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Center-Based Care and Parenting Activities*

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Abstract

We estimate effects of center-based care on parenting activities using time use data for Germany. Our estimates imply that center-based care reduces the overall time that parents spend with the enrolled child, but has only small negative effects on time spent doing activities together. Correspondingly, center-based care increases activities as a share of the time spent together with the child. The overall effect is driven by households with lower maternal education. Our findings imply that child development effects of center-based care may be explained, not just by the institutional environment, but also by changes that occur within the home environment.

Keywords: Child care, Child development, Time use, Parenting investments, Day care
JEL: D13, I21, J13

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1 Introduction

Children in high-income countries are spending more time in child care centers than ever before: not only is the age of first entry decreasing, but the hours spent in daily care are also increasing over time (i.e. OECD, 2017). Nevertheless, parents are spending more time on activities with their children than they did in the 1960s (Dotti Sani and Treas, 2016).[2] Based on these trends, it is far from obvious that parenting activities are reduced as a result of the increasing usage of center-based care. Parental interactions play a key role in children's development, independent of the role of learning institutions, such as child care centers (e.g. Cunha et al., 2006; Todd and Wolpin, 2007; Bono et al., 2016; Kim et al., 2018; Moroni et al., 2019). Specific activities, such as reading to the child, are particularly valuable (e.g. Kalb and van Ours, 2014; Price and Kalil, 2018). Therefore, knowing whether center-based care increases, decreases, or has no effect on parenting activities is important for understanding the effects on child development (we discuss each possibility in section 3).

Our study asks: what is the effect of using center-based care on parenting activities? Although there is a huge economic literature on the effects of center-based care programs on various outcomes, evidence on the effect of center-based care on parenting activities is rather limited. Research mainly focuses on the effects of center-based care on maternal labor supply (for a recent overview i.e. Müller and Wrohlich, 2020) and child development (e.g. Havnes and Mogstad, 2011; Datta Gupta and Simonsen, 2012; Havnes and Mogstad, 2015; Blanden et al., 2016; Cornelissen et al., 2018; Felfe and Lalive, 2018; Kuehnle and Oberfichtner, 2020) with a few further studies looking at other outcomes like maternal well-being (i.e. Schmitz, 2020), child abuse (Sandner and Thomsen, 2020) and fertility (Bauernschuster et al., 2016). Studies by Baker et al. (2008) and Herbst and Tekin (2010) are some of the few economic studies to look at the effects of child care programs (in Canada and the U.S., respectively) on the style and quality of parental interaction (among other outcomes). However, while important, quality and style of parenting are not necessarily closely related to the absolute and relative time spent on parenting activities.

Depending on the context, many studies find positive effects of center-based care on child development, especially for children from less-educated parents, while others show zero or even negative effects (e.g. Baker et al., 2019). The direction and size of the effect is most commonly thought to be related to the educational opportunities offered at the child care center relative to the home environment, with some studies focusing specifically on the role of center quality (e.g. Bauchmüller et al., 2014). However, this institutional channel typically takes the educational

[2] Moreover, the type of parents who see the largest increases in parenting activities—i.e. more educated parents, according to Dotti Sani and Treas (2016)—are those who have seen the largest increases in usage of center-based care (e.g. see Jessen et al., 2018 for Germany).

environment at home as a fixed consideration (e.g. Guryan et al., 2008, Kalil et al., 2012).[3] A much less-explored channel is whether usage of center-based care might impact child development by changing the home environment, for instance, by affecting parenting activities.

Our main contribution is to use time-diary data to estimate effects of center-based care usage on parenting activities in Germany, a country with a universal child care system (see section 2). We do this by estimating the effects separately on (i) parents' overall time spent together with the child, (ii) the absolute amount of time spent on parenting activities, and (iii) the relative time spent on parenting activities (i.e. as a share of the time spent together with the child).[4] We estimate the activities share for parenting activities in general and also estimate effect for specific types of parenting activities such as reading and primary care. In doing so, we follow the child development literature, which distinguishes between activities that involve different levels of interaction (Kalil et al., 2012; Fort et al., 2020). We contribute to a very sparse literature addressing our question.[5] To the best of our knowledge, the only existing economic study is Kröll and Borck (2013), which uses data from the German Socio-Economic Panel (SOEP) and finds that center-based care increases maternal interactions with children. However, the analysis is based on how often mothers report having undertaken specific activities with their children in the past fortnight, rather than precise time diary data. The few studies from other social sciences that examine the relationship between center-based care and parent-child interactions tend to find small decreases that come mostly through primary care rather than development-enhancing activities (e.g. Booth et al., 2002; Folbre and Bittman, 2004; Craig and Powell, 2013; Habibov and Coyle, 2014). However, these studies do not attempt to address selection on unobservables. None of these studies examine parenting activities as a share of time spent with the child, and few place emphasis on the specific types of activities carried out.

