

**Parental Dedication and Children's Education.  
An Analysis of Germany\***

Julia Cordero Coma

*Pompeu Fabra University*

Gøsta Esping-Andersen

*Pompeu Fabra University*

DRAFT

PLEASE DO NOT CITE OR CIRCULATE WITHOUT AUTHORS' PERMISSION

**Abstract**

*Parental time dedication is decisive for children's cognitive and emotional development, in particular when it favors highly stimulating activities. We examine two underexplored issues: a) the effect of time inputs in early childhood on later educational achievement and b) effect differences by parents' level of education. We analyze the German Socioeconomic Panel and estimate with controls for sibling fixed-effects. We find, firstly, that the entire parenting effect derives from maternal involvement. Secondly, maternal time dedication (at age 2-3) increases the likelihood of attending the prestigious Gymnasium track for children of highly educated parents, especially in cases of educational homogamy. As is well-known, children of less educated parents are far less likely to attend Gymnasium. But, surprisingly, for these children the intensity of parenting seems to make no difference whatsoever.*

*\* This study is part of a project financed by ERC Advanced Grant, no. 269387, awarded to Gøsta Esping-Andersen*

## **Introduction**

A core question in social mobility research is how, and to what degree, our life chances are influenced by family-of-origin characteristics. In recent years we have seen intensified attention to the underlying mechanisms that influence children's life chances, in particular with regard to the inculcation of cognitive and behavioral skills.

In the classic Becker model, genetic transmission, monetary, and time investments are the primary channels through which the family influences children's life chances (Becker, 1962; 1981; Becker & Tomes, 1986). Here we focus exclusively on parental time inputs. It is well-documented that financial resources exert a strong influence – in some countries more than in others (Björklund & Jäntti, 2009). The few studies which address the time dedication effect suggest that it may play a role as important as that of monetary investments, both in terms of the quantity and quality of parenting time (Hsin & Felfe, 2008; Fiorini & Keane, 2014). And this is particularly salient in early childhood, be it for children's wellbeing and attachment or for the development of their abilities. Despite the strong heritability of cognitive abilities (Plomin, 1999), stimulating environments have been observed to compensate for different initial endowments (Friend, DeFries & Olson, 2008).

Studies in developmental psychology and neuroscience conclude that some of the most relevant aspects of child care are sensitivity and responsiveness (Landry, Smith & Swank, 2006). Sensitivity refers to how appropriate responses are to children's needs, whereas responsiveness is defined as the adaptation of care to changes in children's needs. Inadequate contact with parents, particularly during early childhood, can be harmful for children's cognitive and emotional development, in part because it can prevent parents from gaining the knowledge and ability to provide sensitive and responsive care (Waldfogel, 2006).

In light of this, it is not surprising that debates have focused on the potentially adverse consequences of maternal employment during children's early ages. Maternal working hours can be a major constraint on child dedication, mainly in terms of quantity, but also of quality. Working mothers may return home stressed and tired and may, therefore, be less capable of active parenting. However, the empirical evidence is far from conclusive. Although most studies find adverse effects of first-year maternal employment, evidence of its impact in the following years is mixed (Waldfogel, Huan & Brooks-Gunn 2002; James-Burdumy, 2005;

Ermisch & Francesconi, 2013). Additionally it is quite clear that both mothers and fathers dedicate more time to their children today than only a few decades ago (Bianchi, Robinson & Milkie, 2006)

A second prominent line of research focuses on types of parenting. Although the relevance of warmth, nourishment and proper supervision remains constant across childhood, the relative importance of certain activities depends on the child's developmental stage (Kalil, Ryan & Corey, 2012). At the infancy stage, basic care – feeding, bathing and comforting – is the most important activity for children's socio-emotional and mental development. In toddlerhood, basic care remains crucial but pretend-play becomes central for the promotion of cognitive and social skills (Ruff & Capozzoli, 2003). At the preschool stage didactic activities, in particular reading to the child, are the most suitable for language and literacy development (Snow, 2006).

The question, then, is whether certain types of parents are better equipped to engage in the most effective activities at each stage, and whether significant differences in type of parenting are in fact present. Lareau's (2003) influential qualitative work suggests that middle- and upper-class parents are more inclined to favor a "concerted cultivation approach", stressing activities that are designed to improve children's skills, social and cultural capital. They are, for instance, more likely than working-class families to employ verbal reasoning to discipline them. Several quantitative studies support Lareau's thesis (Bianchi & Robinson, 1997; Craig, 2006; Hsin, 2008).

Across all education levels mothers remain the main providers of child care (Casper & Bianchi, 2002). But the mix of tasks they perform is different from that of fathers. Even when mothers spend more absolute time playing with children, the proportion of their time that consists of physical and routine care is notably higher (Lamb, 1997). But we also see an increase in both the range and intensity of fathers' activities, although primarily among the higher educated (Craig, 2006).

The routinely observed association between parental socioeconomic status and child outcomes (Ermisch, 2008) may therefore in part be mediated by the specific nature of parenting (Feinstein, Duckworth & Sabates, 2004). It is only recently that we see empirical studies specifically designed to estimate the influence of parenting styles on children's

cognitive and behavioral outcomes (Booth et al., 2002; Huston & Aronson, 2005; Hsin & Felfe, 2014). The data for these studies come from large-scale time diaries or from recent cohort studies that provide more detailed information on parenting and child outcomes at early ages. Their findings support the idea that parental time investments may reinforce socioeconomic inequalities.

Most of these studies have, however, an important limitation: they are unable to estimate longer-term effects of parental time inputs in early childhood. The reason is that data sources which provide information *both* on later cognitive or educational outcomes and also rich information about parental time investment in early childhood are rare. One exception is the U.S. Panel Study of Income Dynamics - Child Development Supplement (PSID-CDS) which a number of studies have utilized (Hofferth, 2006; Hsin & Felfe, 2014; and Milkie, Nomaguchi & Denny, 2015). The Hsin and Felfe study comes closest to ours since it explicitly focuses on the later effects of early childhood dedication. In this study, they estimate whether an increment in the time children spent with parents in different types of activities in the 0-12 age span produces superior performance in an age-standardized cognitive test five years later. Both Hofferth (2006) and Milkie et.al (2015) focus on a broader array of child outcomes, including also behavioral dimensions, but neither study identifies the long-run effects of parenting in very early childhood (and Hofferth's study is primarily focused on potential effects of blended families versus biological father presence).

Our study is very much in address to the diverging destinies problematic (McLanahan, 2004). Our focus is exclusively on early childhood parenting effects on later (late teens) educational achievement. And we utilize a very different data source, namely the German Socio-economic Panel (GSOEP). The choice of the latter has a triple motivation. Firstly, these issues have, to our knowledge, never been studied empirically outside the U.S. The GSOEP permits us therefore to test parenting effects in a very different socio-cultural setting. Of particular interest here is the German tradition that mothers interrupt employment for several years post-birth. Secondly, while the PSID-CDS includes questions about parenting time in only three waves since 1997, the GSOEP offers annual data for the entire period 1984-2012. This gives us a better opportunity to tease out the longer term dynamics between early childhood care and later educational outcomes. And thirdly, the GSOEP provides high quality information on both parents' time dedication, spanning a sufficient number of years so as to permit us to follow children into late teen-hood.

