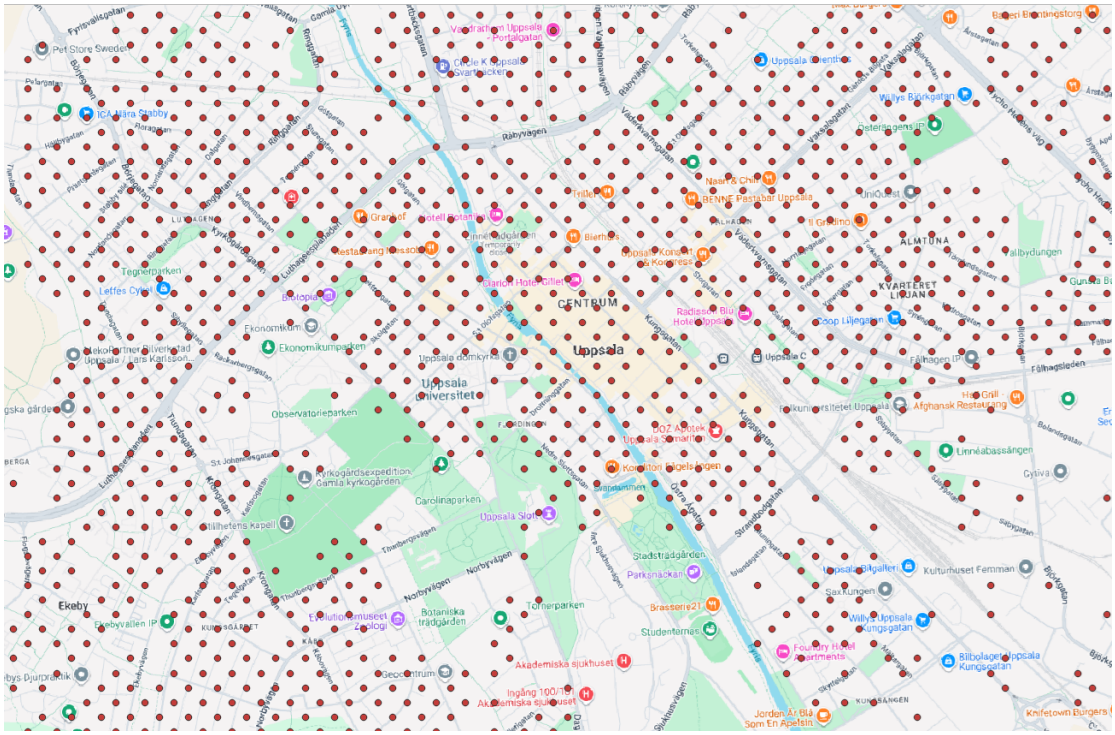
2.1 Parental cohabitation and separation

A novelty of our data is that it records the residential location of the Swedish population based on a grid consisting of 100 x 100 meter squares on December 31st of every year starting in 1982. Figure 1 shows the granularity of the residential location data for the city of Uppsala. We classify parents as cohabiting in a given year if they are registered in the same 100 x 100 meter square at the end of the year. While this approach might classify separated parents as cohabiting if they are separated yet live in very close proximity to each other, the grid in practice is fine enough that such cases are very few. We show this by comparing our measure of cohabitation based on the residential location to cohabitation according to the Swedish Register of the Total Population for the later cohorts in our sample. For later cohorts, the Register of Total Population classifies parents as belonging to the same family if they either are married or are cohabiting in the same residential unit with common children. Both measures of cohabitation overlap almost perfectly in the years for which they are both available as shown in Appendix Figure A.1.

For the earliest cohorts in our sample (those born between 1952 and 1965), we measure parental cohabitation based on the Swedish Register of the Total Population. In the earlier years, only married individuals are considered as being part of the same household.[1] While this limits some of our analysis for the earliest cohorts, the geographic location data fortunately becomes available just before the rise of unmarried cohabitation among parents in Sweden. Since much of our

[1]From 1998 onwards, cohabiting individuals with common children also begin to be classified as part of the same household in the Swedish Register of the Total Population. We can already observe these from 1982 onward using the location data.

Figure 1: Granularity of residential location data



Note: The figure shows the spatial scale on which place of residence is recorded for the city of Uppsala. Each dot represents a grid-cell of 100 x 100 meters. Grid cells without any registered residents are excluded.

analysis considers parental cohabitation at age 16 as the key outcome, and having unmarried cohabiting parents at age 16 remained very rare for children born in 1966, the measurement error is limited, and no trend-breaks in cohabitation rates are visible once we switch to the residential data in 1982 as shown in appendix Figure A.1.

We classify couples as having separated if they cease cohabiting and do not cohabit again at a future point in time. We classify those who begin cohabiting again as not having separated in order to avoid conflating true separations with cases where parents temporarily reside in different locations for e.g. work or other reasons. The drawback of this approach is that true separations, where the couple separates for a few years and gets back together later, are not classified as separations in our analysis. However, cases where a couple ceases cohabiting and then cohabits again for a sustained period of time are relatively rare.

2.2 Definition of SES

As we are interested in studying the developments in separation events by SES, we need a consistent definition of SES. Throughout the baseline analyses, we define SES based on the years of maternal education. The reason for this is three-fold. First of all, maternal educational attainment is virtually always available and linked to children. In contrast, in particular among single-parent households at birth, the details of the father are not always known. Given that the likelihood of not observing the fathers differs by SES, excluding children with missing details on the father may introduce a SES bias. Second, the years of maternal education are highly predictive of the outcomes of children as shown in appendix Figure A.2. Among mothers with just compulsory education, around 20% of children enroll in university. In comparison, around 80% of children born to a mother with a 4-year college degree enroll in university. As such, maternal education and children's outcomes are highly correlated. Third, as recent literature points out, maternal characteristics are in general more predictive of the outcomes of children compared to paternal characteristics (Lundborg, Plug and Rasmussen, 2024). As such, assigning families to SES based on maternal characteristics is more closely linked to the outcomes of children, compared to paternal characteristics.

Throughout the paper, we convert maternal education into years of education. The conversion of educational attainment into years of education is discussed in detail in appendix section B.1. Information on educational attainment becomes available in the Swedish data from 1990. We define the maternal education as the most recent record on the maternal education, since the coverage and encoding of the educational registers has generally improved over time.

2.3 Sample selection

We present the developments over time for the cohorts of children born in 1952 - 2007. We end the analyses with the 2007 cohort since this is the last cohort for which we observe children during the year in which they turn 16. This is an important age in the Swedish context, as it is when children typically graduate from primary school and finish their compulsory education.

Beyond showing descriptive changes over time for the longest possible time-period, we present more detailed results for the cohorts born between 1995 and 2007. We focus on this group for two reasons. First, there are substantially more extensive register data on parental income and education starting in 1990, which means that for children born in this period, we observe at least 5 years of pre-birth parental characteristics. Second, we will show that parental separation rates were relatively stable across these cohorts. This means that we are able to present results without being overly concerned about changes within the sample period. Characterization of couples by separation probability using machine learning is also done for mothers who had their first child in 1995-2007. Finally, we observe detailed data on educational outcomes, including a variety of national test scores and primary school GPA, for most of these cohorts.

We restrict the sample to children born in Sweden to Swedish-born mothers. There are four reasons for this restriction. Firstly, we do not necessarily observe age at parental separation for foreign-born children, since this may have occurred prior to arrival in Sweden. Second, data on parental characteristics, including educational attainment, is better documented and more comparable among mothers who completed their education in Sweden. Third, focusing on children of Swedish-born mothers allows us to abstract from changes in ethnic and religious composition of the population due to the substantial migration inflows to Sweden during the period under study. Finally, we are able to make intergenerational connections to the grandparent generation for the majority of children with Swedish-born mothers. However, the descriptive findings are similar when including children born in Sweden to non-Swedish born mothers.

Finally, we exclude children if they or either of the parents are deceased before the year they reach the age of 16. We do not exclude children for whom either parent migrated abroad, since this can be an endogenous outcome of a parental separation event. Changes in cohabitation rates are presented for those whom the maternal education is known. Since education is recorded in the administrative data from 1990 onward, children with mothers who died or emigrated before 1990 are missing information on maternal education and are thus excluded from the

corresponding results. This excludes at most 13% of children (in the 1952 cohort). In total, the sample used for the key descriptive results consists of 4,937,052 children. For the more detailed analyses based on the 1995 - 2007 birth cohorts, we have complete data on 1,035,740 children. Throughout the descriptive and causal analyses, we consider the child to be the unit of observation. As such, the analyses reflect the experiences of children, rather than parents.[2]

3 Descriptive evidence on parental separations

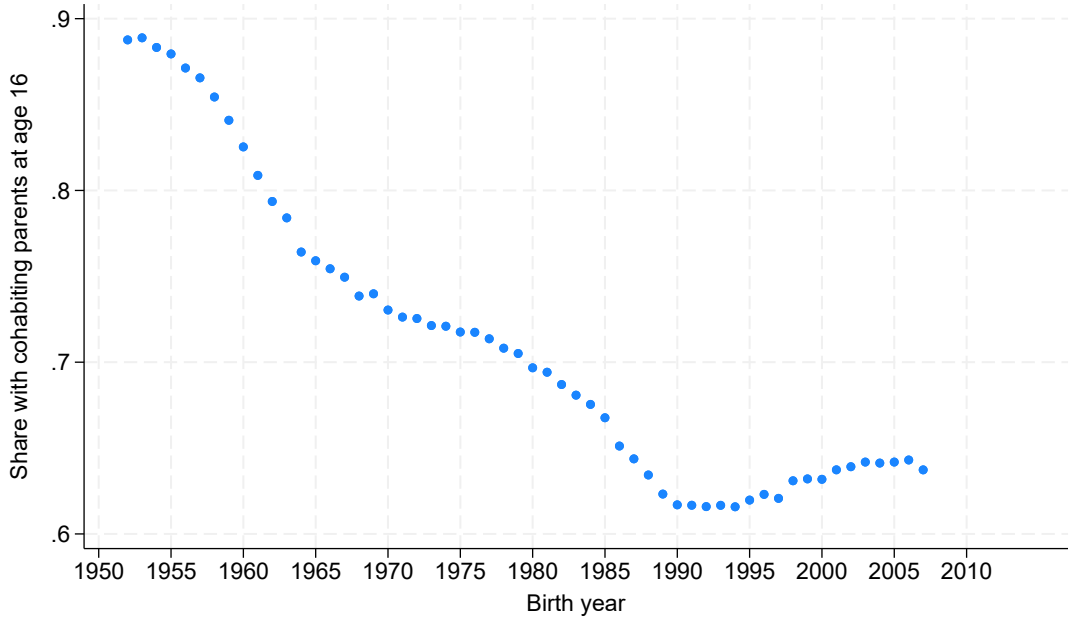
To understand the evolution and nature of parental separations, we start by documenting several descriptive facts that guide the rest of the analysis. Specifically, we document (1) how separation rates have evolved across socioeconomic groups, (2) the type and timing of parental separation events by group, (3) the importance of the distinction between separations and divorce, and (4) the spatial variation in separations.

3.1 Developments in parental separations

Figure 2 shows how the likelihood that children have cohabiting parents at age 16 has developed among the 1952 - 2007 birth cohorts. Among children born in the early 1950s, around 89% of children had cohabiting parents at age 16. At the same time, a gradual decline in household stability is visible already among the very first cohorts for which we have data, which gathered speed between the 1957 and 1964 birth cohorts. Among those born in 1965, 75% of children had cohabiting parents at age 16. Cohabitation rates continued to monotonically decline until the the late 1980s. By the 1990, only 62% of children born in Sweden had cohabiting parents at age 16. Cohabitation rates remained at this level throughout the early and mid-1990s, until there was a slight rebound in the late 1990s. Among children born in the most recent cohorts for whom data is available, around 65% of children

[2]In the appendix, we separately show results when restricting the sample to first-born children in case the age of the oldest child in the household affects family dynamics. We generally find very similar estimates when focusing on first-born children compared to the main estimates.

Figure 2: Parental cohabitation at age 16 by birth cohort



Note: Figure shows parental cohabitation probability when the child is aged 16 for the birth cohorts 1952 - 2007. Cohabitation measured as parents being married according to the Register of the total population for cohorts born in 1952 - 1965 and as parents living in the same 100x100 meter cell for cohorts born in 1966-2007. See Figure A.1 for a comparison of sources on cohabitation rates.

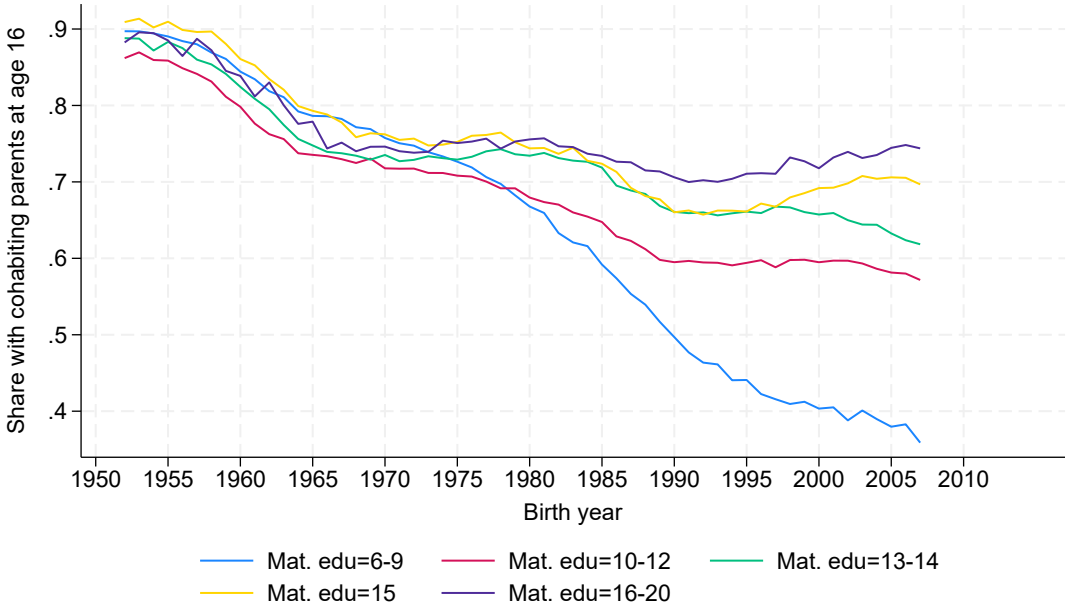
had cohabiting parents at age 16.[3]

Panel (a) of Figure 3 breaks down the developments in parental cohabitation rates by maternal education. Among the early cohorts in our sample, a similar share of children (85 - 91%) grew up with cohabiting parents regardless of the level of maternal education. Between 1950 and 1970, the decline in household stability was shared equally between all maternal education groups.

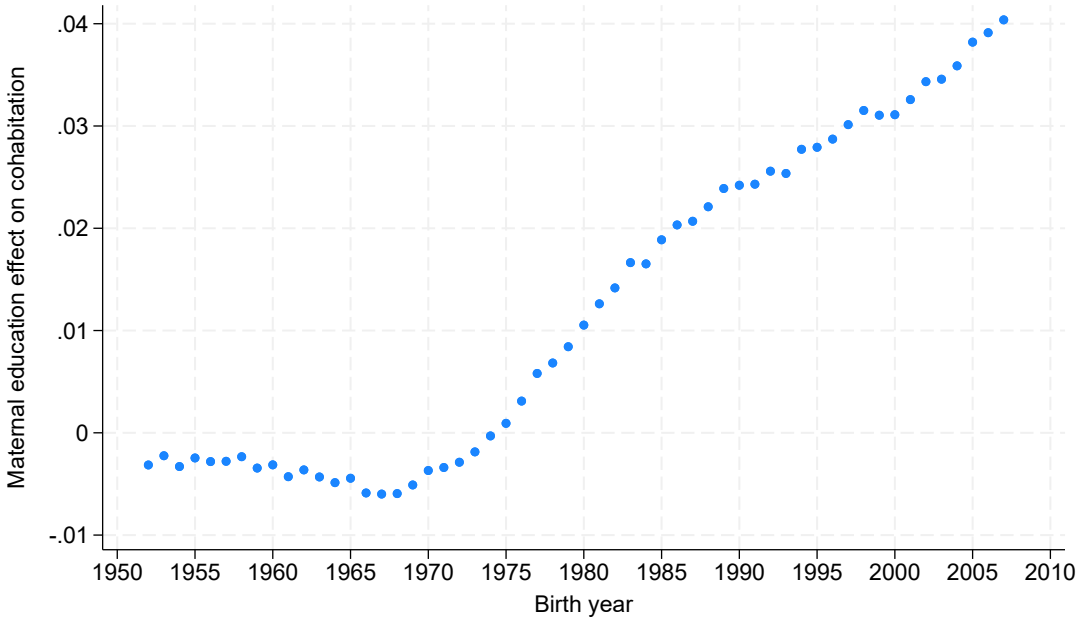
However, this changed starting with the cohorts born in the 1970s. Whereas the stability of highly-educated households slowly stabilized, the stability of low-educated households continued to deteriorate. For children born to a mother with 10 - 12 years of education, the likelihood of having cohabiting parents at age 16 dropped from 72% in 1970 to 58% for those born in the mid-2000's. The decline in household stability for mothers with only compulsory education has been

[3]While these Figures may appear high within the international context, they are consistent with the official data from Statistics Sweden, who report that 3 - 3.5% of children between ages 0 - 17 experience a parental separation event each year (Statistics Sweden, 2023).

Figure 3: Changes in household stability by maternal education



(a) Parental cohabitation at age 16 by birth cohort and maternal education



(b) Slope of the SES-gradient in parental cohabitation at age 16 by birth cohort

Note: Panel (a) shows share of parents cohabiting when the child is aged 16 for different cohorts by maternal education. Panel (b) plots the regression coefficient obtained when regressing parental cohabitation at age 16 on years of maternal education for each birth cohort between 1952-2007.

even more severe. In contrast, the likelihood of having cohabiting parents hardly changed between 1965 and 2007 for children born to mothers with a 4 year college degree. As such, the decline in cohabitation rates during this period is almost entirely driven by children born in low-SES households.

One concern is that the changes by maternal education reflect changing selection into educational categories, since mothers became more educated over time, rather than changes in the experiences by maternal education. However, this is not the case. Appendix Figure A.4 replicates panel (a) of Figure 3 based on the relative position of the mother's education within the birth cohort. The results are very similar, highlighting that it is the relative maternal education that drives the widening SES-gap in household stability over time.

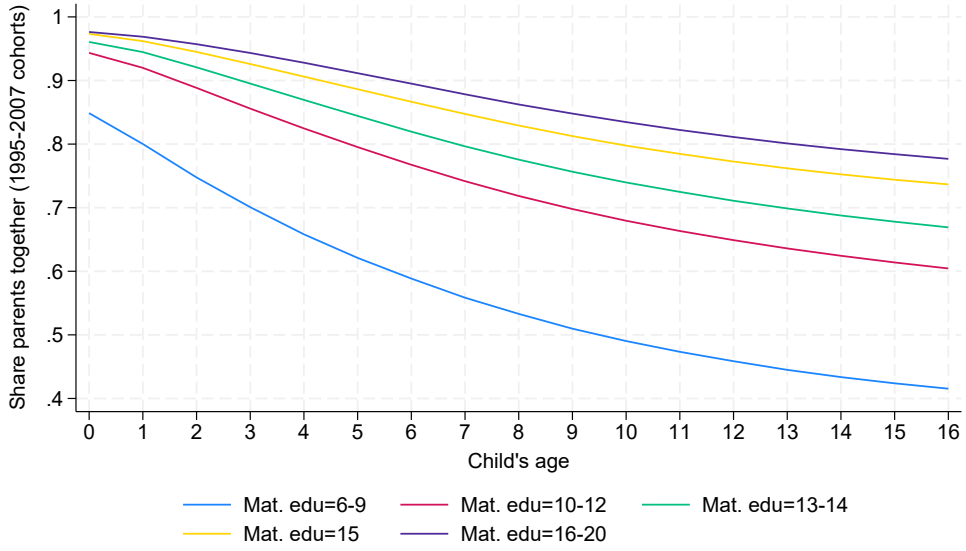
Panel (b) of Figure 3 provides a parametric estimate of how the relationship between maternal education and parental cohabitation developed over time. Each dot is obtained by regressing the parental cohabitation rate at age 16 on maternal education within the birth cohort. The gradient with respect to maternal education was negative for children born before 1970. For these cohorts, one additional year of maternal education was associated with a 0.2 - 0.3 pp lower probability of parental cohabitation at age 16. The gradient reversed around 1975 and monotonically increased ever since. For the 2007 birth cohort, an additional year of maternal education was associated with an increase in the likelihood of parental cohabitation of more than 4 percentage points.

3.2 Types of parental separations

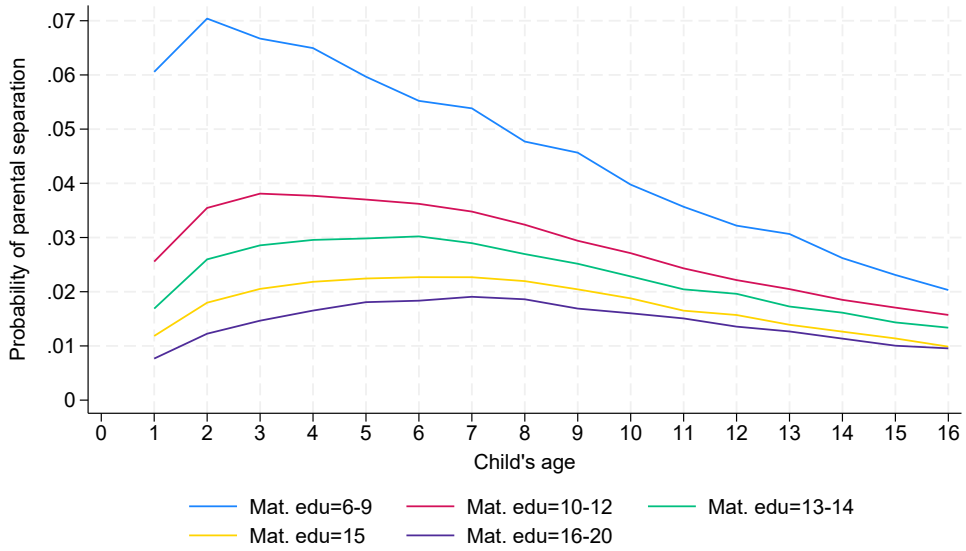
Figure 2 shows that the share of children who do not live with both parents at age 16 increased significantly over time. Figure 3 shows that large differences in household stability have appeared between children with high- and low-educated mothers. To study this development in more detail, and to distinguish between the role of parental separation events during childhood and single parenthood at birth, Figure 4 shows the likelihood of parental cohabitation and separation rate by age and SES for the 1995 - 2007 birth cohorts.