Another major contribution of our study is to outline a framework of mechanisms and apply it to the data. We distinguish between direct effects, which are changes in parenting activities that occur while the child is at the child care center, and indirect effects, which are changes to parenting activities outside of center hours while the child is at home (e.g. in the evenings and on weekends). Indirect effects may be either positive or negative depending on whether center-based care is a complement or a substitute for parenting activities, which itself depends on changes to parental motivation or time constraints. We apply the framework empirically by using the diary data to estimate effects on

[3] One of the few economic studies not to take the home environment as given is Kuger et al. (2019), which shows that the quality of center-based care affects the quality of the home environment, using established quality measures for both environments.

[4] Our analysis is restricted to families with one child below the age of ten for data reasons. Using a household survey, we show in a complementary analysis in appendix C.2 that when we contrast results with and without the same sample restriction they hardly differ.

[5] Interestingly, some studies focusing on the impact of maternal employment on parenting activities show that parental quality time with children does not need to decline with increases in maternal employment (e.g. Bono et al., 2016 and Bastian and Lochner, 2020).

parenting activities at specific times of the day: during typical care center hours or outside of those hours. We explore whether the effects likely reflect changes to motivation or to time constraints by additionally looking at effects on non-parenting activities (such as paid work and leisure). Previous studies neither distinguish between direct and indirect effects, nor attempt to systematically explore mechanisms.[6] In doing so, our study contributes to a literature on the economics of parenting that tries to explain parenting decisions as rational choices that may be affected by the institutional environment (e.g. Doepke and Zilliboti, 2017 and Doepke et al., 2019).

A further contribution is that we do not just focus on center-based care usage, *per se*, but on the effect of the dosage as well: We complement our main analysis with an examination of the effects of full-day vs. half-day care on parenting activities. We do this using the same time-use data and further survey data, the German Family Panel (*pairfam*). The dosage of center-based care is an important margin since the literature finds quite differing effects on child development by hours of center-based care (e.g. Loeb et al., 2007; Datta Gupta and Simonsen, 2010; Felfe and Zierow, 2018).

Our method involves regressing time spent on parenting (and non-parenting) activities on an indicator for center-based care usage. We estimate an unconditional model, and a conditional model with a rich set of controls for child, parent, and household characteristics. To account for potential selection on unobservables into center-based care, we implement the coefficient stability approach of Oster (2019). Selection on unobservables is accounted for by assuming it relates to the degree of selection on observables, which itself is measured based on coefficient movements (and changes in the R-squared) that occur when including control variables. We present 'identified sets' that are estimate bounds based on assumed upper and lower limits for the degree of selection on unobservables. In general, we find that our coefficients are relatively stable to the inclusion of controls, thus suggesting fairly limited selection bias. In a further check, we show that our coefficients are also similar to those estimated when using a fuzzy difference-in-differences (DD) model that makes use of exogenous variation in center-based care usage from the different timing of roll-out of places by age group. Overall, while we do not claim to estimate 'causal' effects, we are comfortable using the word 'effect' to describe our estimates since we believe them to be a fairly close proxy.

Our estimates imply that center-based care usage reduces the overall time that parents spend with their child but that there are only small effects on the time spent on parenting activities with the child and on educational activities, specifically. As a result, center-based care usage increases the time spent on parenting activities as a share of the overall time spent together with the child. The effects come through mothers and fathers in households where the mother has lower educational

[6] A previous study that also analyzes the effect of center-based care on parenting activities also finds evidence of the impact of center-based care on non-parenting outcomes like housework (Craig and Powell, 2013).

attainment. For households with higher maternal education, mothers increase their share of parenting activities (although by less than lower education mothers), but fathers decrease it, resulting in no effect on parenting activities overall. Our results are consistent with the few existing studies that find only small decreases in parenting activities (see above). However, our additional finding of an increase in parenting activities when expressed as a share of overall time suggests an improvement in educational opportunities within the home environment. Overall, this result is consistent with the majority of the literature on the effects of center-based care on child development (which find stronger effects for children from lower educational backgrounds) but provides an additional channel not previously explored in much detail.