One drawback, however, is the lack of detailed information on distinct types of parental time inputs.

## **Our Approach**

Our study includes some original features. Firstly, in contrast to the Milkie et al. (2015) study (which does not identify long-term dynamics), we focus on educational outcomes later in childhood, specifically the likelihood of attending the academically-oriented upper-secondary school track in the German school system at age 17. As will be explained below, this is a suitable measure of educational performance, and it is known to strongly influence life chances in adulthood.

Secondly, we highlight the influence of educational homogamy on parental child dedication. The common strategy in this line of research is to focus on the parents' education level, in particular the mother's. However, we expect that assortative mating among the highly educated will reinforce the positive effect of education. As noted, higher educated parents are more likely to adopt a "concerted cultivation", in contrast to the "natural growth approach" typically favored by working class parents. They may also be more inclined to engage in joint caring, since they give very high priority to active child care (Bonke & Esping-Andersen, 2011). Children will benefit more from their mothers' and fathers' time investment when their home environment is especially stimulating, which is more likely to be the case when parents share values and preferences associated with a high level of education.

We shall additionally address two potential endogeneity problems. Firstly, parents' time dedication may be driven by their perception that the children are doing poorly in school. As Ermisch & Francesconi (2013) affirm, by focusing on parental childcare during the very early ages (ages 2-3 in our case), we can minimize this biasing effect. Except for extreme cases, it is very difficult to assess children's endowments at this stage, (Datar, Kilburn & Loughran, 2010; Eiser & Morse, 2001; Korat, 2004; Sattler, Feldman & Bohanan, 1985). Many studies have also observed that parents tend to overestimate their children's functioning (Martin & Johnson, 1992; Miller 1986). Besides focusing on very young children, we will deal with this potential problem by dropping the very few cases that need constant care because of health reasons and by controlling for a measure of exceptionally poor school performance.

Secondly, parents who spend more time on childcare may be a selected group in terms of characteristics that also influence child outcomes. We address this problem by also comparing across siblings so that we can control for unobserved heterogeneity within families – as will later be explained in the methods section.

## **The German Context**

We focus on children born in West Germany in the 1980's and early 90's. Comparatively speaking, German gender relations remain quite traditional with women specializing in care giving; mothers are expected to withdraw from employment when the children are young.

Germany has a non-comprehensive education system with very early tracking. At age 10 (12 in Berlin and Brandenburg), children are sorted into three main tracks that differ in their academic versus technical orientation. *Hauptschule* provides general education and prepares students for blue-collar work. *Realschule* is an intermediate track, offering more extensive general education. Finally, *Gymnasium* is the most prestigious track, the only one that provides direct entry into tertiary education. A fourth type of secondary school, the *Gesamtschule* (comprehensive school), offers both lower and upper secondary certificates. But it accounts for a very small share of secondary school enrolment.

The number of years of schooling varies between the tracks: Gymnasium ends at age 19, whereas students at the inferior secondary track are expected to take up apprenticeship (or work) at age 16. Track choice is primarily based on the recommendation of the teachers at the end of primary education. In some Länder, the recommendation is binding. Mobility between tracks is possible, although in practice quite infrequent.

## **Data and Variables**

The GSOEP is a household panel survey conducted annually since 1984 (Wagner, Frick & Schupp, 2007). We use data from the last version available (v29), which contains information up to 2012. All household members aged 16 years and over are interviewed. Since 2001, a youth questionnaire has been included, and most are interviewed when they turn 17. The GSOEP is an excellent source for our purposes because (a) it follows the child during a long

period of time, (b) it offers very rich information on the members of the household, and (c) it includes information about the time spent on child care by both parents.

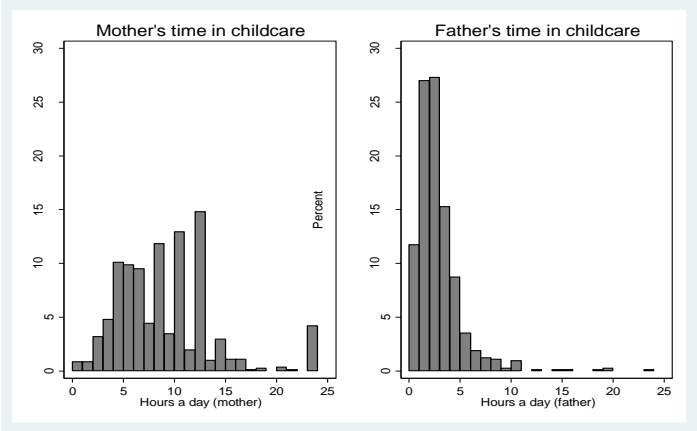
Until 2012, the youth questionnaire was administered to 4,190 young men and women. Our final sample is considerably smaller because in only 33% of the cases the mother had already entered the GSOEP sample when the child was 2-3 years old. In 80% of the cases in which the mother entered the sample later, she was included as part of the refreshment samples from 1998. Also, children who were not living with their mother at that age are dropped from the sample (6 cases). Our analyses are restricted to individuals who were living with their mother (and her partner) at age 2-3 and who provide information about their education at age 17.

Before discussing the final sample, we provide detailed information about our key variables. The dependent variable derives from the youth questionnaire and is dichotomous: whether the child was attending the prestigious Gymnasium track at age 17. We exclude the few (6%) who attend a comprehensive school because the prestige of, and requirements for, the final degree is not comparable with other tracks. The alternative, namely a measure of completed schooling, would force us to limit our already modest sample to individuals who are at least 20 years old. In any case, the correlation between the track attended at age 17 and completed school education is likely to be very high.

The main explanatory variables measure parental time dedicated to child care. In every wave respondents report the number of hours they spend on child care on a typical weekday. In some waves (1985-1990, and every two years since 1993), data for Sundays is included. We identify care intensity when the child was 2-3 years old – we opt for age 2 if there is available information on all the variables for this age; otherwise, we observe the child at age 3. As noted, focusing on the earliest years helps minimize the problem of reverse causality because the younger the child is, the less it is likely that the parents will be cognizant of their child's educational abilities, and thus adjust their time dedication accordingly. In addition, the very few cases where the child or any of her/his siblings required special care because of health problems are removed from the sample. A dummy variable that measures whether the child repeated a grade in primary school (grades 1-4) is included so as to control for cases of poor early school performance (7% in our sample). This data derive from the youth questionnaire.