Panel (a) shows the likelihood that parents cohabit at every age by maternal

Figure 4: Parental colocation probability and separation hazard rate by age



(a) Parental co-location probability by age and maternal education



(b) Separation hazard rate by age and maternal education

Note: Figure shows parental cohabitation probability at ages 0 - 16 by years of maternal education (Panel a), and parental separation probability by age by years of maternal education (Panel b). Figure based on children in our sample born in 1995 - 2007.

education. The differences in single-parenthood at birth between groups are comparatively small, with 95 percent of parents cohabiting at birth among the 10 - 12 years education category and 98 percent of parents cohabiting at birth among the 16 - 20 years education category. The only group which stands out are chil-

dren whose mothers have at most 9 years of education. Among this group, 85% of parents cohabit at the child's birth, which still explains less than half of the difference compared to the other SES-groups by age 16.

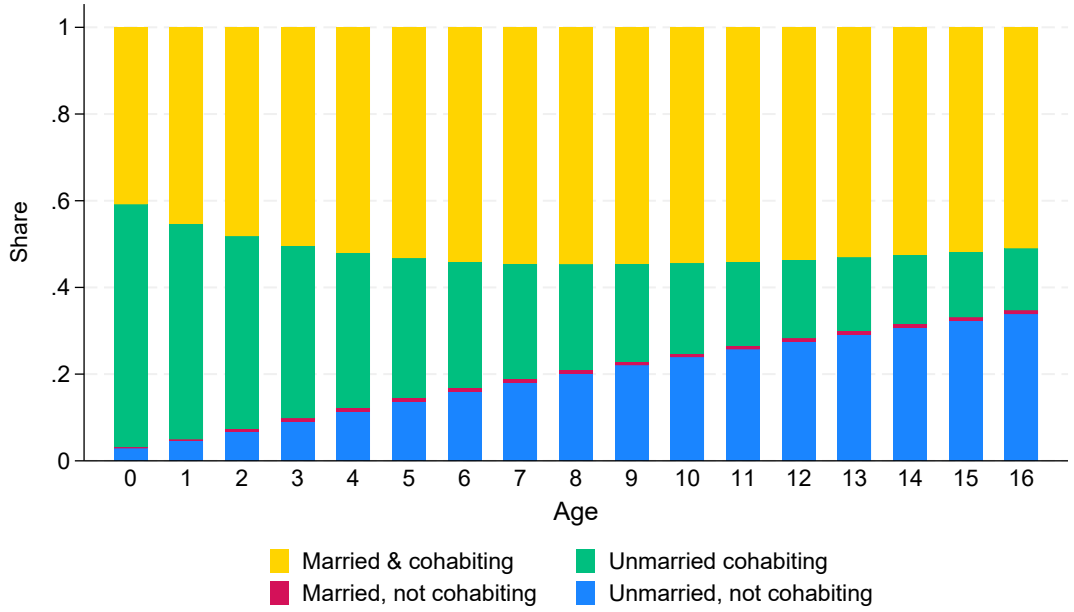
As such, majority of the differences in parental cohabitation at age 16 by SES are driven by differences in separation rates during childhood. This is confirmed by Panel (b) of Figure 4, which plots the likelihood that parents separate at any given age, given that they were still cohabiting in the year before (i.e., the hazard rate). The likelihood of experiencing parental separation is higher for children of less-educated mothers in every single age in childhood. The hazard rates are monotonically decreasing with maternal education for every age, despite a smaller share of low-SES parents cohabiting at any age due to the higher separation rates experienced up to that age.

The slope of the age-gradient reveals some additional information. While hazard rates are decreasing with age for children born to low-educated mothers, they are much flatter for households where the mother is highly educated. The peak in hazard rates occurs at a significantly later age for households where the mother is highly educated. This suggests that the mechanisms that underlie parental separation events may differ between socioeconomic groups. Among low-educated mothers, the pattern is consistent with the existence of a large share of low-initial surplus couples that break up soon after they have a child due to information updating or adverse shocks. In contrast, the patterns for high-SES households are suggestive of a process of slow deterioration following an initially higher match surplus.

3.3 Parental separation versus divorce

A key innovation in this study is the identification of parental separations based on the termination of parental cohabitation, rather than divorce. To highlight how these measures differ, this section shows the change in observed separation events when focusing on divorce, which is the most commonly used measure in the literature. While unmarried cohabitation became common in Sweden earlier compares to most other countries, it is increasingly common across Europe. For

Figure 5: Parental relationship structure by age

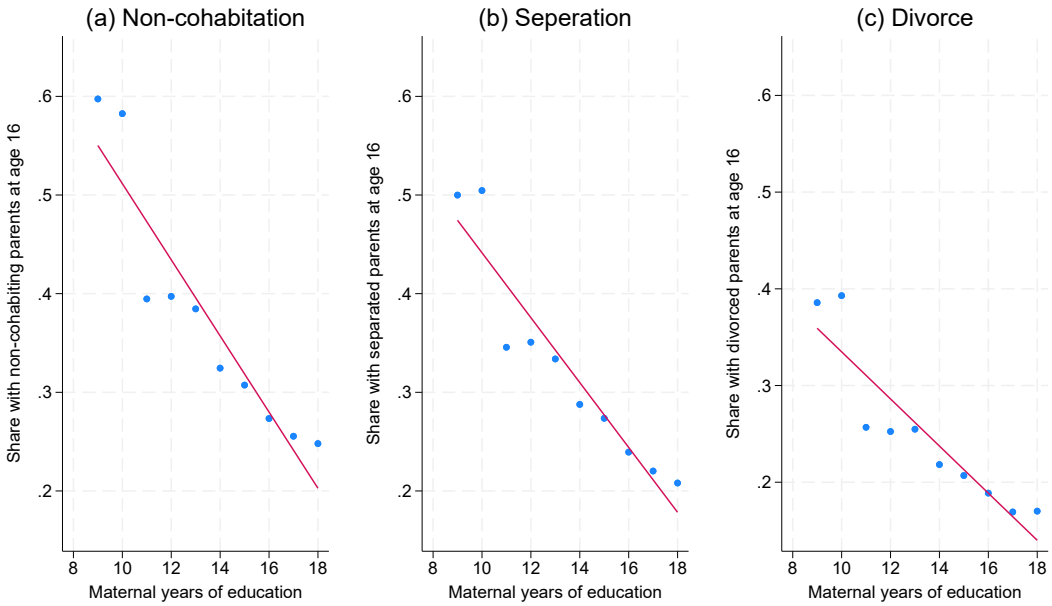


Note: Figure shows parental relationship structure by age for the birth cohorts 1995 - 2007. If parents are unmarried and not cohabiting at an earlier age, but cohabiting (either unmarried or married) at a later age, they are reclassified as unmarried cohabiting at the earlier age. If parents are married and not cohabiting at an earlier age, but are married and cohabiting at a later age, they are reclassified as married cohabiting at the earlier age.

instance, 58% of children in France and 50% of children in Spain are born to unmarried couples in recent years (European Commission, 2025).

Figure 5 shows the development in parental relationship status over the childhood for the 1995 - 2007 birth cohorts. At birth, the most common form of parental partnership is cohabitation without marriage (55%), followed by married cohabitation (40%), and unmarried non-cohabitation (4%). As such, married parents are a minority of parents at the time of birth. At age 16, the share of children with married and cohabiting parents is 48%, significantly higher than the share at birth. The reason is the low persistence of unmarried cohabitation as a relationship state. Among parents who are cohabiting but unmarried at birth, 37% have separated, 37% are married and cohabiting, and 24% remain unmarried and cohabiting by the time the child reaches age 16. As such, inflows into marriage among unmarried cohabiting couples more than offsets divorces among married couples in the earlier years of childhood.

Figure 6: SES gradient by separation event

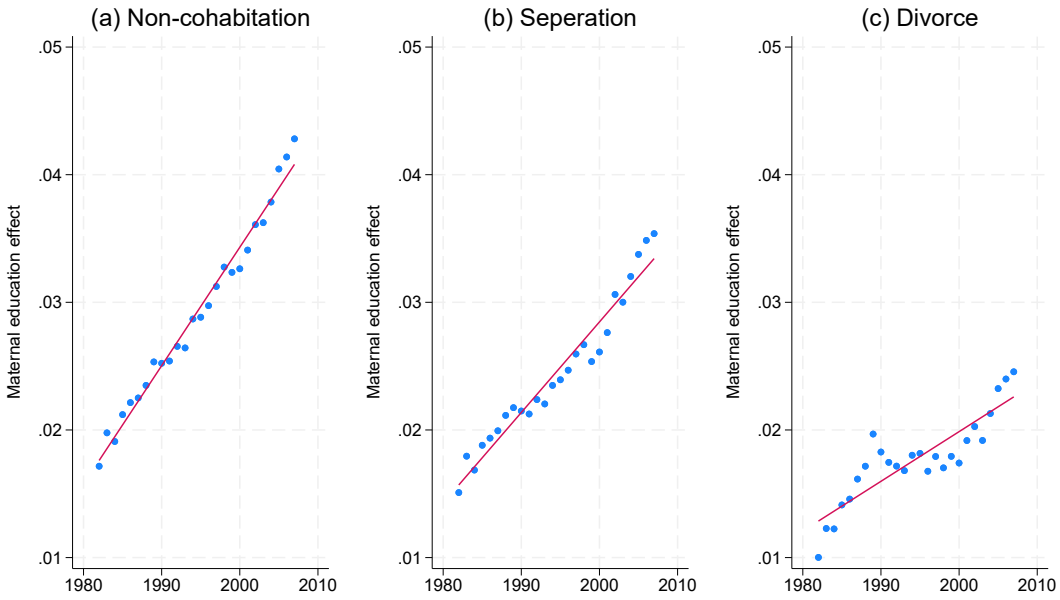


Note: Panel (a) shows the gradient between maternal education and the probability of having non-cohabiting parents at age 16. Panel (b) shows the gradient between maternal education and parental separation by age 16, conditional on the parents having cohabited at birth. Panel (c) shows the gradient between maternal education and having experienced divorce by age 16, conditional on parents having been married at any point prior to age 16. The respective slopes are -0.0402 (non-cohabitation), -0.0315 (separation) and -0.0218 (divorce). Figure based on children in born between 1995 - 2007.

Figure 6 shows how the distinction between parental separations and divorce affects the observed SES-gradient. The Figure shows the maternal education gradient with respect to cohabitation, separation, and divorce at age 16. The patterns regarding cohabitation and separation are similar, since the vast majority of non-cohabitation in childhood is due to separation of initially cohabiting parents as highlighted in the previous section. In contrast, the relationship between SES and divorce is substantially weaker. This is driven by the positive selection of low-SES households into marriage, with a particularly large difference in household stability between married and unmarried mothers among low-SES households.

Furthermore, Figure 7 shows that the increasing association between maternal education and parental separation probability previously discussed in Figure 3 is far less prevalent when restricting attention to parental divorce. As such, considering parental separations that do not involve a divorce is critical to understanding so-

Figure 7: Change in SES gradient over time by separation event



Note: Panel (a) shows the gradient between maternal education and the probability of having cohabiting parents at age 16. Panel (b) shows the gradient between maternal education and the probability of not experiencing a separation by age 16 among parents that cohabited. Panel (c) shows the gradient between maternal education and the probability of not experiencing a divorce by age 16, among parents that were married at any point prior to age 16. Figure based on children born between 1982 - 2007, since we can only identify single-parents at birth based on geo-coded location data from 1982 onward. Note that the peak in divorce probability around 1989 is due to the survivor benefit pension reform, which caused a rush into relatively unstable marriages among households with children as previously studied by Persson (2020).

cietal changes over the last decades and to reflect parental separation rates among low-SES households.

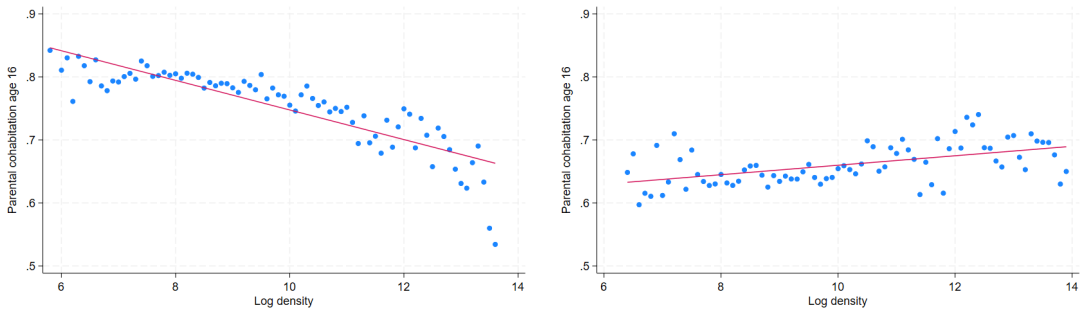
3.4 The changing geography of parental separations

Finally, we highlight the existence of substantial spatial variation in parental separation probabilities, which suggests that local economic or social environments may play an important role in shaping household stability. Figure 8 shows the probability that parents cohabit at age 16 by population density for the 1970 - 1972 and 2005 - 2007 birth cohorts. Despite the absence of an SES-gradient in separations for the 1970 - 1972 cohort (see Figure 3), substantial spatial variation in separation probabilities exists. Over 80% of children born in 1970 - 1972 to

households in rural communities had cohabiting parents at age 16. In contrast, parental cohabitation rates at age 16 were well below 70% in denser places. As such, even though the SES variation is limited for the 1970 - 1972 birth cohort, we see a clear spatial gradient on the urban-rural dimension in household stability.

The geographical pattern is substantially different 35 years later. Among the

Figure 8: Parental cohabitation at age 16 by population density across time



(a) 1970 - 1972 birth cohorts

(b) 2005 - 2007 birth cohorts

Note: Figure shows how the probability of parental cohabitation at age 16 by population density for children born in the 1970 - 1972 cohort (left) and children born in the 2005 - 2007 cohort (right). Density is calculated as the log of the number of people living within 10km of the 100 x 100 meter grid-cell of residence at age 15. As such, the density measure is highly granular and also captures the substantial variation in density within municipalities. Estimates shown based on bins that are 0.1 logpoints wide. Bins with fewer than 200 observations are not displayed here.

2005 - 2007 birth cohorts, children growing up in rural communities are significantly less likely to live with cohabiting parents at age 16 compared to children in urban communities. Interestingly, there has been comparatively little change in household stability for places towards the top of the density distribution between 1970 - 2007. As such, virtually the entire change in parental separation rates during this period is driven by a decline in household stability in rural areas.[4]

The flatter urban-rural gradient for the recent birth cohorts does not imply that spatial variation no longer exists. Figure 9 shows a map with the likelihood that parents cohabit at age 16 for each municipality in Sweden. Among recent birth co-

[4]This is not simply a function of suburbanization or white flight during this period. The suburbs of Stockholm fill virtually all other top-10 spots for the 1970 - 1972 cohorts that are not occupied by the three largest cities, while none of the suburbs even break into the top-40 municipalities by separation probability for the 2005 - 2007 birth cohorts.

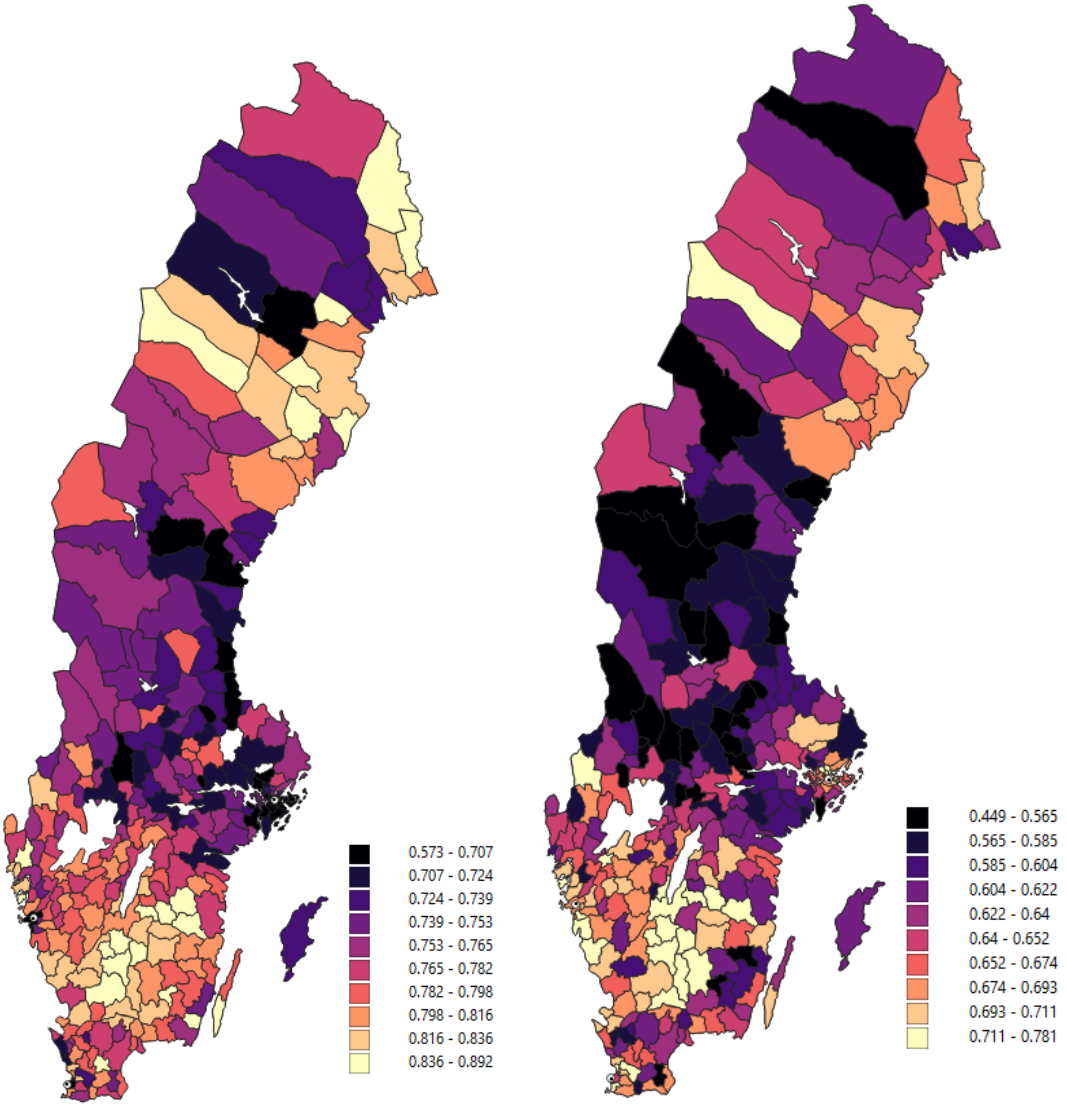
horts, parental cohabitation probabilities at age 16 at the municipality level range from 45% to 78%. Most of the variation among recent birth cohorts are within relatively rural areas. Among the municipalities in central-Southern Sweden, parental cohabitation rates are well over 70%, which is equivalent to every single mother holding a college bachelor's degree. In contrast, the center of parental separations shifted towards former industrial areas in central Sweden, with parental cohabitation rates below 50% in some municipalities, which is equivalent to the entire population having at most a vocational high-school degree.

While SES is very predictive of the parental separation probability, it can explain only a limited degree of the spatial heterogeneity in parental separations. Appendix Figure A.5 plots the separation rates at the municipality level against the average residuals from a regression when flexibly controlling for parental SES and maternal age at birth. Accounting for detailed measures of SES and maternal age at birth can explain at most 30% of the spatial variation, highlighting that the spatial differences are not simply driven by spatial selection based on observed parental characteristics. For the 1970 birth cohort, spatial selection based on SES explains virtually none of the extensive spatial variation, since SES itself was not predictive of separations (see Figure 3). As such, the spatial variation appears to reflect factors other than selection based on observed household characteristics.

3.5 Robustness

One concern is that the results in this section are based on a subsection of the Swedish population, namely those born to Swedish-born mothers. However, including children with a migration background does not materially alter any of the descriptive facts, as highlighted in appendix section A.2. A second concern is that some of the results, in particular regarding the timing of separation events, may be driven by the presence of older siblings. In addition, the number of children to a couple is endogenous. Since each child is counted as a unique observation, this may weight the analyses in various ways. However, the descriptive facts remain unchanged if we restrict the sample to the first child born to the mother as shown in appendix section A.3.

Figure 9: Parental cohabitation rates at age 16 across space and time



(a) 1970 - 1972 birth cohorts (b) 2005 - 2007 birth cohorts

Note: Figure shows parental co-habitation probability at age 16 by municipality of birth for the 1970 - 1972 birth cohorts (left) and 2005 - 2007 birth cohorts (right) . To facilitate comparison, the municipalities are divided into equally-sized deciles according to the rate of parental separation by age 16. Some municipalities in Sweden are extremely small (around 2.500 inhabitants as of 2023). In both maps, municipalities with fewer than 100 children born across the three birth cohorts are excluded.