Our estimates at different times of the day reveal that positive indirect effects (outside of center hours) drive the overall increase in the parenting activities share for mothers and fathers from households with lower maternal education. The indirect effect for these households partly reflects an increase in reading to the child and coincides with a reduction in housework and leisure. A potential explanation for these positive indirect effects is if child care centers encourage activities with children (such as reading). A further possible explanation is if parents reinforce child development by spending more time on activities with children (e.g. Nicoletti and Tonei, 2020). The reduction in housework suggests that an easing of time constraints may also help explain these findings. For households with higher maternal education, however, the positive indirect effect on the activities share is smaller and outweighed by a negative direct effect. The negative direct effect is explained by the fact that the time replaced by center-based care for mothers is relatively activity-rich. The indirect effect is small since a positive effect for mothers is attenuated by a zero indirect effect for fathers. An increase in time spent on leisure for fathers from households with higher maternal education suggests that the motivation channel is weaker here than for other parents. This could be explained if these fathers have less involvement with day care teachers, or if their time investments are substitutes rather than complements to child skills (see e.g. Fredriksson et al., 2016).

Finally, our results show that full-day care, in comparison to half-day care, does not provide additional positive effects on parenting activities. We find decreases in the frequencies of certain parenting activities, although the effect sizes are small. This is in line with the literature that finds more limited child development effects at this margin (e.g. Felfe and Zierow, 2018).

2 Institutional background

In 2019, 34 percent of children in Germany under three and 93 percent of those aged three to five were enrolled in center-based care. For both age groups, just over half of the enrolled children were in full-time care, defined as 35 hours or more per week (Autorengruppe Bildungsberichterstattung,

2020). The child care system in Germany can be characterized as a virtually universal, strongly state-subsidized system. For-profit providers play a very limited role, with only 2.6 percent of institutions in 2017 being private and non-charitable (Destatis, 2017). Parental fees are mostly income-dependent and relatively low compared to most other OECD countries (OECD, 2020), with many states having even abolished fees altogether for older age groups at least (Huebener et al., 2019). In 2012, average fees amounted to 144 Euros per month and family, on average (Schröder et al., 2015). In general, parents cannot obtain higher quality by paying higher fees, which weakens the link between family income and center-based care quality compared with countries using a market-based system (Stahl et al., 2018).

Figure 1 shows enrollment rates in center-based care for under and over three year olds separately for East and West Germany over the time period covered by our analysis. For over-threes, the majority of the expansion in child care center slots took place in the 1990s in response to the 1996 introduction of a legal entitlement to a place for children over three years and a general trend in Europe to expand center-based care for children three years and older (see e.g. Spiess et al., 2008). In both East and West Germany, enrolment rates for over-threes have been above 80 percent since before 2000. Despite a strong increase in full-day enrollment in West Germany in the 2010s (Jessen et al., 2018), full-day rates remain below 50 percent. In East Germany, full-day enrolment rates are much higher, covering 74 percent of over-threes children in 2018.

[Figure 1 about here]

In contrast, for under three year olds, enrollment rates were very low well into the mid-2000s, particularly in West Germany. In 2008, a federal law (KiföG) was passed, extending the legal claim to a place at a child care center to children of at least one year of age, coming into effect in 2013. The legal change and the accompanied increased provision came in response to a long-lasting over-demand for center-based care, in particular by parents with infants and toddlers (i.e. Spiess and Wrohlich, 2005; Wrohlich 2008). However, while enrolment rates for under-threes subsequently climbed, demand increased further still resulting in a continuation of shortages (Jessen et al., 2020).

Parents in Germany make frequent use of informal care, especially by grandparents. In 2017, between 50 percent and 60 percent of all children from six months old until the age of six years had grandparents as caregivers; for older children, grandparents were mainly used in addition to center based care. Other private caregivers looked after between only 10 percent and 30 percent, of children, depending on child age. Nevertheless, informal care, such as that offered by grandparents, is typically for only a few hours per week and complementary to formal care. This is shown in Tables B4 and B5: informal care is higher for children who attend a child care center, suggesting that informal care

may have been used to extend hours of formal care, rather than to substitute it.

Parental care in Germany is characterized by a strong gender divide, with mothers acting as the primary caregivers (Schober, 2014). Parenting activities (and housework), therefore, are carried out to a much larger degree by mothers despite a slight narrowing of the gender gap since the 1990s, as illustrated in appendix Figure B2. Consistent with the 'primary-male-breadwinner' model, evidence shows that the roll-out of center-based care, as described above, had an employment effect for mothers but made no difference for fathers (Müller and Wrohlich, 2020). In addition, parenting activities (in minutes per day) exhibit a strong upwards time trend for both mothers and fathers, which is broadly comparable to that found in other countries (Dotti Sani and Treas, 2016).