Our measures of caring time are the weighted sum of caring hours on weekdays and Sundays – multiplying hours on a weekday by five and those reported for Sundays by two, and dividing the result by 7. Including Sundays reduces the sample size because the information was not available in every wave. The variables for both mothers’ and fathers’ caring time have, respectively, 16% and 21% missing values. However, it enriches our measure and enables us to take into account parental compensation for weekday time constraints. We have not imputed the missing values given that this is our key explanatory variable. Table 1 in the Appendix presents the descriptives for all variables considered. In the analysis of fathers’ caring time, we limit our sample to children who reside with both parents at age 2-3 (sample B). Given that less than 0.5% of the children were living with a step-father, we also omit these. As observed in Figure 1, a few parents reported spending 24 hours a day on childcare, which is clearly exaggerated. We therefore introduce a top-code equal to 16. As a robustness check, the analyses will be replicated on the subsamples of those where information on child care on Sundays is not included, and also after removing the extreme cases.

**Figure 1. Distribution of mothers’ and fathers’ caring time at age 2-3.**



To check for non-linear effects we recode the variable for mothers’ time into quartiles: 0 to 5 hours, 5 to 8 hours, more than 8 to 11, and more than 11 hours a day. The indicator of fathers’ time has three equal-sized categories: the two extremes refer to 1 hour and a half or less and 3 hours or more, respectively.

The parents’ educational level is measured by ISCED-97. We distinguish two categories: ISCED levels 0-4 (non-tertiary education) and 5-6 (tertiary education). We shall also test for educational homogamy effects and include therefore a dichotomous variable when both



parents have tertiary level education. The reasoning is that the positive influence of parental time investment is expected to be particularly strong when both parents are highly educated. We distinguish four groups: neither parent is highly educated, only the father, only the mother, and both parents are highly educated. Children whose father was not living in the household at age 2-3 are classified into the two extreme categories, all depending on the mother's education.

For families with several children it is not possible to identify the time dedicated to any specific child. To address this problem we, firstly, control for being a first-born and for the presence of very demanding siblings in terms of time at child's age 2-3; secondly, we examine whether the effect of parenting time in early childhood varies with birth order (as did also Ermisch & Francesconi, 2013). We include an interaction term for maternal caring time and first-born child). Parenting time greatly depends on the number of children, in particular on the presence of infants (Craig & Bittman, 2008). About 18% of the children in our sample had a sibling aged 0-3.

The amount of time dedicated to a child at age 2-3 may be affected by whether he/she had a particularly demanding older sibling. Unfortunately, the GSOEP does not include information about low birth weight or deficient cognitive functioning. Nonetheless, we know whether any sibling repeated one of the first four grades in compulsory education. We construct an "any demanding sibling" variable that takes the value of one if the child had a smaller sibling when he/she was 2-3 years old, or an older sibling who repeated a grade in primary school. The variable has a third category (2) for children who had some older siblings, but information on whether they repeated a grade is not provided because they were not interviewed at age 17. The total number of siblings and the child's birth order are also included. First-born children benefit from exclusive access to parental resources at least during the early years, which may improve their development (Zajonc & Markus, 1975).

The parents' employment status is a key determinant of time availability. Since we consider mothers' paid employment to be endogenous to decisions regarding child care, we omit their employment status from the models. The child's preschool attendance is not included either for the same reason. The model controls for fathers' employment status, since being unemployed is unlikely to be driven by the same factors that lead men to participate in child care, and it may also have important consequences for the family's emotional environment.

The GSOEP does not distinguish whether child care is the primary activity. To compensate for this we take into account the number of hours that the parent spends on housework (since this may be combined with simultaneous secondary caring). The construction of this measure is analogous to that of time in child care.

The average family income (measured in quartiles) throughout childhood is also included, as is the sex of the child and the immigration status of the parents. The latter takes value 0 if at least one of the parents is not an immigrant and 1 otherwise. Family disruption can also affect children's educational performance (Bernardi & Radl, 2014). We include a dichotomous indicator that is coded 0 if the child has lived continuously with both parents until age 17, and 1 otherwise.

## **Method**

We first estimate linear probability models that include the mother's or the father's time in childcare at age 2-3, parental education (the mother's and father's education level and also parental homogamy), and the interaction between the two, as well as the above-mentioned control variables. We estimate with robust cluster standard errors to account for the non-independence of observations, given that the sample includes children with the same mother. Logit models will also be estimated as a robustness check.

This, however, does not address potential selection bias. There may be unobserved factors that lead some parents to spend more time with their children and which also make them more likely to have children who perform better at school. We therefore estimate with family or, more precisely, with mother fixed-effects since we consider as siblings those individuals who have the same mother. A disadvantage of such fixed-effect models is that we cannot estimate the effect of variables that are constant across siblings, such as parental education in our sample, although we control for them.

To deal with this problem we adopt the correlated random-effect model, first proposed by Mundlak (1978). It allows us to estimate both between- and within-group effects (the estimated coefficients of the variables that vary within groups are identical to those in a fixed-effect model). In order to obtain unbiased estimates in a random-effects model, we must add

group means for all the variables that vary between clusters. As Schunck (2013) shows, this is analogous to the hybrid model proposed by Allison (2009). Our model is the following:

$$y_{cs} = \beta_0 + \beta_1 x_{cs} + \beta_2 z_c + \beta_3 (x_{cs} * z_c) + \beta_4 \bar{x}_c + \beta_5 \overline{(x_{cs} * z_c)} + \mu_c + \varepsilon_{cs}$$

where subscript  $c$  denotes clusters (families) and  $s$  refers to siblings.  $x_{cs}$  is a variable that varies between and within clusters,  $z_c$  is a variable that varies only between clusters,  $\mu_c$  and  $\varepsilon_{cs}$  are the error terms at each of the two levels. If we include an interaction between  $x_{cs}$  and  $z_c$ , we must also include the cluster mean of the interaction (Schunck, 2013).  $\beta_1$  is the within-effect estimate, that is the fixed-effect estimate, and  $\beta_2$  is the unbiased between-effect estimate of the variable that does not vary between siblings.  $\beta_4$  refers to the difference between the within and between effects of  $x_{cs}$ . By using robust standard errors, we adjust for potential violations of standard OLS assumptions, i.e. normality and homoscedasticity of the disturbance term. We add a separate analysis that provides information of parenting time at age 9-10, so that we can obtain further evidence for the relevance of parenting in early childhood.

## Results

### A. Exploratory analysis

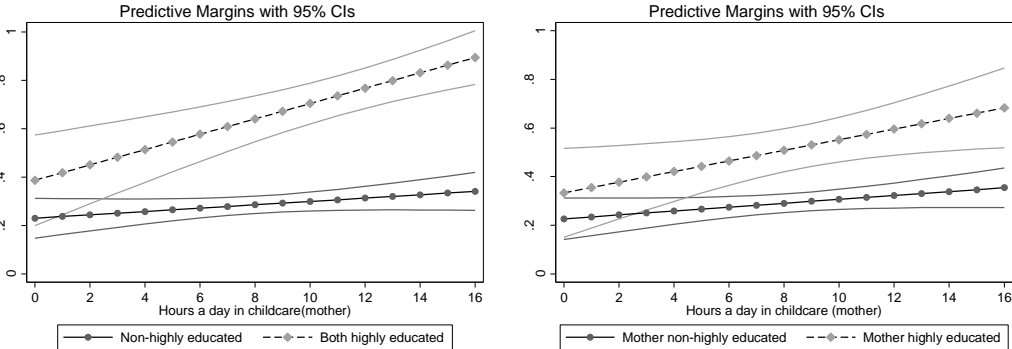
We first estimate linear probability models of the likelihood of Gymnasium attendance at age 17. Appendix Tables 2 and 3 present the analysis of mother's time in childcare, and Appendix Tables 4 and 5 for the father. In order to interpret the following results it should be kept in mind that the volume of parental dedication, as such, is not correlated with the parents' education. This implies that it is unlikely that our results will be biased by differential selection into parental time dedication according to the parents' educational status. As we shall see, however, any given volume has very different consequences depending on the parent's educational level.