Second, there is some inconsistency in how parent-child linkages are treated over time. The administrative records start in 1968 and the sample is mostly consistent over time from this point onward. We do observe parents on the birth certificate for children prior to 1968, but the parental identifiers are missing more frequently,

peaking at 7% of fathers for the 1952 birth cohort. In contrast, the share of missing fathers on the birth certificate are below 1% at every year after 1968. When we examine the relationship status of the mother when the civil registers begin in 1968, we see that almost half of these mothers are registered as widowers. As such, it appears that fathers did not always appear on the birth certificate of children born before 1968 if they passed away prior to 1968. While we exclude cases of missing parents in the baseline sample for the pre-1968 cohorts to deal with this concern, this may create some inconsistencies as it also removes cases of parental migration (not observed prior to 1968) and genuine single parent at birth households. Appendix Section A.4 discusses concern in more detail, and shows that while the treatment of these cases affects the levels of parental separations during the pre-1968 period, it leaves the estimates of the SES-gradient in parental separations in the pre-1968 period virtually unaffected.

4 Conceptual framework and mechanisms

Conceptual framework

In line with the seminal work by Becker (1973, 1974), we consider that cohabiting couples form when there is a match surplus from living together compared to the outside option of each party. Beyond the direct utility generated by the partnership itself, cohabitation may also allow for intra-household specialization, meaning that the couple can produce household outputs more efficiently. While female labour market participation in Sweden has been high for most of the period under considerations, gender-typical specialization in market and non-market work nevertheless remains. For instance, Swedish women continue to take a much larger share of parental leave than Swedish men and are more likely to be employed in jobs where working hours are more flexible, e.g. in the public sector or in remote work-friendly workplaces (Hotz, Johansson and Karimi, 2018; Ginja, Jans and Karimi, 2020). Living together also allows for the couple to specialize in different kinds of non-market household work, further expanding the household production frontier.

Couples break up when the match surplus falls below a threshold such that they

obtain more utility from living separately. There are several models that can explain why match surplus may deteriorate. Becker (1974) posits that the couple might learn about their true match surplus over time, which may turn out to be less than both the expected match surplus and the outside option. Such a learning model would be observed as the probability of separation falling with the time that the relationship has lasted.

A second interpretation is that match surplus is subject to shocks which can reduce it. Such shocks could be economic in nature, such as a partner losing a job, or "love shocks" that change the emotional value of the relationship. There is empirical evidence for both kinds of shocks leading to separations (Jensen and Smith, 1990; Eliason, 2012; Hess, 2004; Frimmel, Halla and Winter-Ebmer, 2024). Such shocks can take two forms. One common assumption is that there is a constant probability that a relationship ends in any given year. A different assumption is that households are subject to continuous shocks, leading to a random walk in the surplus from an initial baseline utility. In this case, the expected duration of a relationship strongly depends on the initial surplus.

Third, households may break up due to a change in the (perceived) costs of exiting a relationship. Changes in social norms and institutions may have reduced the impact of a parental separation event on societal standing and status. One possibility is that low-SES households always had substantially lower surplus relationships, but prohibitive exit costs prevented them from exiting such relationships. Related to this, societal and legal changes may also have improved the outside option among parents. For instance, the expansion of public daycare options together with flexible work arrangements may have made single-parent households a more viable option. Furthermore, changes in the matching rate among previous-matched parents could have improved the outside option among parents in low-surplus relationships, leading to higher separation rates.

The effects of parental separation events may depend on which mechanism underlies the separation. Partners in couples with low match surplus will invest less in family public goods than partners in couples with high match surplus due to lower expected duration of the relationship. Thus, if separations happen because part-

ners gradually learn that their match surplus is lower than initially thought, or because an initially high relationship surplus deteriorates over time, investments in family public goods are initially high and decrease gradually. Once the separation event materializes, it should have a smaller causal effect on children since household investments had already fallen to a lower level.

On the other hand, if separations are explained by unforeseen economic or emotional shocks, the effects on children should be more heterogeneous. Each period, some couples with high and low match surplus will break up. Effects on children from low-surplus couples will be relatively low, while effects on children from high-surplus couples will be relatively high. There will be no deterioration in children's outcomes in periods leading up to separation, since match surplus has not systematically decreased across these periods. Furthermore, short-term disruption effects of parental separation might be present regardless of which model can best explain why separation takes place.

Mechanisms

Given the conceptual framework typically, the question is not necessarily why low-skilled households have higher separation rates, which could be explained in terms of lower match surplus or a higher arrival rate of shocks. Instead, the question is why the parental separation rates have increased specifically for low-SES households and specifically for households in rural areas over the last 50 years. I.e., what changes in the matching market, matching surplus, economic shocks, exit costs, or outside option specifically could have reasonably driven the decrease in household surplus among low-skilled, or alternatively, changed the exit costs from a low-surplus relationship?

Change in Assortative Matching One possibility is that the degree of assortative matching during partnership formation changed. If assortative matching increased and initial relationship surplus depends on the partner's SES, then this may drive a decrease in household stability among low-SES households. However, as shown in Appendix Figure C.13, the degree of assortative matching has not materially changed during this period. Mother from low-SES households have seen

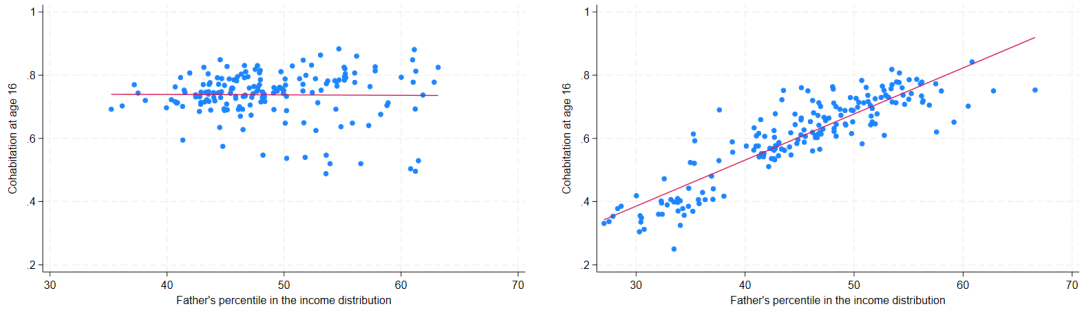
the largest increases in the years of education among partners. When expressed in ranks, there is little evidence of a structural divergence in marriage partner quality between females of low- and high-SES over time as shown in panel (b) of Appendix Figure C.13. This is in line with evidence from the US, which shows that while assortative matching has increased over time, the magnitude of this effect remains relatively limited (Eika, Mogstad and Zafar, 2019). This suggests that changes in assortative matching are unlikely to explain the rising separation rates among low-SES households.

Changes in Economic Conditions The second explanation concerns changes in the relative labor market prospects. The de-industrialization process has particularly affects areas in central Sweden that historically centered around the iron industry, steel industry, and heavy manufacturing industry, which are the same regions in which the household stability among low-SES households has most severely declined. Previous studies in the US context explicitly link the decline in the local manufacturing due to import competition to a decline in the marriage market value of young men, and subsequently, an increase in single-parent households (Autor, Dorn and Hanson, 2019).

To link changes in economic position to changes in household stability in the Swedish context, we study how the changing economic position of parents are related to changes in household stability. Figure 10 shows for all groups of mothers, defined by the interaction of years of education and region of residence, the relationship between the economic position of the father and household stability for the 1970 - 1972 and 2005 - 2007 birth cohorts. In line with the findings of the previous section, we see little of a relationship between household SES and household stability among the 1970 - 1972 birth cohorts. This changed significantly for the 2005 - 2007 birth cohort, with a strong and linear relationship between the paternal position in the income distribution and household stability.

To link these changes more directly, Table 1 shows for all maternal groups, how the change in household stability between 1970 - 2007 relates to the changes in economic position of both parents. Interestingly, the change in the economic position of the father has a stronger relationship with the subsequent change in separation

Figure 10: Paternal economic position and household stability



(a) 1970 - 1972 birth cohorts (b) 2005 - 2007 birth cohorts

Note: Figure shows the average economic position of the father (measured by the percentile position in the income distribution in the two years prior to birth relative to all fathers in a given birth-cohort) and the likelihood that the parents still cohabit at age 16 for the 1970 - 1972 birth cohorts (left) and the 2005 - 2007 birth cohorts (right). Each cell is a combination of maternal years of education x region of residence. Only cells with at least a 100 observations are displayed for each birth cohort.

rates compared to the change in the economic position of the mother. Mothers who experienced a stronger decline in the economic position of the father between 1970 - 2005 experienced substantially larger declines in household stability. This is not driven by a few small maternal groups as shown in column (2), since weighting the maternal groups by their size leaves the estimates virtually unaffected.

The changing relationship between the economic position of the father within maternal groups can either reflect changes in assortative matching or changes in the economic position of fathers conditional on matching. To distinguish between these, columns (5) and (6) relate the expected change in the father's economic position between 1970 - 2007, keeping stable the matching of maternal groups to paternal groups based on the 1970 - 1972 matching, to the subsequent change in household stability. The results in columns (5) and (6) are quite similar to those in columns (3) and (4), highlighting that the negative relationship between changes in the father's economic position and household stability between the maternal groups largely appears to reflect changes in the labor market, rather than changes in assortative matching.

Finally, we link the changes in household stability explicitly to manufacturing industry exposure. Table 2 shows the relationship between changes in household

Table 1: Changes in relative economic position and separation rate

	(1)	(2)	(3)	(4)	(5)	(6)
Change in maternal economic position	-0.0130***	-0.0107***				
	(0.00154)	(0.00132)				
Change in paternal economic position			-0.0187***	-0.0162***		
			(0.00159)	(0.00120)		
Counterfactual change in paternal economic position					-0.0270***	-0.0266***
					(0.00390)	(0.00267)
Constant	0.0238	0.0372**	0.0606***	0.0599***	0.0376*	0.0271*
	(0.0172)	(0.0129)	(0.0113)	(0.00809)	(0.0183)	(0.0120)
N	170	170	170	170	170	170
R^2	0.295	0.282	0.450	0.521	0.221	0.372
Cells weighted by observations?	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Table shows for all maternal education x location cells, how the change in separation rates among children born in 1970 - 1972 and 2005 - 2007 relates to changes in the economic position of parents. Columns (1) - (2) show the relationship with the change in average maternal economic position by cell, columns (3) and (4) the relationship with the average paternal economic position by cell. Economic position is measured as the percentile position of the income of the father/mother in the 2 years prior to birth, relative to all fathers/mothers in the same birth cohort. Columns (5) and (6) instead relate the changed in expected economic position of the father between 1970 - 1972 and 2005 - 2007 to the change in separation rate, holding fixed the assortative matching at the 1970 level for each cell. Only cells with at least 100 mothers in the 1970 - 1972 and 2005 - 2007 birt cohorts are included. The odd columns are unweighted regressions, the even columns weight the cells by the number of observations.

stability and manufacturing industry exposure. We based the manufacturing industry exposure for each maternal group on the share of fathers that are employed in the manufacturing industry in 1970. Column (1) shows a strong relationship. Maternal groups with a 1 pp higher share of paternal manufacturing employment in 1970 experienced a 0.9 pp stronger decline in subsequent household. This holds even when controlling for maternal education as shown in column (2), in which case the relationship is purely estimated from the variation in manufacturing employment across regions within the maternal education groups.

Interestingly, there is nothing structural about this relationship. Columns (3) and (4) show that manufacturing employment in 1970 was positively related to household stability among the 1970 - 1972 birth cohort within maternal groups.

Instead, the exposure to the manufacturing industry is negatively related to subsequent developments in household stability, in line with the previous findings of Autor, Dorn and Hanson (2019) in the context of the US.

Table 2: Manufacturing exposure and change in separation rate

	Change in Household stability		Household stability in 1970	
	(1)	(2)	(3)	(4)
Manufacturing employment in 1970	-0.892***	-0.378***	0.156**	0.316***
	(0.0959)	(0.0427)	(0.0585)	(0.0429)
N	170	170	170	170
R^2	0.340	0.917	0.041	0.674
Maternal Education FE?	No	Yes	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Table shows for all maternal education x location cells, how the change in separation rates among children born in 1970 - 1972 and 2005 - 2007 relates to exposure to the manufacturing industry in 1970. Manufacturing exposure is measured by the share of employed fathers working in the manufacturing industry based on self-reported industry in the 1970 census. Column (1) shows a regression of the change in household stability between the 1970 - 1972 and 2005 - 2007 birth cohorts on the manufacturing exposure in 1970. Column (2) adds controls for maternal education and identifies of regional variation in manufacturing exposure within the maternal education groups. Column (3) regresses household stability in 1970 on manufacturing exposure in 1970, whereas column (4) again includes controls for maternal education. Maternal groups with fewer than 100 observations among either birth cohorts groups are excluded. All regressions use analytical weights to account for the differences in group sizes.

Changes in Social Norms A third explanation is the change in social norms. The exit costs imposed by religious norms against separations could prevent households with otherwise zero or negative surplus from separating. This mechanism lines up well with the spatial patterns of household stability, with low religiosity in the historical manufacturing towns in central Sweden and high religiosity in parts of the Småland region in Southern Sweden. While church membership, baptisms, confirmations and church weddings have declined across all population groups in Sweden over the recent decades, the social norm against separations would be most binding for households with a small or marginal marriage surplus by imposing substantial exit costs. Viewed in this light, the rise is separation rates may not just be due to a changes in relationship surplus among low-SES households,

but also due to a change in the perceived social costs of being in a relationship as opposed to a single parent.

We have data on religiosity as measured by attendance of Sunday masses and relate this to household stability in Table 3. An increase in mass attendance of one per capita for the years 1995-1997 is associated with a 5.1 percentage point higher share of cohabiting parents to children born in 1982-1984. The association decreases with time, and is only 2.4 percentage points for children born in 2005-2007, but remains significant. Larger reductions in Sunday mass atendance are associated with larger decreases in parental cohabitation. A decline in Sunday mass attendance of one per capita between 1995-1997 and 2017-2019 is associated with a 3.3 percentage point decline in the share of cohabiting parents.

Table 3: Church attendance and change in separation rate across municipalities

	HH stability, 1982-84 cohorts	HH stability, 2005-07 cohorts	Δ HH stability, 1982-84 to 2005-07 cohorts
	(1)	(2)	(3)
Sunday mass attendance per capita, 1995-97	0.051***	0.024***	
	(0.0044)	(0.0055)	
Δ Sunday mass attendance per capita, 1995-97 to 2017-19			0.033***
			(0.0086)
N	266	266	266
R^2	0.34	0.06	0.05

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Probability of living with both parents at age 15 in relation to Sunday mass attendance per capita (based on the population of people with a Swedish background). Regressions at the municipal level.

5 Predicting individual separations

The previous sections discuss the factors that can explain parental separation events at the group level. To gain insight into the drivers of parental separation events at the individual level, we also predict the separation probability at the individual level based on characteristics of each parent and of the match. The purpose of this exercise is not causal attribution, but to characterize the extent

to which parental separations are predictable from observable characteristics at birth, and to quantify residual risk even among the most socioeconomically advantaged households. We restrict the sample to parental matches where the first child was born in 1995 - 2007, which provides us with at least 5 years of detailed pre-childbirth data on both parents from the administrative registers. Furthermore, we restrict the analysis to parents who cohabited when their first child was born, since there is little to 'predict' based on variation in parental characteristics at birth for parents that have already separated at birth.[5]

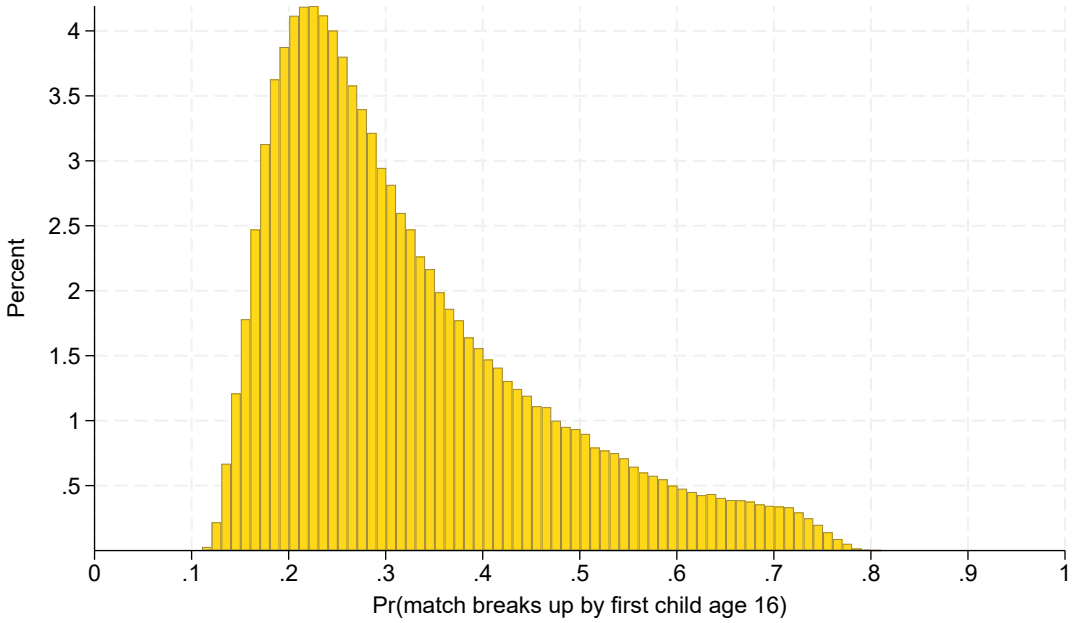
We estimate a generalized random forest (Athey, Tibshirani and Wager, 2019) of 500 trees to predict the probability of separation based on 128 covariates observed in the administrative data.[6] The covariates include duration of cohabitation and marriage before first child, parental ages, children from previous relationships, parental education, municipality and neighborhood characteristics, as well as incomes, sectors of employment, and reliance on social payments in the five years before childbirth. Unlike a traditional prediction model, the forest bases its predictions on the variables which are the strongest predictors of divorce probability. The method is non-parametric, splitting the sample into leaves based on variables and threshold levels which maximize differences in predicted divorce probability. The model is trained on a training set containing 80 percent of the matches in our sample, and its predictions are validated on a held-out test set containing the remaining 20 percent of matches.

The regression forest model is able to predict parental separations quite well in both the training set and the held-out test set as shown in appendix Figure D.15. Based on the held-out test set, the predicted probability of parental separation varies between less than 15 percent and over 75 percent as shown in Figure 11. Both the lower- and upper-bounds are quite interesting. At the upper-bound, the model can identify households for whom the separation risk exceeds 70%, highlighting that strong structural factors that can be identified to predict parental separation events. At that same time, very few children are identified as having a parental separation risk below 15% based on the highly-detailed household char-

[5]With this restriction we also exclude matches where either the father or mother is unknown.

[6]The number of trees will be significantly increased in future versions of this paper.

Figure 11: Histogram of predicted separation probabilities



Note: Predictions based on regression forest. Bin width=0.01. For more details, see Appendix D.

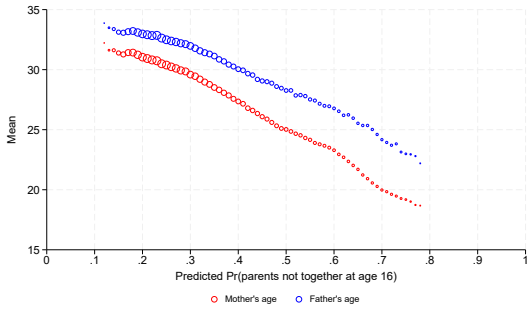
acteristics. As such, while there is a clear SES-gradient in parental separations, it appears difficult for families to isolate themselves from this risk purely on the basis of demographic and economic conditions.

Appendix Figure D.16 shows one potential measure of the importance of the different covariates in driving the model's predictions. The bars represent the share of times a particular variable was used by the trees of the regression forest to make splits in the data.[7] Socioeconomic variables, especially reliance on social payments, education and labour income are the key variables that regression forest uses to predict parental separation probabilities.

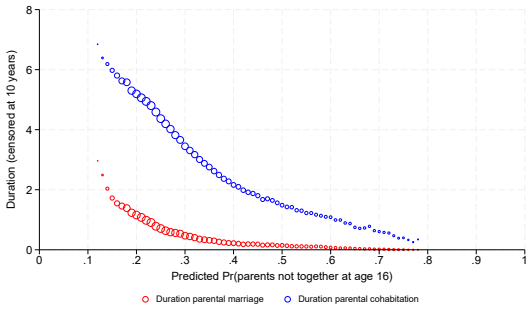
A different, and our preferred way, to assess the importance of the variables is to identify the common set of characteristics among the households that the model identifies as having either a high or low probability of separation. Figure 12 highlights some key characteristics of parental matches with different probabilities of separating by age 16, conditional on having cohabited at birth.

[7]Only splits at depths 1-4, i.e. the first sets of splits made by each tree, are included in the importance measure. Splits at a lower level receive twice as much weight as splits at the next level.