3 Adjustment mechanisms

This section discusses ways in which center-based care usage might affect parenting activities. We focus on the amount of time spent on activities as an outcome rather than any measure of parenting quality or style. We define *direct effects* as changes that occur during the time that the child spends at the child care center, and *indirect effects* as changes that occur outside of center hours as a result of parental adjustments. We describe effects in *absolute terms*, the total time in a day spent on parenting activities, and in *relative terms*, the changes to the time spent on parenting activities as a share of time spent with the child.

3.1 Direct effects

The direct effect (i.e. during center hours) of center-based care on parenting activities in *absolute terms* may be as follows:

- Negative: if center-based care usage reduces the time that a parent spends with their child, when they would have otherwise engaged in some parenting activities in the counterfactual.
- No effect: if center-based care usage does not reduce the time spent with parents. This could be if it fully crowds out informal care, by grandparents, for instance, or if despite being with the child, no parenting activities are done in the counterfactual.
- Positive effects are not possible due to the way we define direct effects as occurring during hours when the child is at the day care center.

Direct effects are most likely negative in absolute terms, as informal care in Germany is typically complementary care rather than a substitute for center-based care (see section 2). Moreover, it is unlikely that no parenting activities at all are done in the counterfactual. Thus, we expect negative effects to prevail, although they may reflect some differences in the distributions of activities across the day in the counterfactual and some adjustments to informal care.

The direct effect on time spent on parenting activities in *relative terms* may be as follows:

- Positive: if center-based care reduces the parent's time spent together with the child during a certain period of the day but does not reduce parenting activities as much relatively since they are more concentrated in another period of the day in the counterfactual.
- Negative: if center-based care replaces a period of the day with many parenting activities in the counterfactual.
- No effect: if parenting activities are equally concentrated across parts of the day in the counterfactual.

Direct effects are most likely positive in relative terms since center-based care typically occurs during the morning and afternoon. These are times when, on average, parents spend less time on parenting activities compared to the evening (this is what we see in our data; see Figure 2).

3.2 Indirect effects

Indirect effects (i.e. outside of center hours) in *both absolute and relative terms* may occur as follows:[7]

- Positive: if center-based care is a complement to parenting activities. This could be if center-based care reduces parental time-constraints or increases parental motivation to interact with their child. Time-constraints may be reduced if parents use the center-based care hours to complete other tasks, such as paid work or housework, thereby freeing up non-center hours for parenting activities. Furthermore, not being at home with a child may mean there is less cleaning and tidying to be done in the evening.[8] Motivation may be increased if spending less time with the child overall means that parents try to ensure that they do more activities with the child in the remaining time. Further, it could be that center-based care inherently encourages parents to interact with their child, e.g. through teacher recommendations (see e.g. Cornelissen et al., 2018; Kuger et al., 2019).[9] Moreover, if center-based care has a direct effect on children's cognitive or socio-emotional development, parents could adjust their inputs in response to this and increase their time spent on specific parenting activities (see Nicoletti and Tonei, 2020).
- Negative: if center-based care is a substitute for parenting activities. This could be the result

[7] Substitution effects leave time spent with child (i.e. the denominator in the 'parenting activities share') unaffected, so all changes in relative terms come about through absolute changes to time spent on child care (i.e. the numerator).

[8] One thing to note is that if increased activities are due to a reduction of time constraints, then this may reflect lower parental stress and a higher quality of interaction than captured by a simple increase in the activity share in time spent with child. Sandner and Thomsen (2020) find evidence that the expansion of center-based care in Germany led to a reduction in cases of child abuse and neglect. They propose a reduction of mental and physical overburdening of parents as the driving mechanism underlying this. Additionally, Schmitz (2020) finds that provision of public child care in Germany directly increases maternal well-being.

[9] This holds especially true if care center staff observe developmental deficiencies, if they believe that educational activities are performed too rarely and/or if they believe that parents are unaware of the benefits associated with them.

of a decrease in parental motivation, e.g. if parents feel that certain activities are no longer necessary since they are already done with child in center-based care. This might be the case in particular if there is a notable positive effect of center-based care on child development. Furthermore, substitution could occur through a worsening of parental time constraints, e.g. if parents use center-based care hours to take on significant extra activities, such as paid work, meaning they have more tasks to do in the evenings instead of parenting activities.

- No effect might arise if center-based care is neither a substitute nor a complement, i.e. if there are no motivation and time-constraints effects or if they are counterbalanced.

While we have priors for the direct effects, there is little evidence on which to base hypotheses regarding the direction of the indirect effects. A separate question is what direction the overall effect might be (i.e. direct and indirect together). Plausibly there might be positive indirect effects on parenting activities that are large enough to overcompensate for a negative direct effect in relative, and, even potentially, absolute terms. Again, we have little guidance to form any priors in this regard. In appendix A, we provide some stylized examples to further illustrate the mechanisms with specific cases.