Model 1 in Appendix Table 2 shows that the likelihood of *Gymnasium* attendance increases (not significantly) by 0.7 percentage points for each additional maternal hour for children with at least one parent who is not highly educated; the increase is substantially larger (3.2 points)

for children with highly educated parents. Model 2 includes mother’s education instead of our indicator of parental education. The coefficient for the interaction is not statistically significant – given the high standard error. Here we see that the likelihood of *Gymnasium* attendance is almost three times greater for each additional caring hour among highly educated mothers compared to those with a less educated mother (0.8 vs. 1.4+0.8).

Figure 2 presents graphically the marginal effects of the interactions – computed from Models 1 and 2 in Appendix Table 2 – for mothers’ childcare dedication and education level. It is evident that children reap a substantial benefit when their highly educated mothers devote more time. In contrast, children from less educated mothers appear to reap no additional benefit, no matter how much time is devoted.

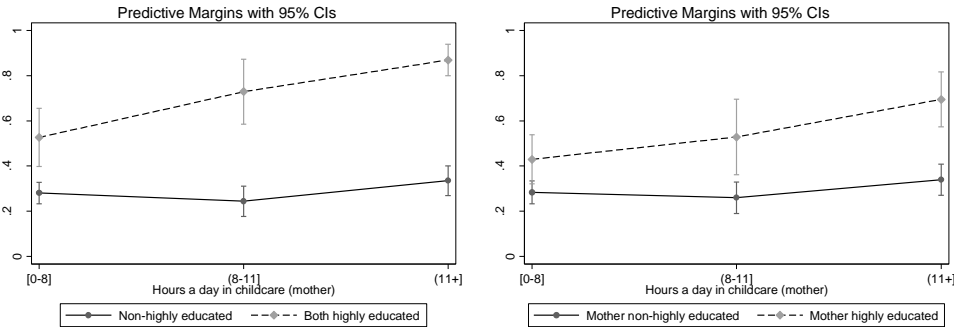
**Figure 2. Marginal effects of the interaction (computed from Models 1 and 2 in Appendix Table 2).**



Appendix Table 3 addresses non-linear effects. Model 1 includes the categorical measure of mothers’ caring time interacted with high educational homogamy. The interaction with the highest level of maternal time is statistically significant, and the interaction with the second highest is close to be significant. An alternative specification that merges the lowest two categories is tested in Model 2. Here the likelihood of *Gymnasium* attendance for children with highly educated parents increases by 24 or 29 percentage points if their mothers dedicated 8-11, or more than 11 hours, to childcare, respectively, when they were small. In contrast, increments in time dedication among the less educated have no effect whatsoever. The marginal effects of the interaction are presented graphically in the left-side graph of Figure 3.

Columns 3 and 4 display analogous models in which we analyze the influence of the mother’s education. As in the previous analysis, the moderating effect of mother’s education on the maternal time–Gymnasium attendance relationship is substantial, although less strong than that exerted by parental educational homogeneity. All in all, these results suggest that the gap in educational performance between children of low and high educated parents widens additionally when highly educated mothers make substantial time investments in early childhood. Again, the benefits of parental time for children’s educational attainment are exclusively found for advantaged families.

**Figure 3. Marginal effects of the interaction between mother’s time in childcare and parental education computed from Models 2 and 4 in Table 3.**



As to fathers’ caring (at age 2-3), our analyses suggest it has no additional independent effect whatsoever. Appendix Table 4 presents the results for interactions between the simplified measures of parental educational homogeneity and the continuous indicator (Model 1), as well as the categorical measure of father’s hours in childcare (Model 2). The effect of fathers’ education is shown in Appendix Table 5.

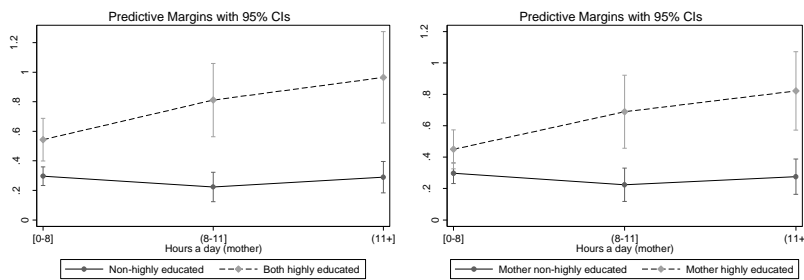
Robustness tests show that our conclusions hold also if we leave out cases in which reported maternal or paternal time in childcare exceeds 16 hours per day. The same obtains when we measure caring time only during weekdays. Again, maternal involvement increases the likelihood of children’s *Gymnasium* attendance only in highly educated families. Fathers’ time commitment during weekdays is also found to have no influence on children’s educational performance at age 17 (results are available upon request). The results also remain unchanged when estimating logit models instead of linear probability models.

## B. Unobserved heterogeneity

Our estimates may be biased if there are unobserved factors that influence both parental time investment and child outcomes. Appendix Table 6 shows the results from a correlated random-effects model which allows us to obtain fixed-effect estimates for the variables that vary within families and between-family estimates for the variables that are constant between siblings. Figure 4 graphically presents the marginal effects of the interactions of interest.

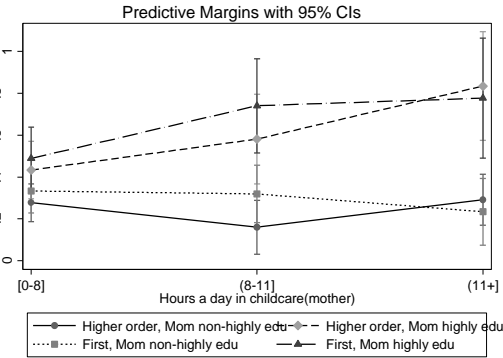
Model 1 examines the moderating effect of parental homogamy on the maternal time–Gymnasium attendance relationship, and Model 2 focuses on the moderating effect of mother’s education. Both parental homogamy and mother’s education are variables that do not change across siblings. The same is true for immigrant family and total number of children. For these, the coefficients are between-effect estimates, while the within-effect estimates are shown for the remaining variables. These models suggest that the gap by parental (Model 1), or by mother’s education (Model 2), is particularly wide when those with a highly educated mother received a substantial amount of maternal time investment in early childhood, even when controlling for unobserved maternal heterogeneity. Note that the effect-estimates are identical to the ones we obtained when analyzing the subsample of children with at least one sibling (N= 396). Note also that we here estimate whether the difference in maternal caring time at age 2-3 of siblings leads to a difference in their likelihood of attending *Gymnasium*. Models that include the continuous measure of mother’s time suggest substantive (but not significant) interaction effects, due to large standard errors (results available upon request).