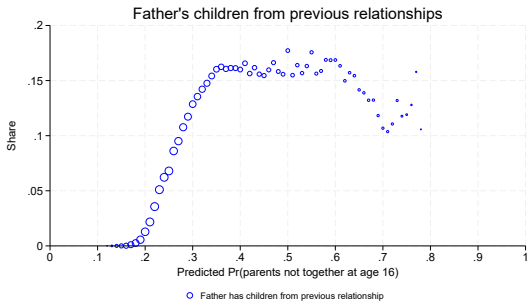
Figure 12: Descriptives of parental matches with different probabilities of breaking up



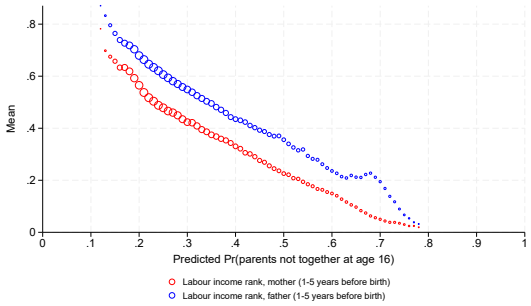
(a) Parental age at birth



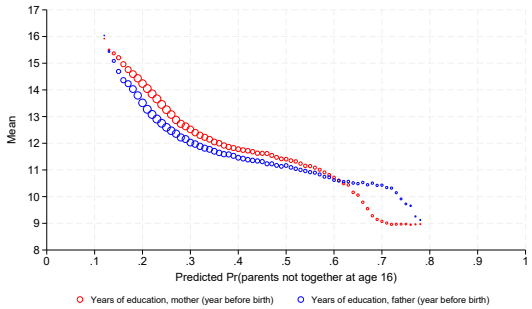
(b) Length of marriage/cohabitation



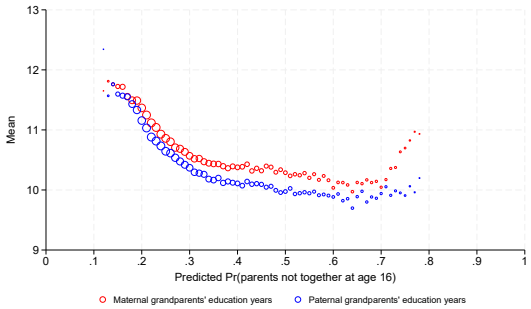
(c) Children from prior relationships



(d) Parental income



(e) Years of parental education



(f) Years of grandparents' education

Note: Means and shares of respective characteristics for parental matches in the associated percentage point of probability of breaking up, as predicted by the regression forest model. Size of markers proportional to number of parental matches in bin.

First of all, matches with higher separation probabilities are younger compared to households with lower separation probabilities. Although childbirth early in life could be interpreted as having found a high-quality match early in life within the scope of a standard search and matching model, young parents are substantially more likely to experience parental separation in practice.

Second, the model highlights the predictive power of parental relationship status at birth. Among the groups with the highest separation probabilities, almost none of the parents are legally married prior to having their first child. In contrast, the average household in the lowest separation probability bins has been married for at least 2 years. Fathers in matches with a high separation probability are also disproportionately likely to have children from previous relationships.

Third, those with a high separation probabilities are likely to have relatively low socioeconomic status, in line with the descriptive evidence from section 3. Parents with the highest probabilities of breaking up are typically high school dropouts and have low earnings. In contrast, those with low probabilities of breaking up tend to have post-secondary education, and both parents have sizable pre-birth labor incomes.

Finally, there is substantial intergenerational persistence. Parents with low separation probabilities tend to have more educated grandparents, as shown in panel (f). Among households with the lowest separation probabilities, the average years of education of the maternal grandparents is around 11.5 years, implying at least some high-school education. In contrast, among those with a separation probability above 40 percent, maternal and paternal grandparents have on average 10.5 and 10 years of education respectively. The lower values for paternal grandparents are explained by them being older due to fathers' higher average ages at childbirth.[8]

6 Effects of parental separations

Finally, after documenting the trends in parental separations and highlighted the factors behind the increasing concentration of parental separations among low-SES families, we turn to estimating the effects of parental separation events on the outcomes of children. Given that the separation event is endogenous to household characteristics, both observed and unobserved, we utilize the variation in timing of parental divorce to study the impact of a parental separation event. This allows us

[8]In the bins with the very highest separation probabilities, grandparents' education actually increases slightly. This is due to the parents and hence grandparents being younger than those in bins less likely to separate.

to study the effects of parental separation on the educational outcomes of children.

6.1 Methodology

Since the selection of households into parental separation events differs greatly with the age at separation (see Figure 4), we use household fixed effect estimates to estimate the impact of parental separation events that occur at various ages. In this case, we compare siblings born to the same couple who were different ages at the time of the separation event, and whom thus spent different parts of the childhood living in a cohabiting family as opposed to a separated family. We restrict attention to children born to first-time parents to avoid complications due to the potential presence of stepchildren and stepparents. Furthermore, we restrict attention to children whose parents cohabited at the start of childhood.

To estimate the effects, we estimate equation 1 for a variety of educational outcomes. The β_m coefficients are identified of children within the same household and, who were at a different age at the time of the divorce. Equation 1 includes cohort-fixed effects, as well as controls for gender and birth-spacing. Since the β_m coefficients are identified from within households where all children experience a separation event, we need an omitted group to compare the effects of experiencing a separation at the various ages against. We chose as the omitted group children whose parents separated in early adulthood between ages 18 - 20. As such, the β_m coefficients should be interpreted as the effect of experiencing a parental separation event at age m, as opposed to experiencing a separation event in early adulthood.

$$\text{Educational outcome}_{ihc} = \alpha_h + \sum_{m=1}^{17} \beta_m \text{Separation}_{im} + \gamma_c + \Gamma X_i + \epsilon_i \quad (1)$$

One complication with the estimation of equation 1 is that there is a perfect collinearity between the difference in the birth year of siblings (i.e., birth spacing) and the difference in age at the time of the separation within households. As such, it is impossible to independently account for birth-spacing in a sample of households where all children separate. Since birth-spacing is related to the gap in cognitive attainment between siblings (Price and Kalil, 2010; Buckles and

Munnich, 2012), accounting for birth spacing may be important. To correct for the effects of birth spacing, we include children whose parents never separated in the estimation of equation 1. Since there is no variation in the age at separation within households where the parents never separate, they do not contribute to the estimation of the β_m parameters. This assumes that the effect of birth spacing is similar within households that do and do not separate at some point during childhood. Appendix section E.1 discusses this point in more detail and provides strong support for this assumption.

6.2 Effect on national test scores

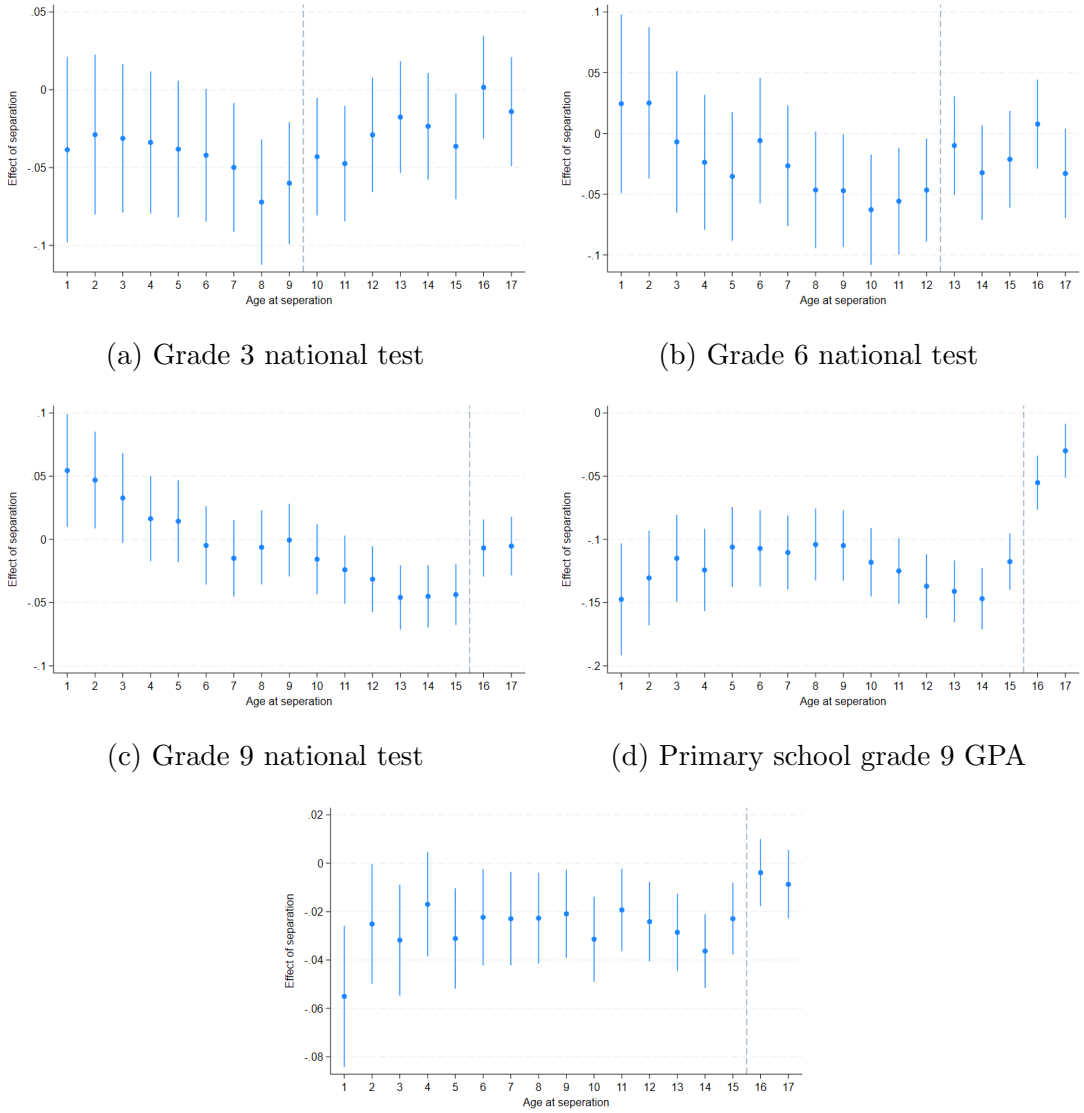
We start by considering the effect of parental separation events the standardized national test scores during compulsory education. Sweden conducts national tests in grades 3, 6, and 9 of compulsory education to measure educational outcomes. The grades 3 and 6 tests are generally considered low-stakes, since tracking does not start until after 9th grade. The grade 9 national test is somewhat higher stakes, since it informs teachers about the relative ability of students, which may feature into the compulsory school GPA determination. The compulsory school GPA (typically assigned in the year in which children turn 16) is the key outcome for children in terms of future educational pathways, since children are allocated to their preferred high-schools and high-school tracks on the basis of the compulsory school GPA.

Data on the national test scores have been collected by Statistics Sweden since 2003 for the grade 9 test, 2010 for the grade 3 test, and 2012 for the grade 6 test. The grade 3 test measures children's ability in mathematics and Swedish, whereas the grade 6 and grade 9 tests also include English. Each test yields a variety of ranked sub-scores, some numerical, some categorical, and some pass/fail. We use item response theory to extract the underlying latent abilities based on the various tests in every given year. The tests generally cover a wide range of item difficulties with few children achieving the maximum score across all sub-tests in any given year, which results in very few mass points in the inferred ability distribution. Appendix section B.2 provides more information on the distribution and

predictiveness of the national primary school tests.

Panels (a) - (c) of Figure 13 shows the coefficients obtained by estimating equa-

Figure 13: School outcomes and age at separation - HH FE estimates



(a) Grade 3 national test

(b) Grade 6 national test

(c) Grade 9 national test

(d) Primary school grade 9 GPA

(e) Academic high-school diploma

Note: The panels show the estimated effects of age at parental separation on national test scores and primary school GPA (all normalised within birth cohorts) as well as high school academic track graduation. The baseline group is those whose parents separate when the child is between ages 18 - 20, the estimates show the effects of experiencing a separation event at age m instead of age 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. Sample restricted to children born to parents who did not have previous children with anyone else. Since the tests that place in the year that children respectively turn 10, 13, and 16, there is always a substantial group of children for whom the separation event occurs well after the outcome is measured. The dashed lines show the age at which outcomes are measured. Standard errors are clustered at the household level.

tion 1 on the national standardized tests for all cohorts for which data is available. Three things stand out. First of all, there is limited evidence that the length of childhood spend in the pre- vs post-separation years directly affects learning outcomes as measured by the national test scores. Children whose parents separated during early childhood perform similar on the national tests compared to children whose parents separated much later in childhood or even in early adulthood. As such, parental separation events that occur in early childhood, rather than later in childhood, do not appear to leave long-lasting scars in terms of human capital outcomes.

Second, there is clear evidence of disruption effects following parental separation. Across all three national tests, the effects are most negative when the separation occurs in the years directly prior to taking the test. In the case of the grade 3 national test scores, the estimates are most negative for separations at ages 8 - 9. For the grade 6 test scores, the estimates are most negative for separations occurring between ages 10 - 11. Finally, for the grade 9 national test scores, the effects of separation are most negative between ages 13 - 15. As such, it is not the case that the duration of childhood exposure to cohabiting or separating parents matters most, but instead, the age at which the separation event happens relative to the age at which outcomes are measured appears most important.

Third, the effect sizes in general are limited in terms of size. The effect of parental separations on national test scores at any age in childhood, as opposed to experiencing a separation event in early-adulthood between ages 18 - 20, is typically within the 0.05 SD range. For comparison, an additional year of maternal education is associated with a 0.11 - 0.16 SD improvement in national test scores. These effect sizes are noticeable, since a parental separation event drastically changes the household structure and household dynamics for the child from that point onward. However, it appears that the disruption caused by the change in household structure, rather than the change in household structure itself, is generating negative effects on learning outcomes.

Table 4 shows the results when we put additional more structure on the individual β_{im} estimates to compare the estimates between the different separation ages.

Table 4: Effects of parental separation on educational outcomes

	(1) Grade 3 test	(2) Grade 6 test	(3) Grade 9 test	(4) Grade 9 GPA	(5) HS Track
Separated age 1 - 4	-0.0381	-0.0182	0.0137	-0.126***	-0.0209*
	(0.0211)	(0.0254)	(0.0154)	(0.0149)	(0.00984)
Separated age 5 - 8	-0.0534**	-0.0367	-0.0162	-0.110***	-0.0209*
	(0.0187)	(0.0222)	(0.0134)	(0.0129)	(0.00851)
Separated age 9 - 12	-0.0473**	-0.0587**	-0.0240*	-0.121***	-0.0219**
	(0.0166)	(0.0193)	(0.0115)	(0.0111)	(0.00729)
Separated age 13 - 15	-0.0266	-0.0237	-0.0474***	-0.135***	-0.0285***
	(0.0148)	(0.0166)	(0.00996)	(0.00952)	(0.00619)
Separated age 16 - 17	-0.00711	-0.0134	-0.00717	-0.0418***	-0.00527
	(0.0142)	(0.0151)	(0.00925)	(0.00859)	(0.00570)
N	470945	292781	585093	604274	533744
R^2	0.647	0.716	0.726	0.737	0.666

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Estimated effects obtained by estimation equation 4 on national standardized test scores, standardized primary school GPA, and high school academic track completion. The baseline group is those whose parents separate when the child is aged 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. Sample restricted to first children born to both parents. Standard errors are clustered at the household level. See appendix section E.2 for a more detailed description and discussion of the estimating equation.

The estimates in columns (1) - (3) confirm that it's predominantly the effects of disruption, rather than the duration of experiencing separated parents, that drives the effects on the national test scores.

Interesting, the comparatively small effects of parental separations obtained from the sibling design are fully consistent with cross-sectional evidence. Table 5 shows the cross-sectional differences in national test scores depending on whether parents cohabit in the year prior to the national test, both conditional and unconditional on household characteristics. Conditional on parental education and age at birth, children whose parents cohabit in the year prior to the test score between 0.04 and 0.07 SD better on the national standardized tests compared to children whose

Table 5: Cross-sectional difference in test scores and primary school GPA (in s.d.)

	Grade 3 test		Grade 6 test		Grade 9 test		Grade 9 GPA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parents together	0.155***	0.0756***	0.202***	0.0364***	0.225***	0.0770***	0.337***	0.208***
year before test?	(0.00260)	(0.00252)	(0.00290)	(0.00276)	(0.00211)	(0.00195)	(0.00179)	(0.00168)
N	750471	750356	552291	552166	951445	951356	951445	951356
R^2	0.033	0.116	0.009	0.171	0.013	0.214	0.040	0.208
SES controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Estimates for all cohorts for which the relevant national tests scores are available. SES controls include a flexible interaction of parental education and parental age at birth. Children who were born to single-parent households are excluded from the sample. To facilitate comparison, the cohorts are restricted in case of the primary school GPA to the same for which the grade 9 standardized tests are available. Both the test scores and GPA are standardized to mean zero and s.d. 1 within each birth cohort.

parents did not cohabiting in the year prior to the test. As such, parental separation events appear to have limited effects on learning outcomes as measured by the national standardized tests.

6.3 Effect on teacher-assigned grades and academic track enrollment

The effect of parental separations on educational outcomes changes substantially when instead focusing on compulsory school GPA. This difference is visible both in the sibling estimates, as shown in panel (d) of Figure 13 and column (4) of Table 4, as well as the cross-sectional evidence in Table 5. Rather than showing evidence of critical age effects or length of separation effects, the main distinction for the effect on compulsory GPA by age is whether the separation event occurred before or after the GPA was determined at the end of compulsory education. The estimates are substantial, since experiencing a separation event at any age between ages 1 - 15, as opposed to between ages 18 - 20, is associated with a 0.1 - 0.15 SD decline in compulsory school GPA. This estimate is around 3 times larger compared to the effect on national test scores in both the sibling comparison as well as the cross-section. This is despite the fact that the compulsory school GPA and

grade 9 test score are available for the same cohorts, and are determined within a few months of time.

The compulsory school GPA is the sole admission criterion based on which municipalities rank children for admissions to high school programs. As such, the primary school GPA is the outcome that affects the future educational option set available to children, rather than the national test scores. Panel (e) shows the effect of parental separation at the various ages on academic track completion in high school, with around 60% of children attending the academic track during this period. Children whose parents separated when they were between ages 1 - 15 have a 2 - 3 pp lower probability to complete high-school compared to children whose parents separated when they were between ages 18 - 20. This estimate is similar to previous estimates by Hertegård (2025*a*) based on studying the impact of parental separations using the Swedish 1974 divorce-law reform. Similar to the effect on primary school GPA, neither the duration nor age at parental separation plays much of a role, other than whether the separation event occurs before or after age 15.

Since the compulsory school GPA is the sole criterion for high school track admissions, the lower rates of academic track completion may well be due to the effect on compulsory school GPA. This is confirmed in both the sibling comparison and cross-section. As Table 6 shows, controlling for compulsory school GPA renders the estimates of the age at separation on academic track completion insignificant for all ages. Similarly, children whose parents separated prior to age 15 are around 4pp less likely to attend the academic track in the cross-section as shown in Table , conditional on SES. This difference disappears when conditioning on compulsory school GPA. As such, it appears that it is the lower compulsory school GPA, rather than different choices conditional on GPA, explains why children whose parents separated during childhood have lower rates of academic track completion in high school.

An important question is why the effects of parental separations differ between the primary school GPA and grade 9 national tests. One possible explanation is that parental separations directly affect teacher assessments if teachers internal-

Table 6: Effect of parental separations on high school academic track graduation

	(1)	(2)
Separated age 1 - 4	-0.0209*	-0.00520
	(0.00984)	(0.00968)
Separated age 5 - 8	-0.0209*	-0.00451
	(0.00851)	(0.00838)
Separated age 9 - 12	-0.0219**	-0.00285
	(0.00729)	(0.00718)
Separated age 13 - 15	-0.0285***	-0.00471
	(0.00619)	(0.00606)
Separated age 16 - 17	-0.00527	0.00246
	(0.00570)	(0.00550)
N	533744	480669
R^2	0.666	0.719

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Estimated effects obtained by estimation equation 4 on high school academic track completion. The baseline group is those whose parents separate when the child is aged 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. The estimates in column (2) include a dummy for each possible score on the primary school GPA. Standard errors are clustered at the household level.

ize the separation event as a signal of children's potential ability, in particular as parental separations are more common among lower performing students. However, a different, and more likely, possibility is that teachers grade different aspects of learning compared to the national test, including, for instance, homework preparation. Children who have separated parents may receive less effective parental support with homework and assignment preparation due to the increased coordination costs between parents in assigning homework support, keeping track of school progress, and teacher expectations. Regardless of which mechanism drives the outcomes, it appears that the effects on teacher-assigned grades, rather than direct learning outcomes, are driving the effects.

6.4 Robustness and heterogeneity

One concern is that the national test scores and teacher-assigned GPA may differ in how well they measure student ability, which may bias the results against national test scores. To investigate this, we first restrict the compulsory school GPA in grade 9 to only include English, Mathematics, and Swedish, the same subjects that are part of the grade 9 national test. Appendix Figure E.17 shows the results, with very similar estimates. Second, we test whether national test scores are significantly less predictive of future educational outcomes compared to teacher-assigned grades using the student outcomes in grade 6.[9] Appendix Table E.4 shows that conditional on observing the outcomes in the same subjects, both measures are quite similar in how well they predict grade 9 test scores, grade 9 GPA, and academic track enrollment.

Next, we study whether the estimates may be driven by the high-stakes nature of the teacher-assigned grades and national test scores in grade 9, since these determine future educational possibilities. To investigate this, we estimate the effects on the national test scores and compulsory school GPA in grade 6. The results are shown in Appendix Figure E.18 and Table E.5. The age-patterns in the parental separation effects are similar to the baseline estimates, and again reveal substantially larger effects on the teacher-assigned grades than the national test scores. This is also in line with cross-sectional evidence, which shows a fourfold difference in the effect of having separated parents on compulsory school GPA compared to national test scores, as shown in appendix Table E.6.

Finally, we study heterogeneity in the estimates. First, we study the heterogeneity by SES. The estimates are shown in Appendix Figure E.19, split by low-SES (maternal education at most high school) or high-SES (at least some post-secondary education). The effects of parental separations at the various ages on the national test scores and academic track enrollment are quite similar between both groups. The main difference is in the effects on the grade 9 GPA, where the age-pattern

[9]The compulsory school GPA in grade 9 is the sole admission criteria for secondary school tracks. As such, it should always be more predictive of future outcomes than the national tests not necessarily due to potential differences in how well it measures student ability, but due to the mechanical effect on potential future educational pathways.

is very similar, but parental separations between ages 1 and 15 are associated with somewhat better educational outcomes relative to parental separations that occur later in life. Next, we study the effects of parental separations by marriage status at birth, with the estimates shown in appendix E.20. We again find similar estimates for the national test scores and academic track enrollment, and slightly smaller effects on the grade 9 test score among couples that are married at birth. Finally, we separately estimate the effects of parental separations vs legal divorce, using the timing of the respective events. The results are shown in Appendix Figure E.21. The parental separation estimates by age are once again similar for the national test scores and academic track enrollment, and slightly less negative at early ages based on divorce rather than marriage. As such, the effects of parental separation events are generally very similar across groups, although the evidence suggests that the effects on the grade 9 GPA is somewhat smaller for high-SES families, initially married families, and divorces instead of separations.

7 Conclusion

This paper studies the prevalence, determinants, and effects of parental separations. Parental separation is a common occurrence in childhood with over 35% of children in Sweden living in separated households by age 16, yet it remains understudied in the economic literature. In this paper, we make four novel contributions.

First, we document novel descriptive statistics surrounding parental separations. The relationship between parental separation probability and SES is a relatively recent phenomenon, with the slope of the gradient increasing from non-existent to fairly substantial over the last 50 years. This is fully driven by a decline in family stability among low-SES households. Given that the median child in low-SES households is now expected to experience a parental separation, the findings have important implications for the study of equality of opportunity.

Second, we highlight some shortcoming of the reliance of divorce as a measure of parental separations, as has been common in previous literature. The average parental separation event does not involve a divorce for recent cohorts, given that

most parents are not married at birth, and non-married parents have significantly higher separation rates. As a result, the observed separation events based on divorce in practice are strongly skewed towards high-SES households. However, since the selection into marriage changes over time by SES, the SES gradient in parental separations is underestimated by 50% when using divorce, and very little of the increasing relationship over time between SES and parental separation is visible based on divorce. As such, our approach to determine parental separations from parental colocation provides strikingly different results.

Third, we study the determinants of separations at the level of parental matches using a regression forest. The model can predict parental separations at the individual level remarkably well, with predicted likelihoods varying between 20% and 80%. The information from the model can be used in public policy to identify the most at-risk families, and consider potential interventions. Although relationships and marriages are deeply personal, previous studies show that public policies play a role in determining family stability (Gruber, 2004; Avdic and Karimi, 2018; Olafsson and Steingrimsdottir, 2020; Persson, 2020; Hertegård, 2025*a*; Adda, Pinotti and Tura, 2025). At the same time, our model also highlights some limitations. Despite the extremely rich administrative data available, children in the group with the lowest parental separation probability based on the generalized random forest still experience parental separation in about 15 - 20% of the cases. This highlights that individual characteristics and experiences play an important role, beyond the economic and social structures that can be observed in administrative records.

Finally, we provide novel evidence on the effects of parental separation on the outcomes of children. Similar to the findings of Hertegård (2025*a*) and Johnston, Jones and Pope (2025), we find effects of parental separations on the long-run educational outcomes of children. However, our data enable us to go one step further and investigate what mechanisms drive the effects on the long-run educational outcomes. We find little evidence that parental separations have permanent scarring effects on learning outcomes as measured by the standardized tests. Instead, we find more support for short-term disruption effects on learning outcomes

following parental separations, similar to the effects of parental job loss on educational outcomes in Norway as documented in Carneiro et al. (2023). In contrast, the long-term effects are three times larger on teacher-assigned grades. Since these are critical in the Swedish context for future educational possibilities, we show that it is the effect on teacher-assigned grades, rather than effects on learning outcomes or educational choices conditional on grades, that generate the persistent effects of parental separations on long-term educational outcomes.

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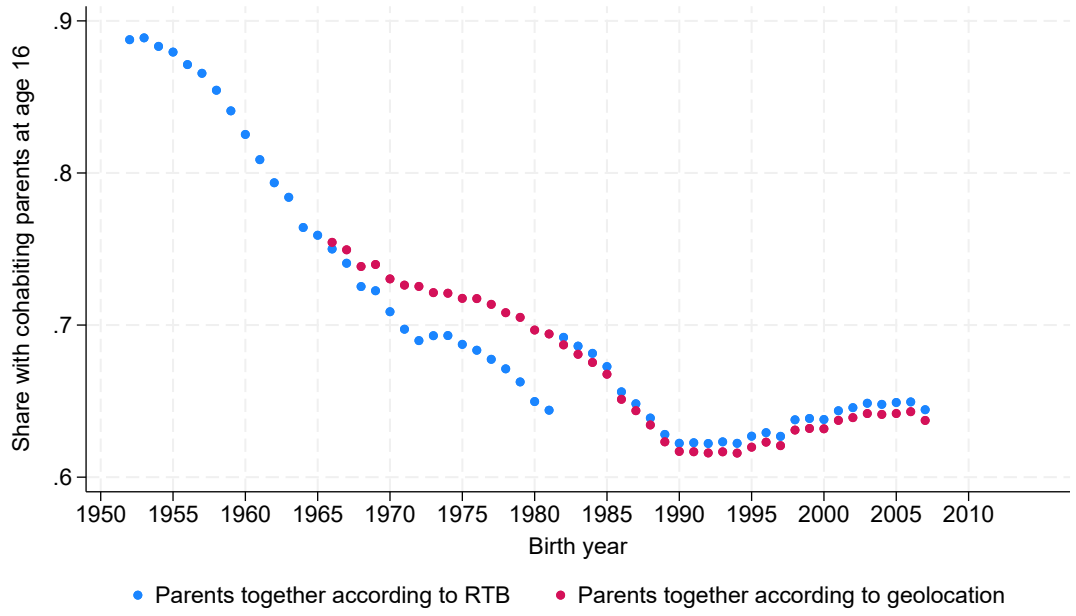
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Appendices

A Descriptive evidence

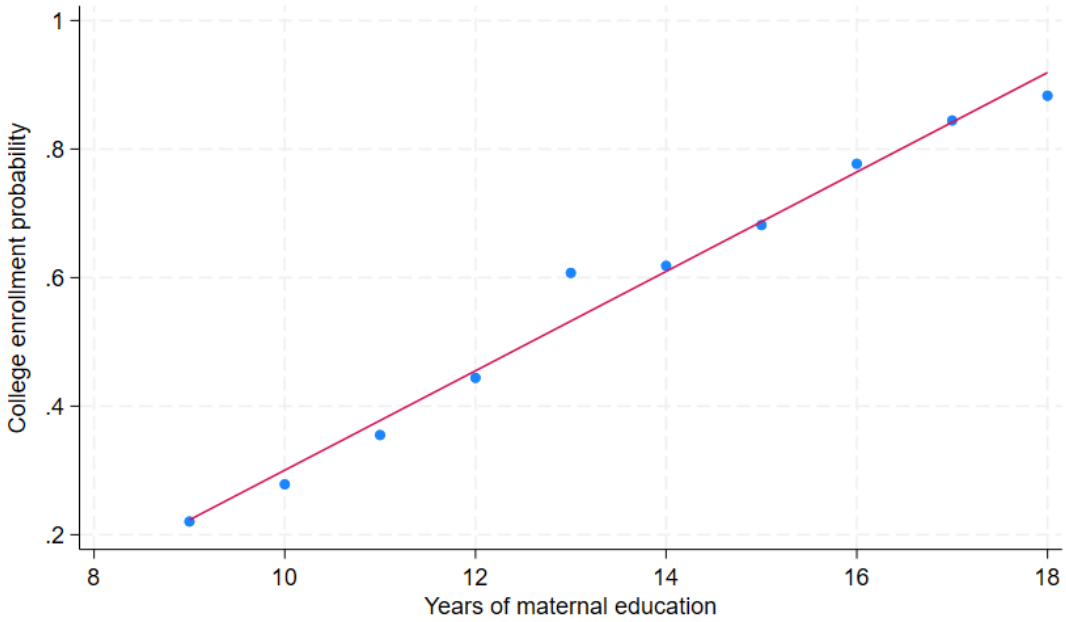
A.1 Further descriptive results

Figure A.1: Different sources on parental cohabitation at age 16 by birth cohort



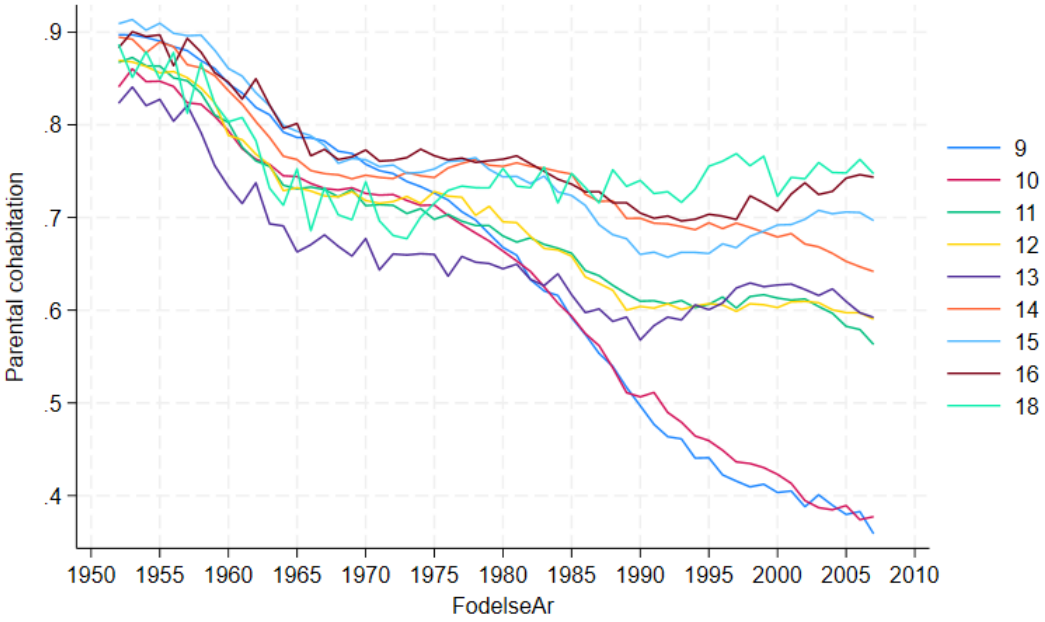
Note: Figure shows parental colocation probability at age 16 according to different sources. The Register of the total population begins for the cohort born in 1952 and captured legally married parents regardless of cohabitation until the cohort born in 1981. For the cohorts born in 1982 -2 007, the Register of the total population captures legally married parents regardless of cohabitation as well as those who cohabit. Parents are identified as cohabiting based on geographic location for the 1966 - 2007 cohorts if they live in the same 100x100 meter cell.

Figure A.2: College enrollment probability by maternal SES



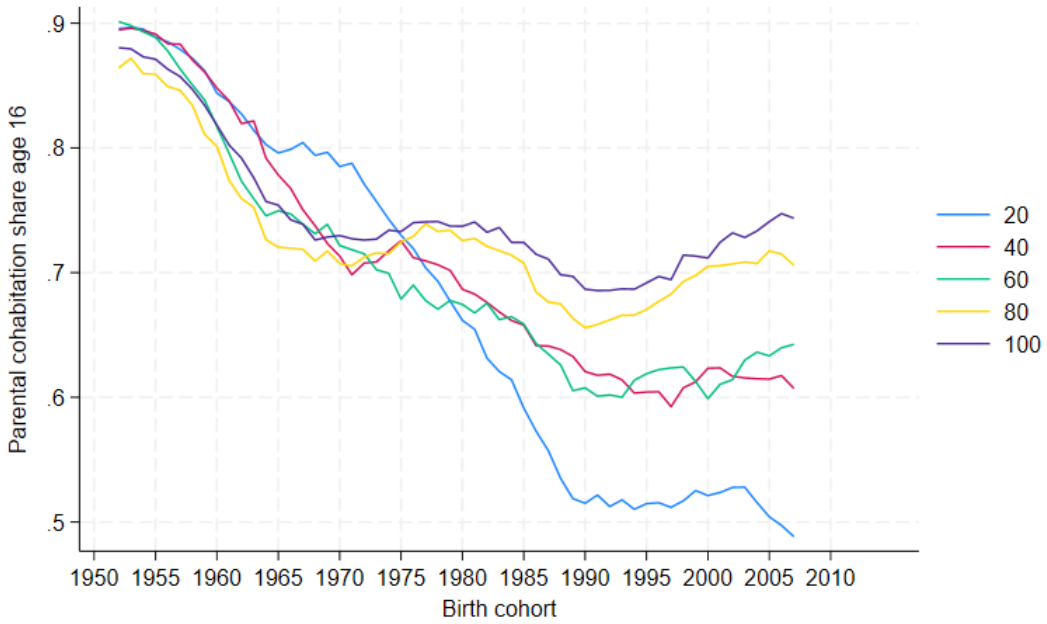
Note: Figure shows the likelihood that children register to attend a university or applied university (y-axis) by maternal years of education (x-axis). Calculations based on all children born in Sweden to Swedish-born mothers between 1995 and 2007.

Figure A.3: Parental cohabitation at age 16 by years of maternal education



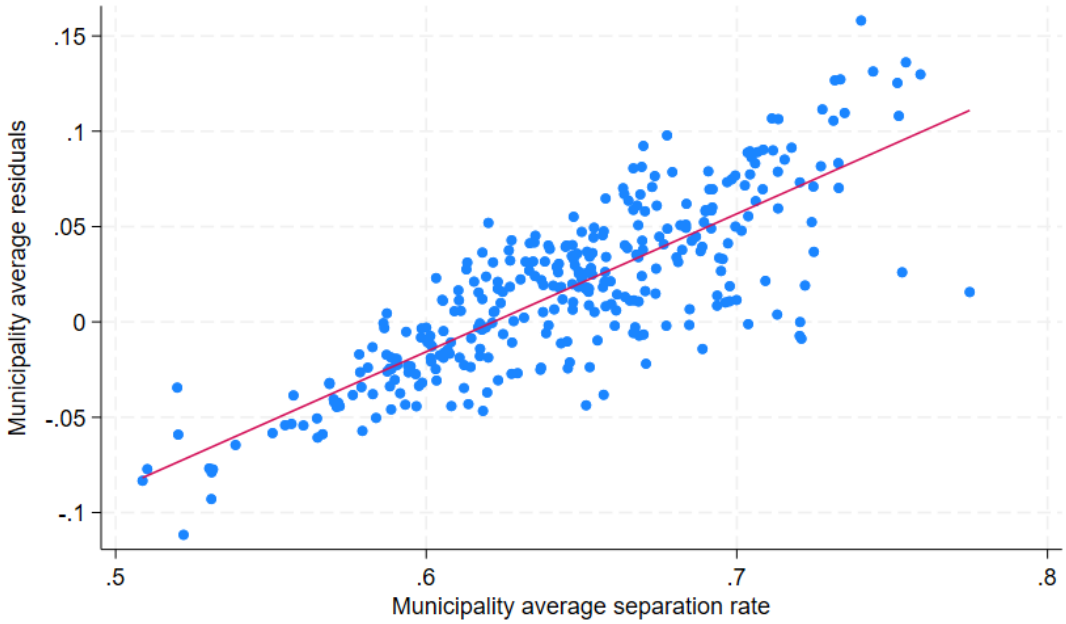
Note: Figure shows the development in parental cohabitation at age 16 by years of maternal education for the individual birth cohorts between 1966 and 2007. Note: the coding of education changes between 1999 and 2000 in the CBS LOUISE database. This due to the introduction of SunNiva2000 as the new standard, and imperfect matching between old and new educational categories. Hence, there us a large change in maternal education assignment between 1989 and 1990, since we define maternal education at 10 years after birth. Note: none of this matters for baseline estimations, since all children in the baseline sample are born in or after 1990.

Figure A.4: Development in parental cohabitation by maternal education quintile



Note: Figure shows the development in parental cohabitation at age 16 by maternal education quintile. For each birth cohorts, the individuals are ordered by the 3-digit maternal education groupings (see appendix Table B.1 for more detail), and divided into 5 equal size quintiles. As such, the quintiles are based on the position of maternal education, relative to all other mothers in the same cohort. As such, each position in the graph represents 20% of children by maternal education in any given cohort.

Figure A.5: Municipality average residuals conditional on SES



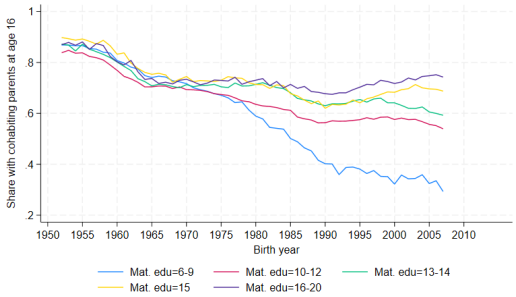
Note: Figure shows the average residuals when correcting for parental education (flexible interaction of the categories listed in Table B.1 for both parents) and age at birth on the y-axis. On the x-axis is the average separation rate by age 16 in the same municipality. The slope is 0.78, highlighting that at most 22% of the variation across space can be explained based on parental education and differences in parental age at birth.

A.2 Inclusion of children with a migration background

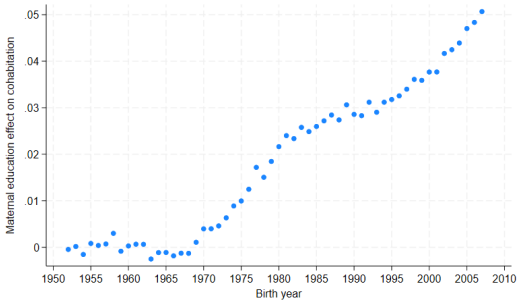
Around 16.5% of the children born between 1990 and 2000 in Sweden had a mother born outside of Sweden. This group is excluded from the baseline study, since the share of foreign-born mothers changed substantially over the study period (rising from 8% for the 1974 birth cohort to 18% in the 2001 birth cohort) and maternal education is typically less-well recorded for mothers with a migration background. Furthermore, restricting attention to the children born to Swedish-born mothers enables us to use information on the grandparents as well in the overwhelming majority of cases.

To show that the results are robust when estimated on the full population of children born in Sweden, the figures below show the key estimates when also including children with a migration background. The estimates are generally very similar to the baseline estimates, although the SES-gradient in panel (a) of figure A.6 is slightly flatter, which might be related to the higher degree of noise in educational attainment observed for foreign-born mothers.

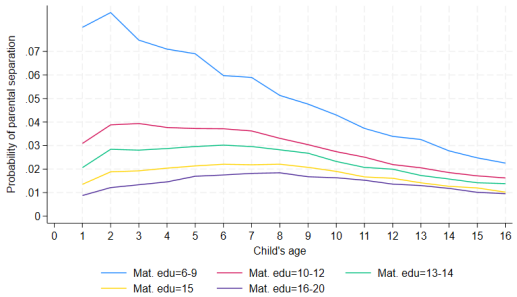
Figure A.6: Repetition of key descriptive results including second-generation immigrants (to be updated)



(a) Parental cohabitation at age 16 by birth cohort and maternal education



(b) SES-gradient in parental cohabitation at age 16 by birth cohort



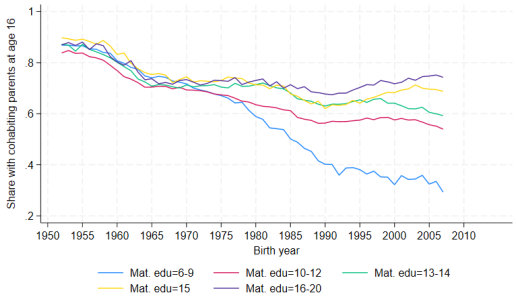
(c) Separation hazard rate by age and maternal education

Note: Figure shows parental separation hazard rate by age (top-left), parental co-location probability by years of maternal education and birth cohort (top-right), as well as development in SES-gradient over time (bottom). All three figures include all Swedish-born children, rather than children born to Swedish-born mothers. The analogue figures in the main text are respectively and panels (a) and (b) in Figure 3, and panel (b) in Figure 4.

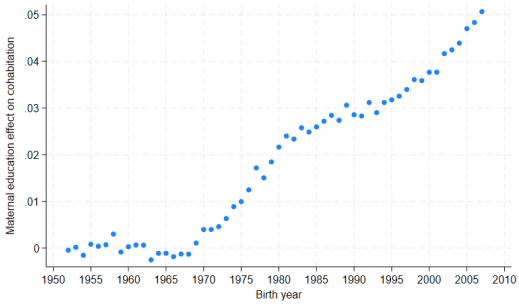
A.3 Sample restricted to first-born children

Throughout the descriptive analyzes, we treat the child as the unit of observation. However, we classify households by SES. This may introduce some friction, since both household size and the age of siblings may certain changes over time. To show that the same results hold when providing the same weight to all households, we repeat the key descriptive results based on the first-born child to each mother. This also has the benefit that if separation events are related to the age of the oldest child, we would be able to see this in different hazard rate patterns. Figure A.7 shows the key descriptive figures when restricting attention to first-born children, with very similar results in all cases.

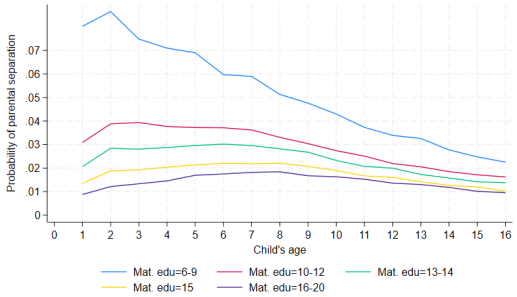
Figure A.7: Repetition of key descriptive results for first-born children



(a) Parental cohabitation at age 16 by birth cohort and maternal education



(b) SES-gradient in parental cohabitation at age 16 by birth cohort



(c) Separation hazard rate by age and maternal education

Note: Figure shows parental separation hazard rate by age (top-left), parental co-location probability by years of maternal education and birth cohort (top-right), as well as development in SES-gradient over time (bottom). All three figures are exclusively based on first-born child of the mother. The analogue figures in the main text are respectively and panels (a) and (b) in Figure 3, and panel (b) in Figure 4.