**Figure 4. Marginal effects of the interaction between maternal childcare and parental education (left side) or mother’s education (right side). Fixed-effect estimation.**



As noted earlier, we assumed that the mother’s dedication at age 2-3 is uncorrelated with the child’s endowments (except in extreme cases, which we controlled for via grade repetition in primary school). It could be argued that the specific time dedicated to the second-born at age 2-3 could be influenced by the mother’s assessment of the earlier child’s performance. Additionally, the effect of maternal childcare may be stronger for first-born children because they profit from exclusive parental dedication until the second arrives. We therefore examine whether mother’s time is modified by birth order. Here we only present results from a correlated random-effect model similar to Model 2 in Appendix Table 6 that adds an interaction term for first-born child and mother’s time in childcare. Figure 5 graphically presents the marginal effects. The analysis suggests that for children who received more than 8 hours of maternal time (instead of 8 or less) hours, the first-born is more likely to attend the Gymnasium track. But the differences are small and not statistically significant.

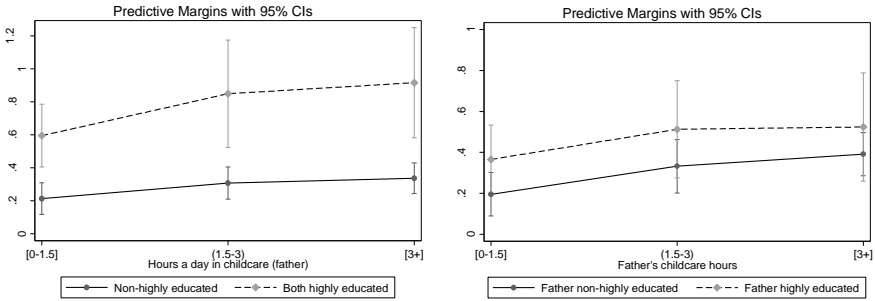
**Figure 5 Marginal effects of the interactions between mother’s time dedication and mother’s education and birth order. Fixed-effect estimation.**



The analyses of father-time effects which control for sibling fixed-effects yield mixed results. Figure 6 shows the marginal effects of the interaction with highly educated parents (left side) or father’s education (right side) computed from analogous models to those displayed in Appendix Table 6. Greater amounts of paternal time do not significantly increase the likelihood of Gymnasium attendance in any of the two groups considered (left-side graph), although the increments are higher for those with highly educated parents. On the other hand, the right-side graph shows that both children (with and without a highly educated father) improve their chances of attending Gymnasium when the father dedicated three hours or more hours. But the effect is only significant for those with a less educated father. These inconclusive results suggest that children whose father participated more actively when they

were small may have a better educational outcome than their siblings, irrespective of parents' education. It must be noted that the sample size in the second model is slightly smaller (N=729). Father's education is not a constant within clusters because there are (only) two families in which the father's education level was raised between births. This is too little variation for a consistent estimator of the within-effect of education. Even if this does not change the estimation for the interaction effect, we decided to drop the four affected children from the sample.

**Figure 6. Marginal effects of the interaction between paternal childcare and parental education (left side) or father's education (right side). Fixed-effect estimation.**



*C. Is the child's age decisive?*

A skeptic might argue that any beneficial effects of a mother's dedication in the early years are not actually due to the stage of the child's development, but rather because maternal dedication at infancy is a good predictor of her involvement throughout childhood. We therefore include an analysis of whether the significant effects of early childhood investments disappear if we control for time investments during a later stage in the child's life.

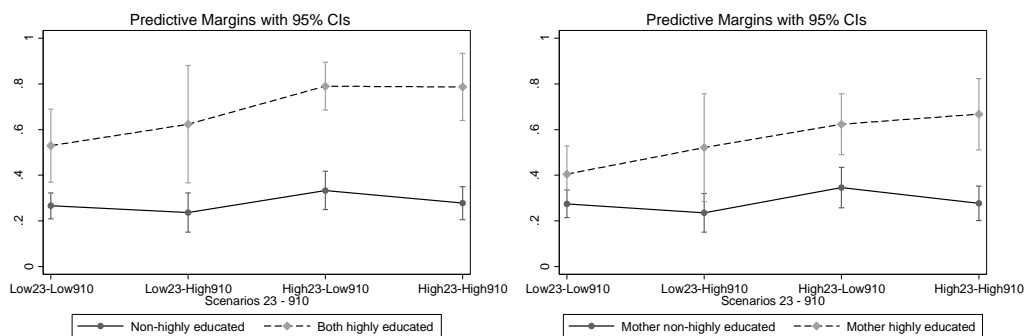
To address this we add an analysis with maternal time dedication at age 9-10, chosen because 10 is the official age at which children begin lower secondary education in almost all German regions. The scenarios we examine distinguish whether the mother's time dedication was more than 8 hours a day or not at age 2-3 and whether it fell above or below the mean at 9-10. The average mother's caring time at ages 9-10 was 6.87 hours per day.



The *first scenario* refers to children whose mothers scored low on time dedication at ages 2-3 and also at ages 9-10 (42%). The *second scenario* captures mothers who made a low investment at age 2-3, but were then highly committed at age 9-10 (11%). The *third and fourth scenarios* (19% and 27%, respectively), refer to mothers who invested a large amount of time in early childhood; in the fifth scenario they were likewise intensely involved at age 9-10. Figure 7 presents the marginal effects for these scenarios: the left-side graph estimates for highly educated homogamous parents; the right-side graph for mother' education. The effects are estimated from models that include all the control variables plus a dummy variable for the presence of a sibling (0-3 years old) at age 9-10. Due to missing cases the sample size drops to 714.

As can be seen, children of highly involved mothers at ages 2-3 are significantly more likely to attend the *Gymnasium* track, independently of the level of maternal time at ages 9-10. And as earlier, this obtains exclusively for children of highly educated parents. Pair-wise comparisons demonstrate that these children's educational success is greater in the fourth and fifth scenarios (at the  $p < 0.05$  level). This additionally supports the thesis that early childhood conditions are uniquely decisive.

**Figure 7. Marginal effects for different parental investment scenarios.**



## Concluding

Our study addresses the age-old and massively researched question of how social origins influence children's life chances. But only few studies have been able to identify how

parenting in the earliest years influences later achievements. Our findings point to a mechanism through which certain family dynamics reinforce social inequalities.