A.4 Consistency between pre-1968 and post-1968 period

The full populations registers in the Swedish context, including the individual registrations, start in 1968. In general, the birth certificates are available for the full population, including those born before 1968. However, in practice the birth information is somewhat worse registered in the pre-1968 priod. While around 1% of children born in Sweden has no registered father on their birth certificate for the cohorts born between 1968 and 2007, the coverage declines substantially prior to 1968. Among the children born in 1952, around 7% of children are missing a father on their birth certificate.

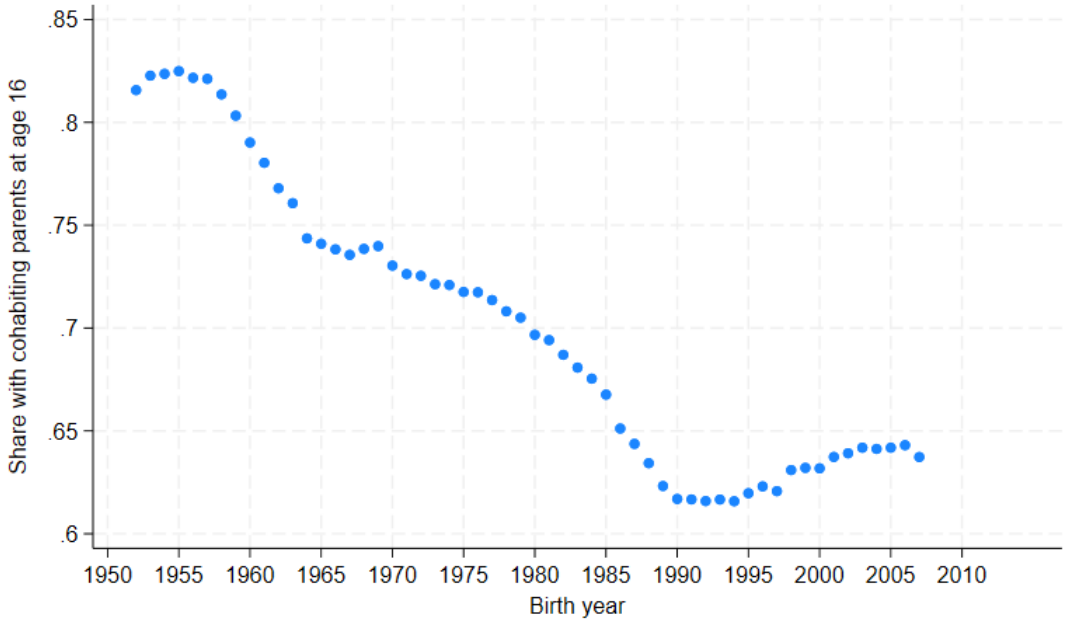
For the baseline sample, we counts children with a missing father on the birth certificate as being born into a single-parent household. Furthermore, we exclude

cases where either parent dies before age 16 according to the death register. Since the death register also only starts in 1968 and covers cases from 1968 onward, this creates some difficulties when using the pre-1968 period. Since 45% of mothers with children without a father on the birth certificate are registered as widowed in 1972 (first year that consistently records civil status), compared to 5% of all mothers, it appears that administrative procedures at the time lead to deceased parents to be omitted from the birth certificate.

Since we have no identifiers nor a death record in these cases, we cannot fully distinguish between genuine single parents at birth, parental deaths prior to age 16, and parental migration events prior to age 16 for the cohorts born before 1968. In the baseline sample, we restrict the sample for the pre-1968 cohorts to those where both parents are observed in either 1968 or 1969 in the registers, to ensure that both parents are in fact alive and could potentially cohabit. However, this invariably means that we exclude some cases of children born into single parent households or cases where a parent migrated, rather than died. This affects around 6% of children born in 1952. To assess how this affects the estimates, we re-estimate the two Figures in the main text that use the longest possible time period, namely Figures 2 and 3, and remove the restriction that both parents are observed in either 1968 or 1969 for the pre-1968 birth cohorts.

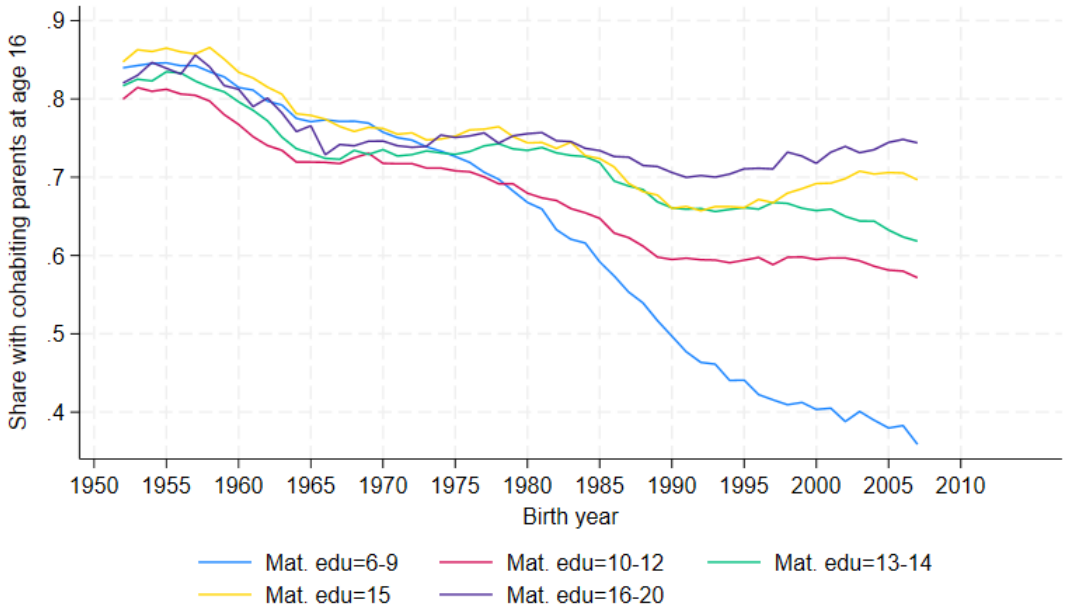
As shown in Figure A.8, this restriction drops the share of cohabiting parents at age 16 among the 1952 birth cohort by around 6pp, which is almost fully driven by the larger number of unobserved father-ID's, rather than the father's not being observed in 1969 or 1969 conditional on being known. However, this share of missing fathers is spread very evenly across the various SES groups. As a results, the inferred SES-gradient for the pre-1968 cohorts shown in Figure A.9 is almost identical to to the results observed in Figure 3 in the main text. As such, the uncertainty over the fate of the fathers that are missing on birth certificates in the pre-1968 period predominantly affects the levels, rather than have any meaningful impact on the inferred SES gradient.

Figure A.8: Parental cohabitation at age 16 by birth cohort - excluding 1968/1969 restriction

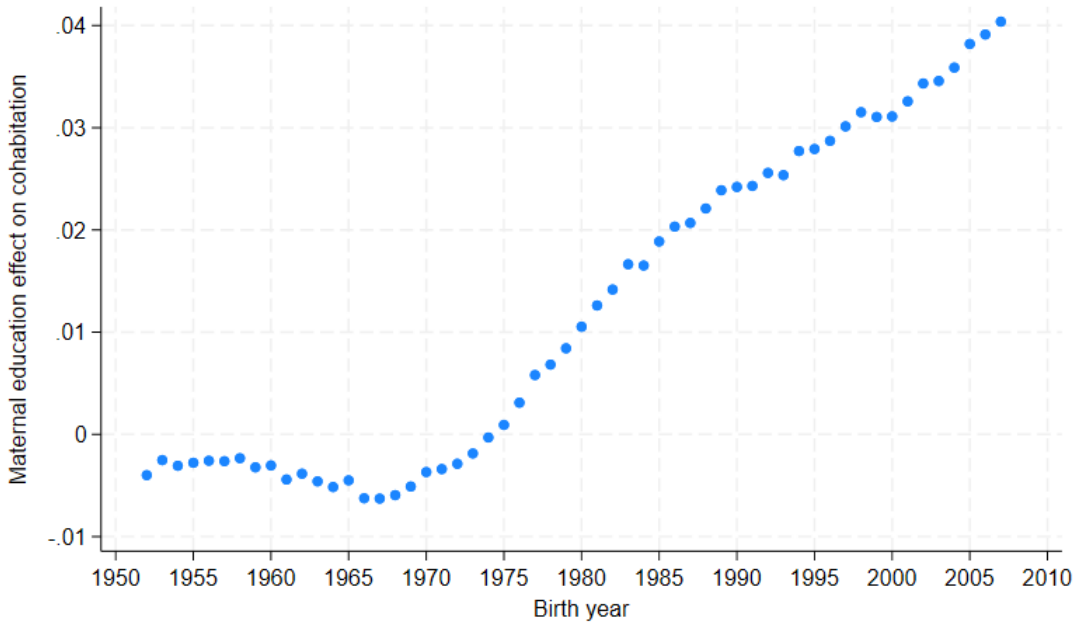


Note: Figure shows parental cohabitation probability when the child is aged 16 for the birth cohorts 1952 - 2007. Cohabitation measured as parents being married according to the Register of the total population for cohorts born in 1952-1965 and as parents living in the same 100x100 meter cell for cohorts born in 1966-2007. See Figure A.1 for a comparison of sources on cohabitation rates. In this Figure, we drop the restriction that parents for the cohorts born before 1968 are observed in either 1968 or 1969 to account for the missing data on parental deaths prior to 1968.

Figure A.9: Changes in household stability by maternal education - excluding 1968/1969 restriction



(a) Parental cohabitation at age 16 by birth cohort and maternal education



(b) Slope of the SES-gradient in parental cohabitation at age 16 by birth cohort

Note: Panel (a) shows share of parents cohabiting when the child is aged 16 for different cohorts by maternal education. Panel (b) plots the regression coefficient obtained when regressing parental cohabitation at age 16 on years of maternal education for each birth cohort between 1952-2007. In this Figure, we drop the restriction that parents for the cohorts born before 1968 are observed in either 1968 or 1969 to account for the missing data on parental deaths prior to 1968.

B Educational variables

B.1 Parental education

Information on the highest level of completed education at the individual level is available in the Swedish registers universally since 1990 via the LOUISE and LISA registers. There have been some minor changes in the allocation of individual degrees to level of completion at Statistics Sweden, in particular between 1999 and 2000. To ensure continuity across birth cohorts, we define parental education as the highest level of education observed in the registers in the most year for which information on the individual is available.

For parents that pass away prior to 1990, educational achievement is never documented in the registers. However, this forms a limited problem, given that the baseline estimates are based on children born since 1990, whose parents would thus always be captured by the relevant registers. For the very earliest cohorts the survivor bias may play some role, but this is relatively unlikely to explain any of the divergence observed since 1970, since we would observe educational attainment by the latest when the children are aged 20.

Table B.1 shows the aggregation level at which parental education is known. Within the Swedish structure, there is a clear correspondence between formal length of the education and the level of education, since vocation degrees at both the secondary and tertiary level have historically been a year shorter than academic degrees. In the reporting of results, we typically rely on the years of education. However, any regression which controls for parental education always controls for the unique combination of the educational codes for both mother and father.

Table B.1: Parental education categories

Years	Code	Description	Share
	100	Elementary school education	0.09%
	106	Elementary school education	0.12%
9	200	Other primary and lower secondary education, 9 (10) years	0.18%
	204	Lower secondary school education	0.01%
	206	Compulsory school education, years 7–9 (10)	6.89%
	310	Other upper secondary education, less than 2 years	0.05%
	312	Upper secondary education, preparation studies, no diploma, less than 2 years	0.67%
10	313	Upper secondary education, vocationally oriented programme, no diploma, less than 2 years	0.63%
	316	Upper secondary education, preparation studies, less 2 years	0.00%
	317	Upper secondary education, vocationally oriented, less than 2 years	2.76%
	320	Other upper secondary education, 2 years	0.41%
	322	Upper secondary education, preparation studies, no diploma, 2 years	0.60%
11	323	Upper secondary education, vocationally oriented, no diploma, 2 years	1.01%
	326	Upper secondary education, preparation studies, 2 years	3.55%
	327	Upper secondary education, vocationally oriented, 2 years	16.66%
	330	Other upper secondary education, 3 years	0.25%
	332	Upper secondary education, preparation studies, no diploma, 3 years	1.22%
12	333	Upper secondary education, vocationally oriented, no diploma, 3 years	5.08%
	336	Upper secondary education, preparation studies, 3 years	9.04%
	337	Upper secondary education, vocationally oriented, 3 years	6.93%
	410	Other post-secondary education, less than 2 years	0.01%
	412	University/college programme, minimum 30 higher education credits, no degree, less than 2 years	3.66%
13	413	Upper secondary supplementary programme, less than 2 years	1.10%
	415	Post-secondary education, not university/college, vocationally oriented, less than 2 years	0.73%
	417	University/college programme, vocationally oriented, less than 2 years	0.25%
	520	Other post-secondary education, 2 years	0.07%
	522	University/college programme, 120 higher education credits, no degree, 2 years	1.50%
14	525	Post-secondary education, not university/college, vocationally oriented, 2 years	1.95%
	526	University/college programme, general, 2 years	0.43%
	527	University/college programme, vocationally oriented, 2 years	7.17%
	530	Other post-secondary education, 3 years	0.01%
	532	University/college programme, minimum 180 higher education credits, no degree, 3 years	2.28%
15	535	Post-secondary education, not university/college, professionally oriented, 3 years	0.07%
	536	University/college programme, general, 3 years	4.40%
	537	University/college programme, professionally oriented, 3 years	10.16%
	540	Other post-secondary education, 4 years	0.00%
16	545	Post-secondary education, not university/college, professionally oriented, 4 years	0.04%
	546	University/college programme, general, 4 years	1.93%
	547	University/college programme, professionally oriented, 4 years	5.78%
	550	Other post-secondary education, 5 years or longer	0.00%
17	555	Post-secondary education, not university/college, professionally oriented, 5 years	0.02%
	556	University/college programme, general, 5 years or longer	0.02%
	557	University/college programme, professionally oriented, 5 years or longer	1.30%
	600	Other postgraduate education	0.00%
18	620	Licentiate programme	0.13%
	640	Doctoral programme	0.74%
-	999	Missing	0.05%
	Total		100.00%

Note: Figure shows the links between years of education and underlying codes. Shares based on distribution of maternal education for children born in Sweden between 1990 - 2007.

B.2 Educational outcomes of children

The educational outcomes consist of three key measures: the scores on the national standardized tests, the primary school GPA, and enrollment and/or graduation

from the academic track. We will discuss each in some detail, particularly the standardized tests.

B.2.1 National standardized tests

Sweden has historically relied on national standardized tests to provide insights into the educational development of children. Since 1998, Sweden has conducted a national test in grade 9, which is typically taken at the end of compulsory education in the year in which children turn 16. The grade 9 standardized tests results are available as part of the Statistics Sweden (SCB) databases since 2003, thus corresponding to the 1987 birth cohort. However, this provided only limited insights into the human capital development of children prior to age 15 for the purposes of public policy development, monitoring, and interventions. As such, an additional national test was introduced in grade 3 in 2010 (available for the birth cohorts starting in 2000), and a further national test was introduced in grade 6 in 2012 (available for the birth cohorts starting in 1999). Testing was suspended during COVID, which means that national tests are not available for 2020 and 2021.

Each national test assesses students' ability in Swedish and Mathematics. The grade 6 and 9 standardized tests in addition assess ability in English. There are certain additional subjects that rotate or that have been available for only certain years. We focus on the scores in the three core subjects of English, Mathematics, and Swedish, to enhance availability over time and between different cohorts.

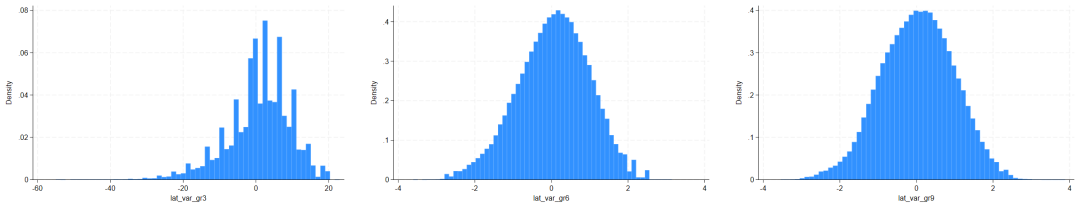
It is difficult to directly transform the scores into a single aggregate score, since the individual subjects typically have scores across a variety of sub-domains or sub-test parts. These scores can be binary (pass/fail), letter grade (A-F), or a numerical grade (number of correct questions). A combination of all three can often be found as part of the assessments of a single subject in a single year (say Swedish in 2013). As such, this creates a complication, since it's difficult to transform the letter grades and pass/fails into a numerical grade, given that each measure has a clear ordinal meaning, but not a clear cardinal interpretation.

To obtain a comparable ability measure that uses as much information as possi-

ble, we estimate a latent factor model for each test-year. We combine the grades in Swedish, Mathematics, and English into a single ability measure to maximize precision. This also mimics the way in which the primary school GPA is constructed, which is the average grade across 16 subjects, which forms the key input into secondary school decisions. Given the ordinal nature of the variables, we estimate an item response theory (IRT) model at the individual level. IRT models have been widely used in economics in recent years in other publications on early childhood measures with similar structured data, typically from surveys (see for instance Kinsler and Pavan (2021); Bau (2022); Andrew et al. (2024); Carneiro et al. (2024)). However, the results are similar when using an average of the numerical scores in mathematics, Swedish, and English and the correlations are fairly high at 0.90 - 0.93.

The inferred latent ability measures follow quite well a standard distribution, as shown in Figure B.10. The benefit of the rich data and variety of measurements means that top-coding is not much of an issue, since there is variation even in the top of the ability distribution in the number of correct items. Furthermore, the ability tests are highly predictive, as shown in Figure B.11 for the grade 3 ability. Children at the bottom of the ability distribution have a probability of less than 20% to attend the academic track, vs over 90% for children at the top of the grade 3 ability distribution. These relationships become substantially stronger over time as seen for instance based on the relationship between the grade 6 national test and later educational outcomes, as shown in Figure B.12.

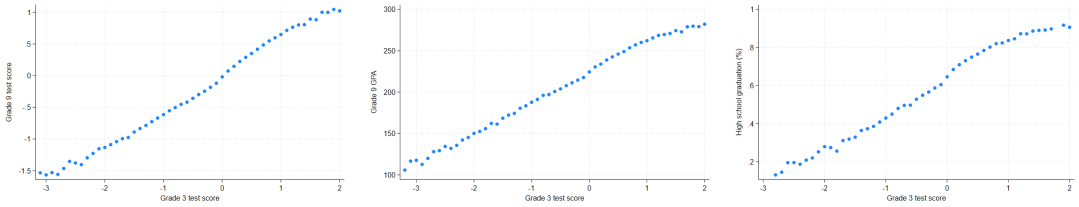
Figure B.10: Distribution of latent ability measures based on test scores



(a) Grade 3 (b) Grade 6 (c) Grade 9

Note: Distribution of latent ability based on grade 3, 6, and 9 test scores for all cohorts with available test data.

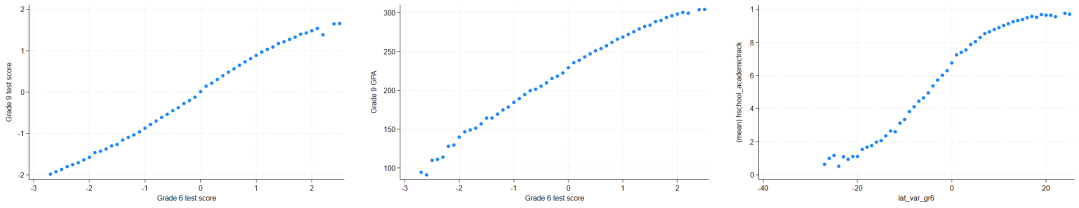
Figure B.11: Predictiveness of latent ability measures - grade 3



(a) Grade 9 test score (b) Primary school GPA (c) Academic HS Track

Note: Figure shows the relationship between grade 3 latent ability and 9th grade latent ability, primary school GPA, and academic track completion in high school.

Figure B.12: Predictiveness of latent ability measures - grade 6



(a) Grade 9 test score (b) Primary school GPA (c) Academic HS Track

Note: Figure shows the relationship between grade 6 latent ability and 9th grade latent ability, primary school GPA, and academic track completion in high school.

B.2.2 Primary school GPA

The primary school GPA is determined at the end of primary school. The grade is determined as a weighted average of the grades on the underlying 16 or 17 subjects in which students graduated.[10] The primary school grades are assigned by the teachers at the end of compulsory education. The primary school GPA forms the key determinant in the choices for secondary schools, since the municipality assign students to their preferred secondary school tracks in order of their primary school GPA. As such, the primary school GPA is the key determinant of secondary school educational opportunities.

The primary school GPA roughly follows a normal distribution. To improve interpretation, we standardize the primary school GPA within each graduation cohort

[10]The underlying subjects are fixed and common for all students, and include Swedish, English, Mathematics, Biology, Physics, Chemistry, History, Geography, Religion, Civics, PE, Crafts, Music, Visual arts, Home and Consumer Studies, Technology, and a second foreign language.

to have mean zero and SD 1, which improves the comparison with the other outcomes.

B.2.3 Academic track enrollment/graduation

Records on the academic track graduation are available at the student-level since 1973, although the full set of information is available since 1985. Throughout the paper, we focus on whether students graduate from an academic high school track since this is best documented in the data throughout the entire period. In recent years, around 60% of students graduate from the academic track in high school. The grades in the academic track are the key admission criteria into tertiary education, and $2/3^{\text{rd}}$ of spots in each study program is assigned based on high school GPA. The other $1/3^{\text{rd}}$ or spots are allocated on the basis of the score on the Swedish Scholastic Aptitude Test (SSAT), the so-called Högskoleprovet, which is comparable to the SATs in the US context. As such, gaining access to a high-quality academic track is a key input into future academic outcomes, although the second chance does always exists through participation in the SSAT.

C Potential mechanisms

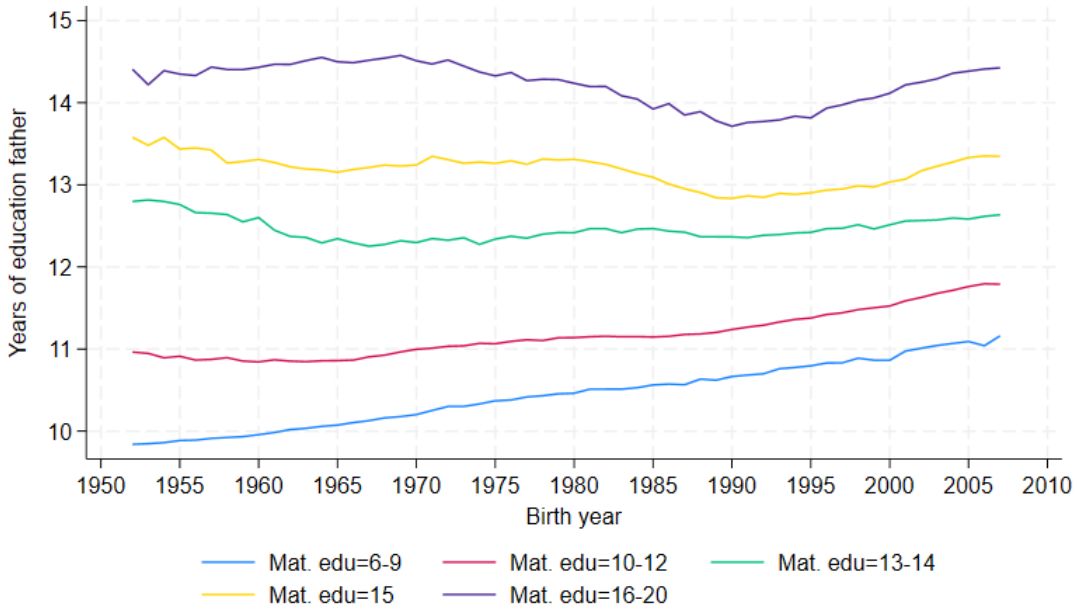
C.1 Assortative matching

One possibility is that the decline in relationship stability among children born to low-educated mothers is due to changes in partner selection. If females married to low-SES partners are generally more likely to separate, and assortative matching substantially increased, then this may reasonably drive the increase in separation rates. To investigate this, panel (a) in Figure C.13 below shows how the educational position of fathers (as percentile in the educational distribution) has changed between 1964 and 2013. While there has been some increase in assortative matching for females in the bottom 10% of the educational distribution, the patterns are generally quite stable. This is remarkably, since we observed a decline in family stability for females in the bottom 60% of the educational distribution (see appendix Figure A.4). As such, the changes are not quite consistent with a change in assortative matching defined by educational percentiles.

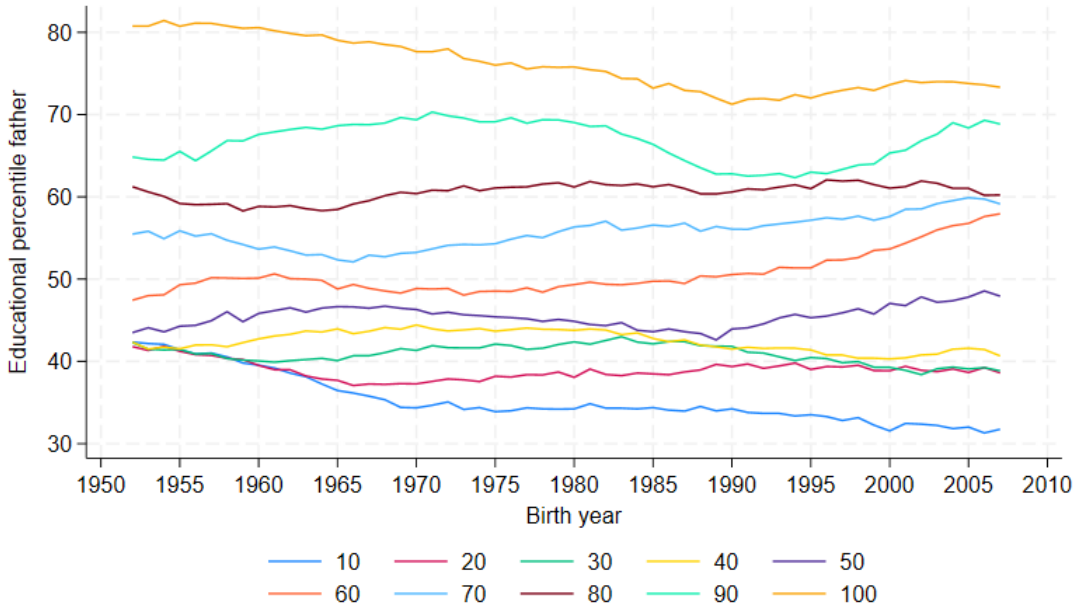
The results are even more striking when studying the changes in assortative matching in levels, as highlighted in panel (b) of Figure C.13. While the average years of education of the father has barely changed over a 50 year period for females in the top-decline of the educational distribution, mothers in the bottom educational decile now have partners that have received over 3 years of additional education compared to the 1960's. As such, the inequality in partners between females of different educational levels has actually decreased when education is measured in years of education, and remained relatively stable in terms of the educational position of the fathers. As such, there is little evidence of a substantial increase in assortative matching over the period under study.

To more directly rule out that changes in assortative matching explain the main results, Appendix Figure C.14 shows the change in household stability over time among children where the parents have the exact same years of education. In this case, we compare the experiences over time by maternal education, conditional on an assortative match based on the education. 31% of parents have the exact same years of education. As shown in Figure C.14, the results and developments

Figure C.13: Changes in assortative matching by maternal education



(a) Father's years of education by maternal years of education

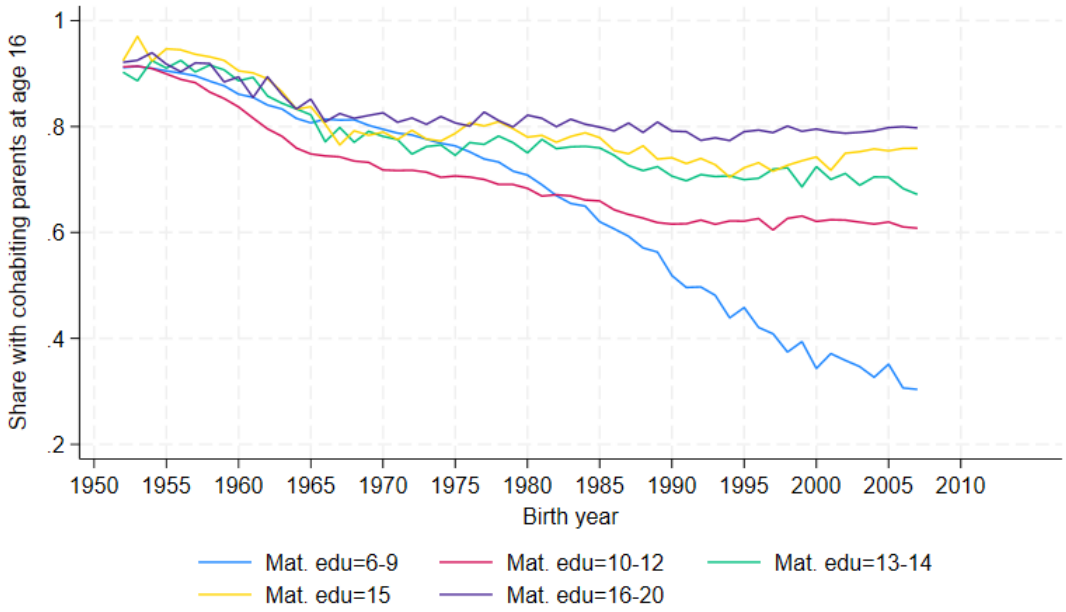


(b) Father's educational percentile by maternal educational percentile

Note: Figure shows the change in assortative matching based on the father's education by the maternal education decile between 1964 - 2013. Panel (a) shows the father's percentile position within all fathers that have children in the same year. Panel (b) shows years of education of the father.

for all the groups are virtually the same as those for the baseline sample displayed in Figure 3. As such, it appears unlikely that changes in assortative matching explains the divergence in household stability by SES over time.

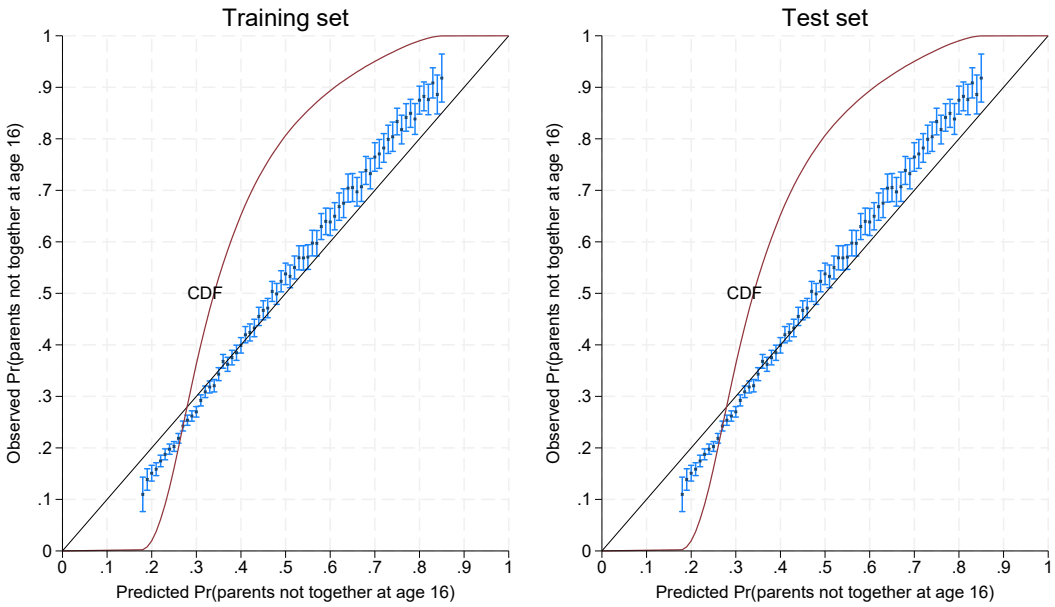
Figure C.14: Changes in household stability among matched parents in education



Note: The Figure shows the share of children with cohabiting parents at age 16 by years of maternal education. Figure restricted to children where parents have the exact same numbers of years of education (31% of sample). 6-9 years of education corresponds to at most compulsory education, 10 - 12 years of education corresponds to some high school or a high school degree, 13 - 14 years to a vocational or incomplete tertiary degree, 15 years to a bachelor degree from a university or applied university, 16 years or above to a master's or doctoral degree.

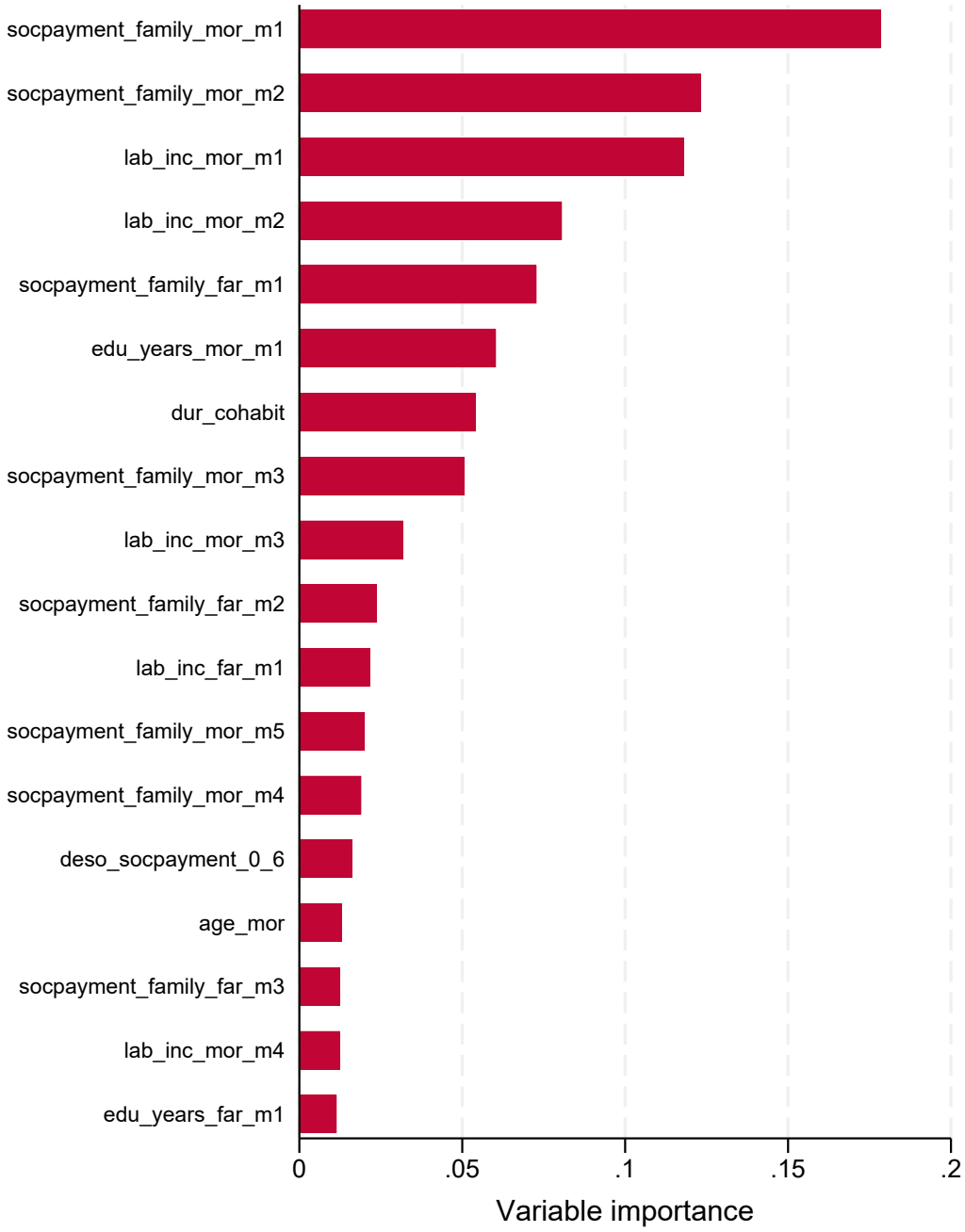
D Generalized random forest

Figure D.15: Calibration of regression forest for predicting separations



Note: Observed Pr(separation) in each percentage point of predicted Pr(separation) in training set and held-out test set. Only cells with at least 100 matches shown. CDF shows share of matches whose breakup probability is lower than a given value. 95 percent confidence intervals.

Figure D.16: Simple variable importance measure from the regression forest



Note: Bars represent share of times the regression forest has split on a particular variable in its trees at depth below 4. Splits at lower depth level given twice the weight of splits at the next depth level.

E Effects of parental separations

E.1 Birth spacing in HH FE models

One complicating factor in the estimation of the household-fixed effect models is controlling for the birth-spacing of children. Given that within a household, the difference in age at birth is fully co-linear with the difference in age at time of separation, it is impossible to estimate these separately. To see this, imagine that we estimate the estimating model below on households with two children when including a continuous birth year to account for educational trends over time:

$$\text{Educational outcome}_{ih} = \alpha_h + \beta_1 \text{Age at separation}_i + \beta_2 \text{Birth year}_i + \Gamma X_i + \epsilon_i \tag{2}$$

Given the inclusion of the household fixed effect, the model is equivalent to taking first differences. As such, the estimating equation based on children i and j in household h is equal to:

$$\Delta\text{Educational outcome}_{ij} = \beta_1 \Delta\text{Age at separation}_{ij} + \beta_2 \Delta\text{Birth year}_{ij} + \Gamma \Delta X_{ij} + \Delta\epsilon_{ij} \tag{3}$$

Since the time of the separation event is identical for both siblings, the difference in age at separation is equal to the birth spacing (i.e., $\Delta\text{Age at separation}_{ij} = -\Delta\text{Birth year}_{ij}$) and their relative effects cannot be independently estimated. In our context, controlling for birth years as such should be unimportant, since the educational attainment variables are normalized within each birth cohort (see appendix B.2 for more detail). If the difference in birth year between siblings (i.e., the birth-spacing) is also unimportant for educational attainment, then the fact that we cannot independently estimate the effects of birth spacing from the effect of difference in age at time of separation would be irrelevant.

However, this is far from the case in practice. To estimate the effect of birth spacing and birth order, we focus on households with two children for simplicity. Table E.2 below shows the effect of birth order and birth spacing on the scores on the national grade 3, 6, and 9 ability tests.

As can be seen from Table E.2, first-born children generally perform better compared to second-born children, which is in line with previous studies (Black, Devereux and Salvanes, 2005). However, the difference also depends on the birth spacing between children. The larger the birth spacing, the smaller the difference in ability between children on the various national tests. Generally, a increase in birth-spacing by 1 year decreases the ability of the first-born child relative to the second-born child by 0.015 - 0.02 SD.

There are many factors that may be at play here, including competition between children for limited parental resources. Alternatively, the timing of birth-spacing may be endogenous to the ability of the first child.[11] Previous research already suggests that birth spacing may not be ortogonal to the realized ability of children, as previously discussed in Price and Kalil (2010) and Buckles and Munnich (2012).[12] However, this creates a difficulty since the difference in age at separation between siblings is fully co-linear with birth spacing between siblings, as highlighted above. As such, the effects of differences in the age at separation would also capture the difference in ability of siblings related to birth spacing.

One solution is to include the households whose families do not separate to correct for the effects of birth spacing. The assumption in this case is that the relationship between birth spacing and potential ability of siblings is similar between households who do, and do not, eventually separate during childhood. Table E.3 below shows the relationship between birth spacing and relative ability by eventual household separation outcome. The effect of birth spacing on the relative ability of siblings is fairly similar across both samples, highlighting that using non-separating parents may be good way to control for the effects of birth spacing. In this case, we can identify the effects of experiencing separation events at various ages from the comparison of siblings in separated household conditional on the effects of birth spacing. This is the approach we follow in the main estimations

[11] One can for instance imagine that complications during pregnancy, birth, or early childhood may affect subsequent birth-spacing decisions by parents.

[12] Interestingly, we find that an increase is birth spacing by a year decreases the difference in ability between the oldest and youngest child by 0.015 - 0.02 SD, whereas Buckles and Munnich (2012) find that it increases the difference by 0.017 SD. The literature on the effects of birth spacing is fairly small, meaning that few estimates are generally available.

Table E.2: Effects of parental separation on educational outcomes

	Grade 3 test	Grade 6 test	Grade 9 test
	(1)	(2)	(3)
First Born	0.113***	0.100***	0.186***
	(0.00974)	(0.0117)	(0.00810)
Birth spacing	-0.0156***	-0.0198***	-0.0212***
	(0.00295)	(0.00358)	(0.00233)
N	246500	160122	279376
R^2	0.664	0.720	0.743

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Estimate based on all households where two children have available information on the national tests. First born refers to the older of the two siblings. Birth spacing is defined as the difference in birth years. Sample restricted to children where both the father and mother had no children from a previous relationship.

in order to correct for the effects of birth spacing.

Table E.3: Effects of parental separation on educational outcomes

	Grade 3 test		Grade 6 test		Grade 9 test	
	(1)	(2)	(3)	(4)	(5)	(6)
First Born	0.113***	0.122***	0.100***	0.0901***	0.186***	0.193***
	(0.00974)	(0.0150)	(0.0117)	(0.0172)	(0.00810)	(0.0106)
Birth spacing	-0.0156***	-0.0185***	-0.0198***	-0.0169**	-0.0212***	-0.0242***
	(0.00295)	(0.00475)	(0.00358)	(0.00557)	(0.00233)	(0.00328)
N	246500	104790	160122	72176	279376	172930
R^2	0.664	0.665	0.720	0.723	0.743	0.741
Parents separated in childhood?	No	Yes	No	Yes	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Estimate based on all households where two children have available information on the national test scores. First born refers to the older of the two siblings. Birth spacing is defined as the difference in birth years between the youngest and oldest child. In all cases, the sample restricted to children where neither the father nor the mother had children from previous relationships.

E.2 Parameterized effects on educational outcomes

Estimating equation 1 provides estimates for each single age at separation. While the data generally allows for the estimation of the individual age of separation effects, these estimates are less suitable for comparisons between groups and robustness checks. To simplify comparisons between different models, we put some structure on individual b_m estimates. Specifically, we group the β_m estimates in age at separation bands as shown in equation 4. The omitted group remains children whose families separated when they were between ages 18 - 20. As before, a household fixed effect (α_h) is included so estimations are based on comparisons in the age at separation within households.

$$\text{Educational outcome}_{ihc} = \alpha_h + \beta_{1-4} I(m_i \leq 4) + \beta_{5-8} I(5 \leq m_i \leq 8) + \beta_{9-12} I(9 \leq m_i \leq 12) + \beta_{13-15} I(13 \leq m_i \leq 15) + \beta_{16-17} I(16 \leq m_i \leq 17) + \gamma_c + \Gamma X_i + \epsilon_i \tag{4}$$

In the case of equation 4, β_{1-4} captures the effect of separation during the first four years of life, β_{5-8} the effect of separation during the years before the grade 3 national test, β_{9-12} the effect of separations during the years before the grade 6 national test, β_{13-15} the effect of separation during the years just before finishing compulsory education, and β_{16-17} the effects of separation in during the high-school years. The omitted category are ages 18 - 20, when children typically finish high school and are deciding whether to enroll in tertiary education.