Our results show quite systematically that the influence of maternal caring time in early childhood varies with parental education. Indeed, the origins-effect is essentially orthogonal. Having highly educated parents, in particular if they are educationally homogamous, makes children benefit substantially from intense maternal time investment. But it would appear that no such beneficial effect exists for children of low educated parents.

We also find that paternal involvement does not make a big difference. Fathers' input is, to begin with, comparatively quite modest. And here we must recall the unique German norm that mothers typically interrupt employment for several years after the birth of a child. In other words, the mother is likely to be omnipresent during a child's early years, whereas the father plays a more peripheral role.

For children with highly educated parents, maternal time dedication at ages 2-3, especially when it is of more than 8 hours a day, significantly increases the likelihood of attending the *Gymnasium* track at age 17. For children with less educated parents the probability of *Gymnasium* attendance is, to begin with, far lower and no matter how much parenting time is invested there is no visible additional dividend. Having two highly educated parents seems to be the condition that maximizes the beneficial impact of maternal time commitment. All told, it appears that parental inputs, both as regards quantity and quality, fuel additional educational stratification. A very intensive time dedication is, of course, only feasible for non-employed and part-timer mothers. Hence, women's long employment interruptions after a birth appear to reinforce social inequalities within the following generation.

Our findings are very much in line with those for the U.S. in Hsin's (2008) study and quite at odds with Milkie et.al's (2015) conclusion that maternal time inputs make no significant difference for children's academic performance --- utilizing the same data as Hsin. But here we must keep in mind that our study differs from Milkie et.al's in several respects. Unlike ours, their study does not identify long-term educational effects; moreover, their (academic) outcome variables are measures of the children's reading and math scores.

The principal shortcoming of our study is the lack of information on what precisely occurs during the parenting hours we analyze. And herein lies most probably the key to why we find such orthogonal effects of high and low educated parents' time-dedication. One explanation lies almost certainly in different parenting practices. Highly educated parents are likely to share similar cultural norms about childrearing and education, and probably also the relevant knowledge and skills that make child care particularly stimulating for their children's development. In contrast, less educated parents are more likely to adopt the 'natural growth' approach. Further research should examine the role of father's time involvement later in child's life when the importance of physical care declines in favor of more interactive care. And if (and when) data become available that permits us to identify the exact content of parental caring we would be far better placed to tease out exactly what drives the orthogonal parenting effects we have uncovered.

Other limitations should be taken into account when interpreting the results. First of all, the characteristics of the German school system force us to be cautious in our conclusions about the long-term consequences of the investment at early childhood. Thinking counterfactually, would parental inputs matter as much for *Gymnasium* entry if instead the German system did not track children at such an early age? To address this possibility it would be of great interest to replicate our study on, say, the Swedish case.

## References

- Allison, P. D. (2009). *Fixed effects regression models*. SAGE publications.
- Becker, G. (1962). Investment in human capital. *Journal of Political Economy*, 70, 9-49
- Becker, G. (1981). *A Treatise on the Family*. Cambridge, Mass: Harvard University Press.
- Becker, G & Tomes, N. (1986). Human capital and the rise and fall of families. *Journal of Labor Economics*, 4, S1-S39.
- Bernardi, F., & Radl, J. (2014). The long-term consequences of parental divorce for children's educational attainment. *Demographic Research*, 30(61), 1653-1680.
- Bianchi, S. M., & Robinson, J. (1997). What did you do today? Children's use of time, family composition, and the acquisition of social capital. *Journal of Marriage and the Family*, 332-344.
- Bianchi, S.M, Robinson, J.P & Milkie, M.A. (2006). *Changing Rhythms of American Family Life*. New York: Russell Sage.
- Björklund, A., & Jäntti, M. (2009). *Intergenerational income mobility and the role of family background*. Oxford Handbook of Economic Inequality. Oxford: Oxford University Press, 491-521.
- Bonke, J., & Esping-Andersen, G. (2011). Family investments in children—productivities, preferences, and parental child care. *European Sociological Review*, 27(1), 43-55.
- Booth, C. L., Clarke - Stewart, K. A., Vandell, D. L., McCartney, K., & Owen, M. T. (2002). Child - care usage and mother - infant “quality time”. *Journal of Marriage and Family*, 64(1), 16-26.
- Casper, L. M., & Bianchi, S. M. (2002). *Change and Continuity in the American Family*. Thousand Oaks, CA: Sage.
- Craig, L. (2006). Parental education, time in paid work and time with children: an Australian time - diary analysis. *The British Journal of Sociology*, 57(4), 553-575.
- Craig, L., & Bittman, M. (2008). The incremental time costs of children: An analysis of children's impact on adult time use in Australia. *Feminist Economics*, 14(2), 59-88.
- Datar, A., Kilburn, M. R., & Loughran, D. S. (2010). Endowments and parental investments in infancy and early childhood. *Demography*, 47(1), 145-162.
- Eiser, C., & Morse, R. (2001). Can parents rate their child's health-related quality of life? Results of a systematic review. *Quality of Life Research*, 10(4), 347-357.

- Ermisch, J. (2008). Origins of social immobility and inequality: parenting and early child development. *National Institute Economic Review*, 205(1), 62-71.
- Ermisch, J. & Francesconi, M. (2013). The effect of parental employment on child schooling. *Journal of Applied Econometrics*, 28, 796–822.
- Feinstein, L., Duckworth, K., & Sabates, R. (2004). *A model of the inter-generational transmission of educational success*. Centre for Research on the Wider Benefits of Learning, Institute of Education, University of London.
- Fiorini, M. & Keane, M. (2014). How the allocation of children's time affects cognitive and noncognitive development. *Journal of Labor Economics* 32 (4). 787-836.
- Friend, A., DeFries, J. C., and Olson, R. K. (2008). Parental education moderates genetic influences on reading disability. *Psychological Science*, 19(11), 1124-1130.
- Hofferth, S. L. (2006). Residential father, family type and child well-being. Investment versus selection. *Demography*, 43: 53-77
- Hsin, A. (2008). *Parenting, Investments in Children, and the Social Reproduction of Skills and Status*. PhD. Dissertation, University of California, Los Angeles.
- Hsin, A. & Felfe, C. (2014). When does time matter? Maternal employment, children's time with parents, and child development. *Demography*, 51(5), 1867-1894.
- Huston, A. C., & Aronson, S.R. (2005). Mothers' time with infant and time in employment as predictors of mother–child relationships and children's early development. *Child Development*, 76(2), 467-482.
- James–Burdumy, S. (2005). The effect of maternal labor force participation on child development. *Journal of Labor Economics*, 23(1), 177-211.
- Kalil, A., Ryan, R., & Corey, M. (2012). Diverging destinies: Maternal education and the developmental gradient in time with children. *Demography*, 49(4), 1361-1383.
- Korat, O. (2004). Mothers' and teachers' attributions of the academic functioning of Israeli second graders: A comparison between social groups. *Early Childhood Research Quarterly*, 19(3), 485-501.
- Lamb, M, (Ed.) (1997). *The Role of the Father in Child Development*. Somerset, NJ: John Wiley.
- Landry, S. H., Smith, K. E., & Swank, P. R. (2006). Responsive parenting: establishing early foundations for social, communication, and independent problem-solving skills. *Developmental psychology*, 42(4), 627.