To illustrate the estimates and provide a baseline for comparison, Table 4 in the main text shows the β estimates obtained from estimation equation 4 on the baseline sample. The sample is the same as that used to estimate the individual β_m estimates in Figure 13. The results in Table 4 show similar effects to those derived from the main Figures. For the three national tests, parental separation events have the largest negative effects when they occur in the years prior to the measurement of the outcome. As such, it appears that the disruption effects dominate and potential length-of-exposure to separation effects.

Interestingly, we again see that for primary school GPA, the key determinant is

whether the separation event occurs at any time prior to finishing compulsory education. Separating between ages 1 - 4, 5 - 8, 9 - 12, and 13 - 15 all result in roughly a similar decline in GPA by 0.11 - 0.13 SD compared to a parental separation event at ages 18 - 20. The same pattern holds for the choice of high school track (academic or vocational). As such, while the disruption effects dominate for the national test scores, it's the fact whether parents are separated or not by the end of primary school that drives the effect on primary school GPA and subsequent academic track completion.

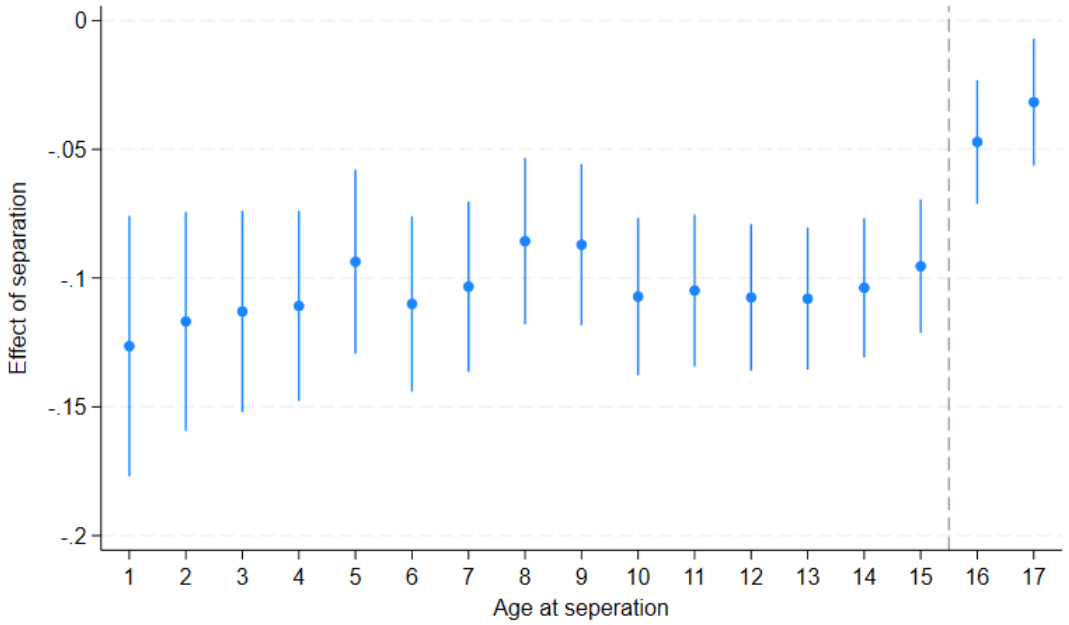
E.3 Robustness

E.3.1 Different precision in the test vs GPA

The main text shows that the affects of parents separations are larger on teacher-assigned GPA than national test scores, in particular when the separations occur early in childhood. One concern is that that national test scores are measured with more noise, for instance since they are measured at one point in time and for a more limited number of subjects, in which case the results may in part be driven that national test scores are a less precise measure of student ability.
We first analyze if there may be a difference due to the number of subjects that are assessed. The national test scores in grade 9 are available for all students in the subjects of English, Mathematics, and Swedish, whereas the grade 9 teacher grades are based on the 16 best subject grades. To study this, Figure E.17 shows the estimates when compulsory school GPA is based purely on the teacher grades in English, Mathematics, and Swedish. The estimates are similar in pattern and magnitude to the baseline estimates for compulsory school GPA in Figure 13, albeit slightly smaller, suggesting that it's not the differences in subject selection that drives most of the difference in age-pattern and effect size.

The second question is whether national test scores in general provide a more noisy signal of student ability compared to teacher-assigned grades, and whether this may drive the results. This is difficult to assess directly using the grade 9 outcomes, since the teacher-assigned grades play a formal role in track admissions for high school, which means that they mechanically are more predictive of future

Figure E.17: Age at separation and grade 9 GPA based on English, Mathematics, and Swedish



Note: Estimated effects of age at parental separation on primary school GPA based on the same three subjects as are part of the grade 9 national tests (English, Mathematics, and Swedish). The baseline group is those whose parents separate when the child is aged 18 - 20, the estimates show the effects of experiencing a separation event at age m instead of age 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. The dotted lines show the age at which outcomes are measured. Standard errors are clustered at the household level.

outcomes. To assess whether test scores are a more noisy ability measure, and thus are less predictive of future outcomes, we instead use the teacher-assigned GPA and national test scores in grade 6. The national test scores in grade 6 are based on the same subjects as the grade 9 national test scores. Similarly, the majority of the grade 6 subjects where we observe teacher-assigned grades is similar to those for which we observe the subject grades in grade 9. As such, we can use the predictiveness of the ability measures in grade 6 to assess whether national test scores are a noisier ability measure, and thus are less predictive of future outcomes.

Table E.4 shows the degree to which the grade 6 outcomes can predict future educational outcomes. The grade 6 GPA is generally more predictive of the future educational outcomes compared to the Grade 6 test score. However, most of this

difference can be explained by the larger number of subjects that is covered, which as explained above, cannot explain the differences in outcomes. When restricting the grade 6 GPA to the teacher-assigned grades in English, Math, and Swedish, the predictive of the teacher-assigned grades and national test scores is fairly similar across the three outcomes measures. As such, it does not appear that the national tests are fundamentally a worse or noisier measure of student ability compared to GPA, at least when GPA is restricted to the same subjects.

Table E.4: Predictiveness of GPA vs test scores

	Grade 9 test score			Grade 9 GPA			Academic track grad		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gr6 GPA	0.835***			0.791***			0.304***		
	(0.00163)			(0.00134)			(0.00113)		
Gr6 GPA - 3 subj		0.769***			0.605***			0.256***	
		(0.00122)			(0.00125)			(0.000957)	
Gr6 test score			0.796***			0.552***			0.233***
			(0.00114)			(0.00136)			(0.000923
_cons	-0.107***	0.0149***	0.00900***	0.0132***	0.133***	0.127***	0.588***	0.634***	0.640***
	(0.00129)	(0.00112)	(0.00105)	(0.00110)	(0.00118)	(0.00127)	(0.000871)	(0.000829)	(0.000837
N	277322	277322	277322	288309	288309	288309	254252	254252	254252
R^2	0.492	0.593	0.642	0.561	0.467	0.385	0.233	0.231	0.212

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: .

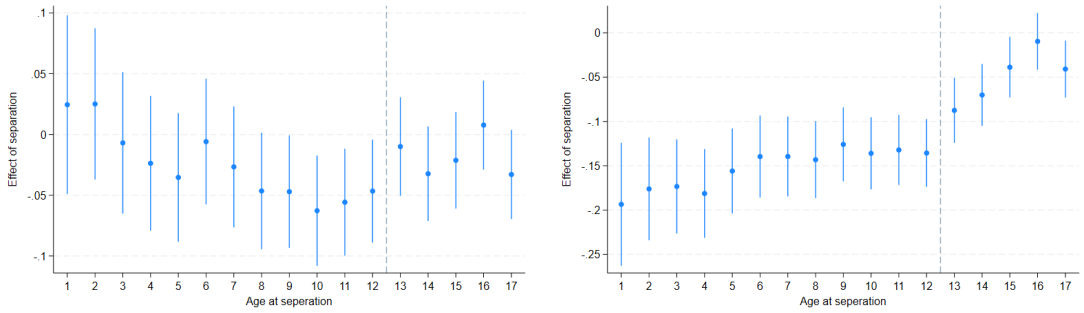
E.3.2 Grade 9 vs grade 6 outcomes

One question is whether the results on the teacher-assigned grades may be driven by their high-stakes nature. Teachers are aware that the grades in grade 9 are critical for student's their academic future, and national tests are conducted across additional subjects to align the grading practices of teachers. To study whether the same differences between national test scores and teacher-assigned grades are visible in a low-stakes environment, we use the teacher-assigned grades and national test scores in grade 6. Neither of these plays any formal role in the future education, in particular since grade repetition in the Swedish context is extremely rare.

Figure E.18 shows the estimates for the grade 6 national test score and the grade 6 GPA. Similar to the baseline estimates, we see relatively small effects of parental separation events on the grade 6 national test score, with the negative effects concentrating among separations that occur in the years just prior to the national test. In contrast, the effect sizes are again substantially larger, and following a different age-pattern, in case of the grade 6 national test. Table E.5 shows the estimates under the functional form of equation 4, with similar conclusions as the main text. As such, the difference in magnitude and age-patterns of parental separations on national test scores and compulsory school GPA are not driven by any particularities in grade 9, but are already visible in grade 6.

Finally, this finding is again not restricted to the within household comparison. Table E.6 shows the effect of parental separation on the grade 6 national test score and GPA in the cross-section. The effect of having separated parents at age 12 on the grade 6 GPA is around 4 times as larger compared to the effect on the grade 6 national test scores.

Figure E.18: Grade 6 outcomes and age at separation (in SD)



(a) Grade 6 national test score (b) Primary school grade 6 GPA

Note: Estimated effects of age at parental separation on grade 6 standardized test score and grade 6 GPA (all normalised within birth cohorts). The omitted group is those whose parents separate when the child is aged 18 - 20, the estimates show the effects of experiencing a separation event at age m instead of age 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. Sample restricted to children born to parents who did not have children with anyone else previously. Standard errors are clustered at the household level.

Table E.5: Effect of parental separations on Grade 6 outcomes

	(1)	(2)
	Grade 6 test	Grade 6 GPA
Separated age 1 - 4	-0.0182	-0.171***
	(0.0254)	(0.0228)
Separated age 5 - 8	-0.0367	-0.138***
	(0.0222)	(0.0199)
Separated age 9 - 12	-0.0587**	-0.128***
	(0.0193)	(0.0172)
Separated age 13 - 15	-0.0237	-0.0640***
	(0.0166)	(0.0147)
Separated age 16 - 17	-0.0134	-0.0224
	(0.0151)	(0.0132)
N	292781	297247
R^2	0.716	0.741

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Estimated effects obtained by estimating equation 4 on grade 6 national test scores and GPA. The baseline group is those whose parents separate when the child is aged 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. Sample restricted to first children born to both parents. Both outcomes are standardized to mean zero and SD one within each cohort. Sample restricted to children with born an observed test score and GPA to improve comparison. See appendix section E.2 for a more detailed description and discussion of the estimating equation. Standard errors are clustered at the household level.

Table E.6: Cross-sectional difference in grade 6 outcomes (in SD)

	Grade 6 test		Grade 6 GPA	
	(1)	(2)	(3)	(4)
Parents together year before test?	0.202***	0.0364***	0.309***	0.150***
	(0.00292)	(0.00278)	(0.00250)	(0.00237)
N	546764	546637	546764	546637
R^2	0.009	0.172	0.028	0.193
SES controls	No	Yes	No	Yes

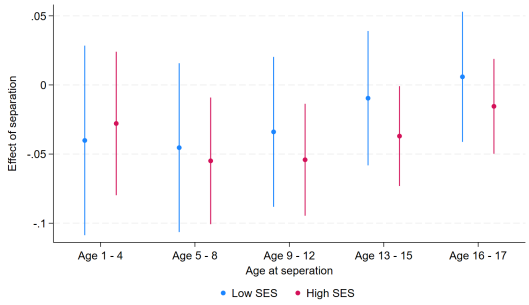
Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

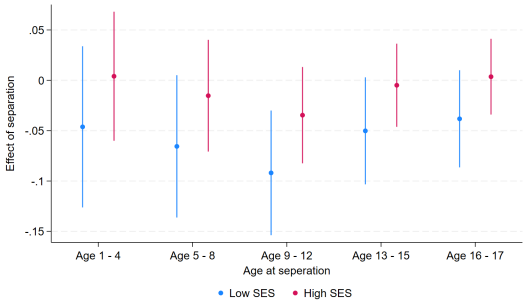
Note: Estimates for all cohorts for which the relevant national tests scores are available. Sample restricted to children with both an observed test score and GPA. SES controls include a flexible interaction of the parental education according to the categories listed in appendix Table B.1 and controls for parental age at birth. Sample restricted to children with born an observed test score and GPA to improve comparison.

E.4 Heterogeneity in separation effects

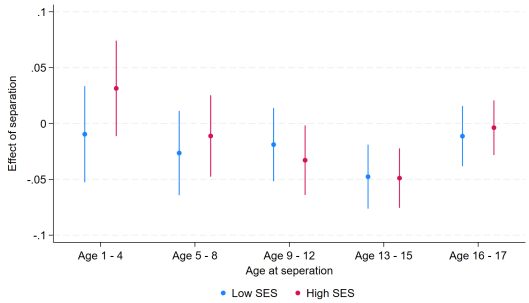
Figure E.19: Heterogeneity by SES



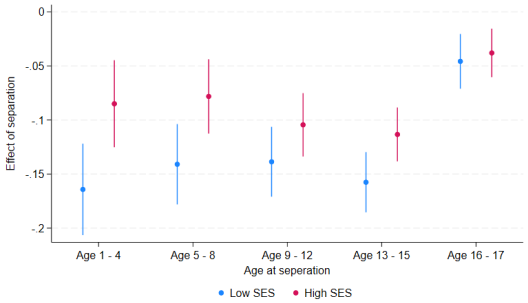
(a) Grade 3 test score



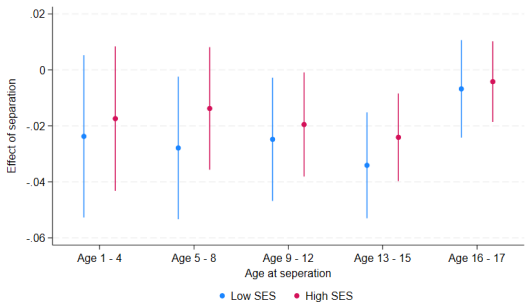
(b) Grade 6 test score



(c) Grade 9 test score



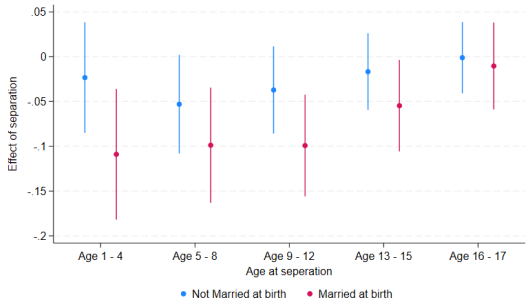
(d) Grade 9 GPA



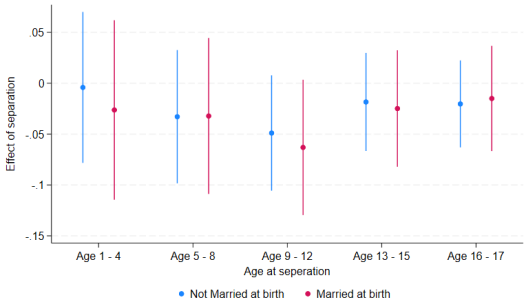
(e) Academic track enrollment

Note: The panels show the estimated effects of age at parental separation on national test scores and primary school GPA (all normalised within birth cohorts) as well as high school academic track graduation. The sample is split between mothers with at most a high school degree (blue) and mothers with some tertiary education (red). The baseline group is those whose parents separate when the child is between ages 18 - 20, the estimates show the effects of experiencing a separation event at age m instead of age 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. Sample restricted to children born to parents who did not have previous children with anyone else. Since the tests that place in the year that children respectively turn 10, 13, and 16, there is always a substantial group of children for whom the separation event occurs well after the outcome is measured. The dashed lines show the age at which outcomes are measured. Standard errors are clustered at the household level.

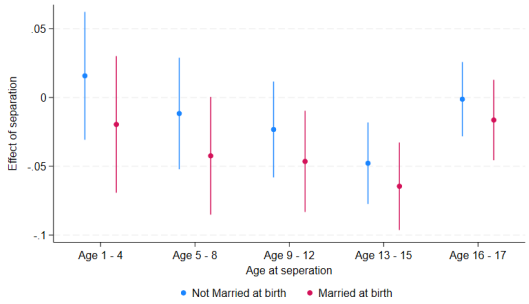
Figure E.20: Heterogeneity by marriage status at birth



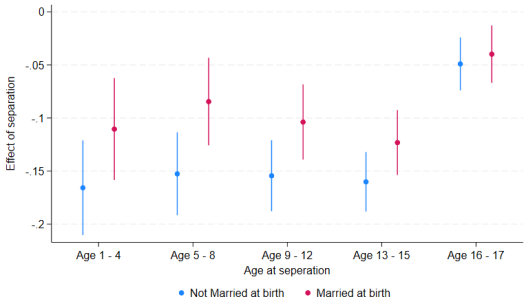
(a) Grade 3 test score



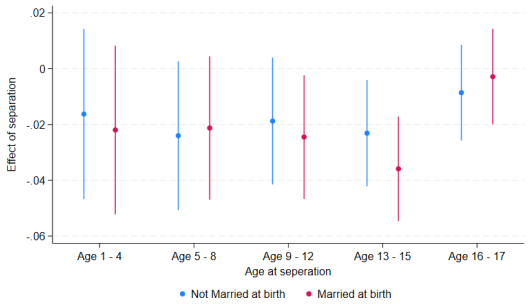
(b) Grade 6 test score



(c) Grade 9 test score



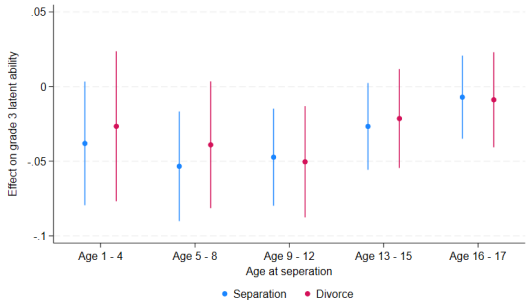
(d) Grade 9 GPA



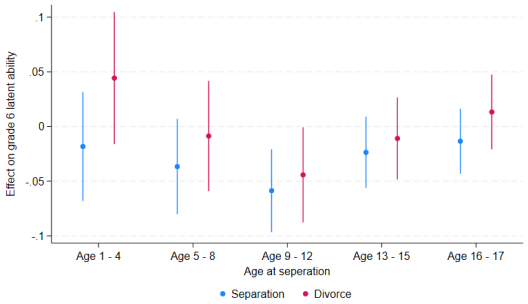
(e) Academic track enrollment

Note: The panels show the estimated effects of age at parental separation on national test scores and primary school GPA (all normalised within birth cohorts) as well as high school academic track graduation. The sample is split between parents not married at birth (blue) and parents married at birth (red). The baseline group is those whose parents separate when the child is between ages 18 - 20, the estimates show the effects of experiencing a separation event at age m instead of age 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. Sample restricted to children born to parents who did not have previous children with anyone else. Since the tests that place in the year that children respectively turn 10, 13, and 16, there is always a substantial group of children for whom the separation event occurs well after the outcome is measured. The dashed lines show the age at which outcomes are measured. Standard errors are clustered at the household level.

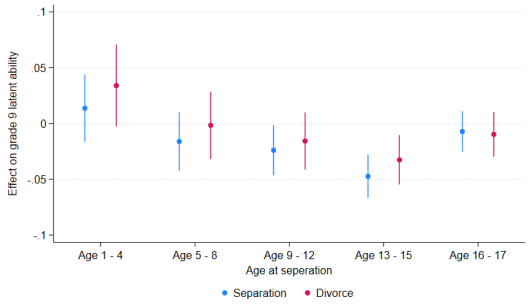
Figure E.21: Heterogeneity by separations vs divorce



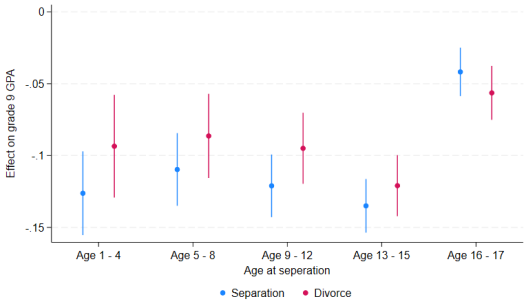
(a) Grade 3 test score



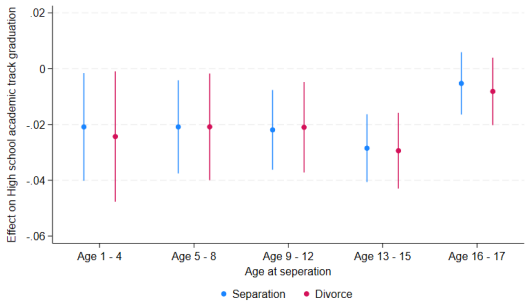
(b) Grade 6 test score



(c) Grade 9 test score



(d) Grade 9 GPA



(e) Academic track enrollment

Note: The panels show the estimated effects of age at parental separation on national test scores and primary school GPA (all normalised within birth cohorts) as well as high school academic track graduation. The sample is split between separations without a divorce (blue) and separations involving a divorce (red). The baseline group is those whose parents separate when the child is between ages 18 - 20, the estimates show the effects of experiencing a separation event at age m instead of age 18 - 20. Household-fixed effects are included, so estimates are obtained from sibling comparisons. Sample restricted to children born to parents who did not have previous children with anyone else. Since the tests that place in the year that children respectively turn 10, 13, and 16, there is always a substantial group of children for whom the separation event occurs well after the outcome is measured. The dashed lines show the age at which outcomes are measured. Standard errors are clustered at the household level.