- Lareau, A. (2003). *Unequal Childhoods: Class, Race, and Family Life*. Berkeley and Los Angeles: University of California Press.
- Martin, C.A. & Johnson, J.E. (1992). Children's self-perceptions and mothers' beliefs about development and competencies. In Sigel, I.E.; McGillicuddy-DeLisi, A.V. & Goodnow, J.J. (Eds.). *Parental belief systems: The psychological consequences for children* (2nd ed.). Hillsdale, NJ, England: Lawrence Erlbaum Associates.
- McLanahan, S. (2004). Diverging destinies: How children are faring under the second demographic transition. *Demography*, 41(4), 607-627.
- Miller, S. A. (1986). Parents' beliefs about their children's cognitive abilities. *Developmental Psychology*, 22(2), 276-284.
- Milkie, M.A., Nomaguchi, K. & Denny, K. E. (2015). Does the amount of time mothers spend with children or adolescents matter? *Journal of Marriage and Family*, 77: 355-372.
- Mundlak, Y. (1978). On the pooling of time series and cross section data. *Econometrica: Journal of the Econometric Society*, 69-85.
- Plomin R. (1999). Genetics and general cognitive ability. *Nature*, 402, C25– C29.
- Ruff, H. A., & Capozzoli, M. C. (2003). Development of attention and distractibility in the first 4 years of life. *Developmental Psychology*, 39, 877–890.
- Sattler, J. M., Feldman, J., & Bohanan, A. L. (1985). Parental estimates of children's receptive vocabulary. *Psychology in the Schools*, 22(3), 303-307.
- Schunck, R. (2013). Within and between estimates in random-effects models: Advantages and drawbacks of correlated random effects and hybrid models. *Stata Journal*, 13(1), 65-76.
- Snow, C. (2006). What counts as literacy in early childhood? In K. McCartney and D. Phillips (eds.), *Handbook of Early Child Development*. Malden, MA: Blackwell Publishing.
- Wagner, G., Frick, J., & Schupp, J. (2007). The German Socio-Economic Panel Study (SOEP): scope, evolution and enhancements. *Schmollers Jahrbuch*, 127, 139–69.
- Waldfogel, J. (2006). *What Children Need*. Harvard University Press.
- Waldfogel, J. Huan, W-J., & Brooks-Gunn, J. (2002). The effects of early maternal employment on child cognitive development. *Demography* 39(2), 369-392.
- Zajonc, R. B., & Markus, G. B. (1975). Birth order and intellectual development. *Psychological review*, 82(1), 74.

## Appendix

**Appendix Table 1. Descriptive statistics.**

<i>N</i>	Sample A		Sample B		Min	Max
	Mean	S.D.	Mean	S.D.		
	810		733			
Gymnasium attendance	0.34	0.47	0.35	0.48	0	1
Girl	0.51	0.50	0.51	0.50	0	1
Immigrant family	0.20	0.40	0.20	0.40	0	1
Net hh income_23 (1 <sup>st</sup> quartile)	0.25	0.43	0.23	0.42	0	1
Net hh income_23 (2 <sup>nd</sup> quartile)	0.25	0.43	0.26	0.44	0	1
Net hh income_23 (3 <sup>rd</sup> quartile)	0.25	0.43	0.26	0.44	0	1
Net hh income_23 (4 <sup>th</sup> quartile)	0.25	0.43	0.25	0.43	0	1
Family disruption	0.23	0.42	0.23	0.42	0	1
Number of children	2.58	1.15	2.54	1.10	1	11
First-born child	0.43	0.50	0.43	0.49	0	1
No demanding sibling	0.51	0.50	0.51	0.50	0	1
Any demanding sibling	0.20	0.40	0.19	0.39	0	1
No info on demanding sibling	0.30	0.46	0.30	0.46	0	1
Grade retention in Primary	0.06	0.25	0.06	0.24	0	1
Mother's hours a day in housework	4.54	2.33			0	14
Father not employed	0.06	0.24	0.07	0.26	0	1
Father employed	0.91	0.29	0.93	0.26	0	1
Single-mother household	0.03	0.16			0	1
Mother is highly educated	0.19	0.39	0.19	0.39		
Father is highly educated	0.24	0.43	0.24	0.43		
None highly educated	0.69	0.46	0.69	0.46	0	1
Only father highly educated	0.12	0.33	0.12	0.33	0	1
Only mother highly educated	0.06	0.24	0.07	0.26	0	1
Both highly educated	0.13	0.33	0.12	0.32	0	1
Mother's hours a day in childcare (cont.)	8.40	3.81			0	16
Father's hours a day in childcare (cont.)			2.70	2.19	0	16
Mother's hours a day in childcare [0-5]	0.26	0.44			0	1
Mother's hours a day in childcare (5-8)	0.26	0.44			0	1
Mother's hours a day in childcare (8-11)	0.21	0.41			0	1
Mother's hours a day in childcare (11+)	0.27	0.45			0	1
Father's hours a day in childcare [0-1.5]			0.33	0.47	0	1
Father's hours a day in childcare (1.5-3)			0.33	0.47	0	1
Father's hours a day in childcare [3+]			0.34	0.47	0	1

**Appendix Table 2. Linear probability models of Gymnasium attendance that include our continuous measure of mother's hours in childcare. Robust cluster standard errors.**

	(1)		(2)	
	Coeff.	S.E.	Coeff.	S.E.
Any demanding sibling	0.008	(0.043)	-0.001	(0.044)
No info on demanding sibling	-0.001	(0.038)	0.004	(0.038)
Repeated a grade in Primary	-0.192***	(0.033)	-0.194***	(0.033)
Girl	0.097***	(0.028)	0.102***	(0.029)
Immigrant family	-0.115**	(0.041)	-0.106*	(0.041)
Household income (2nd q)	0.097*	(0.043)	0.091*	(0.044)
Household income (3rd q)	0.090*	(0.045)	0.067	(0.046)
Household income (4th q)	0.294***	(0.051)	0.263***	(0.056)
Family disruption	0.004	(0.039)	-0.005	(0.039)
Number of children	-0.047**	(0.015)	-0.040**	(0.015)
First-born child	0.042	(0.030)	0.046	(0.031)
Mother's hours a day in housework	-0.008	(0.007)	-0.009	(0.007)
Father employed	0.019	(0.063)	0.031	(0.066)
Single-mother hh	-0.155	(0.083)	-0.089	(0.089)
Mother's childcare hours	0.007	(0.005)	0.008	(0.005)
Both highly educated	0.157	(0.106)		
Both highly educated*Mother's childcare hours	0.025**	(0.009)		
Father highly educated			0.124*	(0.054)
Mother highly educated			0.106	(0.105)
Mother highly educated*Mother's childcare hours			0.014	(0.010)
Constant	0.220*	(0.092)	0.168	(0.094)
Observations	810		810	

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001



**Appendix Table 3. Linear probability models of Gymnasium attendance at age 17 (robust cluster standard errors). Categorical measures of mother’s time in childcare are included.**

	(1)		(2)		(3)		(4)	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
M&F high edu.	0.33***	(0.09)	0.25***	(0.07)				
M-HChC (5-8]	0.03	(0.04)			0.02	(0.05)		
M-HChC (8-11]	-0.02	(0.05)			-0.01	(0.05)		
M-HChC (11+]	0.07	(0.05)			0.07	(0.05)		
M&F high edu.*M-HChC (5-8]	-0.16	(0.13)						
M&F high edu.*M-HChC (8-11]	0.15	(0.11)						
M&F high edu.*M-HChC (11+]	0.20*	(0.09)						
M-HChC (8-11]			-0.04	(0.04)			-0.02	(0.04)
M-HChC (11+]			0.05	(0.04)			0.06	(0.04)
M&F high edu.*M-HChC (8-11]			0.24*	(0.10)				
M&F high edu.*M-HChC (11+]			0.29***	(0.08)				
M. highly educated					0.19*	(0.09)	0.15*	(0.06)
M. high edu.* M-HChC (5-8]					-0.08	(0.11)		
M. high edu.* M-HChC (8-11]					0.08	(0.11)		
M. high edu.* M-HChC (11+]					0.17	(0.10)		
M. high edu.* M-HChC (8-11]							0.12	(0.10)
M. high edu.* M-HChC (11+]							0.21*	(0.08)
Constant	0.25**	(0.09)	0.27**	(0.09)	0.21*	(0.10)	0.22*	(0.09)
Observations	810		810		810		810	

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

*Note 1:* *M&F high edu.* and *M. high edu.* stand for “both parents are highly educated” and “mother is highly educated, respectively. *M-HChC* refers to Mother’s hours in childcare. *Note 2:* The models control for gender, immigrant family, net household income, family disruption, number of children, first-born child, grade retention in Primary, any demanding sibling, father’s education, mother’s hours a day in housework, father’s employment status and single-mother household (the last five variables are measured at age 2-3).

**Appendix Table 4. Linear probability models of Gymnasium attendance that consider father's time in childcare and parental homogeneity. Robust cluster standard errors.**

	(1)		(2)	
	Coeff.	S.E.	Coeff.	S.E.
Any demanding sibling	0.007	(0.045)	0.004	(0.045)
No info on demanding sibling	-0.020	(0.040)	-0.017	(0.040)
Repeated a grade in Primary	-0.206***	(0.033)	-0.210***	(0.034)
Girl	0.084**	(0.030)	0.085**	(0.030)
Immigrant family	-0.110**	(0.042)	-0.105*	(0.042)
Household income (2nd q)	0.111*	(0.045)	0.110*	(0.046)
Household income (3rd q)	0.111*	(0.047)	0.108*	(0.047)
Household income (4th q)	0.314***	(0.055)	0.316***	(0.055)
Family disruption	0.025	(0.041)	0.024	(0.041)
Number of children	-0.052**	(0.016)	-0.049**	(0.017)
First-born child	0.064*	(0.032)	0.062	(0.032)
Father employed	-0.022	(0.066)	-0.004	(0.065)
Both highly educated	0.416***	(0.101)	0.373***	(0.094)
Father's childcare hours (cont.)	-0.007	(0.008)		
Both highly educated*Father's childcare hours	-0.011	(0.029)		
Father's childcare hours (1.5-3)			0.026	(0.042)
Father's childcare hours [3+]			0.007	(0.043)
Both highly educated*(1.5-3)			0.033	(0.109)
Both highly educated*[3+]			0.011	(0.114)
Constant	0.295**	(0.097)	0.244**	(0.094)
Observations	733		733	

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

**Appendix Table 5. Linear probability models of Gymnasium attendance that consider father's time in childcare and father's education. Robust cluster standard errors.**

	(1)		(2)	
	Coeff.	S.E.	Coeff.	S.E.
Father highly educated	0.155	(0.085)	0.153	(0.085)
Father's childcare hours (cont.)	-0.009	(0.008)		
Father highly educated*Father's childcare hours	-0.004	(0.023)		
Father's childcare hours (1.5-3)			0.032	(0.046)
Father's childcare hours [3+]			-0.001	(0.045)
Father highly educated* Father's childcare hours (1.5-3)			-0.046	(0.093)
Father highly educated* Father's childcare hours [3+]			0.026	(0.093)
Constant	0.258**	(0.097)	0.200*	(0.095)
Observations	733		733	

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

*Note:* The models control for gender, immigrant family, net household income, family disruption, number of children, first-born child, grade retention in Primary, mother's education, any demanding sibling and father's employment status (the last three variables are measured at age 2-3).

**Appendix Table 6. Fixed-effect estimations of the effect of mother's time in childcare on Gymnasium attendance at age 17. Robust standard errors.**

	<b>(1)</b>		<b>(2)</b>	
	<b>Coeff.</b>	<b>S.E.</b>	<b>Coeff.</b>	<b>S.E.</b>
Any demanding sibling	0.105	(0.070)	0.114	(0.071)
No info on demanding sibling	0.009	(0.088)	0.019	(0.090)
Grade repeated in Primary	-0.017	(0.055)	-0.015	(0.055)
Girl	0.098*	(0.050)	0.102*	(0.051)
Immigrant family	-0.116**	(0.040)	-0.105*	(0.042)
Household income (2nd q)	0.115	(0.105)	0.110	(0.106)
Household income (3rd q)	-0.116	(0.141)	-0.122	(0.142)
Household income (4th q)	0.041	(0.207)	0.071	(0.211)
Family disruption	0.105	(0.123)	0.100	(0.124)
Number of children	-0.048**	(0.016)	-0.039*	(0.016)
First-born child	0.057	(0.043)	0.053	(0.043)
Mother's hours a day in housework	-0.002	(0.014)	-0.003	(0.014)
Father employed	0.134	(0.178)	0.097	(0.136)
Single-mother hh	-0.059	(0.241)	-0.194	(0.149)
Both highly educated	0.247***	(0.077)		
Mather's childcare hours (8-11]	-0.073	(0.063)	-0.074	(0.066)
Mather's childcare hours (11+]	-0.007	(0.071)	-0.022	(0.074)
Both highly educated* Mather's childcare hours (8-11]	0.341*	(0.138)		
Both highly educated* Mather's childcare hours (11+]	0.428*	(0.172)		
Father highly educated			-0.148	(0.221)
Mother highly educated			0.153*	(0.067)
Mother highly educated* Mather's childcare hours (8-11]			0.313*	(0.129)
Mother highly educated* Mather's childcare hours (11+]			0.394**	(0.141)
Constant	0.325**	(0.100)	0.261*	(0.107)
Observations	810		810	

\* p<0.05 \*\* p<0.01 \*\*\* p<0.001

*Note:* The models also include group means for all the varying variables within families.