4 Data and empirical approach

4.1 German Time-Use Survey

We use diary data from three waves of the German Time-Use Survey, which is a repeated cross-section of around 5,000 households per survey wave taken in 1991/92, 2001/02 and 2012/13 (Maier, 2014; Destatis, 2015). The diary data record the main and (optional) secondary activity of each adult household member in five- or ten-minute slots over two or three days using a three-digit classification (see appendix Tables B2 and B3 for further details).[10] An example of a three-digit activity is 'reading to child', which is from the two-digit activity of 'child care', which belongs to the broad one-digit category of 'work in the household'. We use the activities recorded under 'child care' as our parenting activities. In addition to recording specific activities, the survey indicates for each time slot whether it was spent with a child under the age of ten years present. Importantly, the parent need not necessarily record a parenting activity as the main or secondary activity while spending time with the child.[11] The data also includes information on households—such as usage of center-based care, age

[10] The first wave consists of two successively recorded days that are uniformly distributed, meaning that about three quarters of the days in the sample are weekdays. In the two later waves, individuals' activities are recorded over three days, two weekdays and one weekend day.

[11] For example, a parent may record ironing as the main activity and watching television as the secondary activity, while also indicating that the time was spent with a child

of youngest child, number of children, single-parent household, and location in East or West Germany. At the respondent-level, the data includes information on age, gender, education, marital status, and economic activity.

We use parent-days as the unit of observation for our analysis. We define three measures of parental involvement: (1) *time with child,* as the number of minutes on a day that a parent spends together with their child; (2) *parenting activities,* as the number of minutes on a day spent on child care activities as the main activity; and (3) *parenting activities share,* as the proportion of the overall time spent with a child on a day that is spent on child care activities as the main activity. We think of *time with child* as capturing a more basic form of child care than *parenting activities,* since the latter involves specific interactions with the child, which may better foster child development (see e.g. Kalil et al., 2012). Thus, we think of *parenting activities* and the *parenting activities share* as being the relevant measures of the educational potential of the home environment, the first as an absolute measure and the second as a relative measure. To compute *parenting activities share* we divide *parenting activities* by *time with child,* meaning we lose about 4% of observations for this variable, i.e. all cases where the parent spends no time in the presence of the child on a given day.[12] In some specifications, we also distinguish between particular types of parenting activities: reading to the child, playing with the child, talking with the child, and primary care.[13] We also estimate effects on non-parenting activities, like 'paid work', 'housework', and 'leisure' to investigate mechanisms.[14]

In our analysis, we look at effects for mothers and fathers separately and we differentiate households by maternal education. We follow the common practice in the literature (e.g. Fiorini and Keane, 2014; Nicoletti and Tonei, 2020) of grouping households by maternal education, both because it is highly correlated with paternal education and also because mothers are usually the primary caregivers in our context.[15] We define the educational background as higher if the mother (or, very rarely, male single parent) in the household holds a secondary school certificate from the upper educational track in Germany, which ends with a university entry degree *(Abitur)* and lower otherwise. The education split is motivated by differential effects of center-based care on child development found in the literature and well-established differences in parenting activities by education (see e.g. Bradley et al., 2001; Guryan et al., 2008; Kalil et al., 2012; Gimenez-Nadal and Molina, 2013; Dotti Sani and Treas, 2016). We also differentiate by the time of the day (center hours

[12] Conceptually, this is not problematic since the remaining observations give an accurate picture of the activities share during the time that parents and children spend together. Furthermore, the number of observations lost is fairly small and does not differ statistically by center-based care usage.

[13] 'Primary care' covers bodily hygiene, feeding and clothing the child, as well as passive supervision (i.e. 'keeping an eye on' the child).

[14] Leisure consist of the 1-digit activities 'social life and entertainment', 'sport, hobbies and games', and 'media usage' as shown in appendix Table B2 for the 2012/13 survey wave.

[15] In fact, women spent more hours per day on child care than men in all European countries analyzed in Gimenez-Nadal and Molina (2020).

or non-center hours) in specifications that aim to estimate direct and indirect effects. In these specifications the outcomes are the sum of minutes dedicated to each activity during either center hours or non-center hours in a day. However, for *parenting activities share* we divide *parenting activities* during center hours or non-center hours by *time with child* over the whole day.[16]

We restrict our sample to parents whose youngest child is of the enrollment age for center-based care (i.e. under six years old). Furthermore, we drop all parents who have more than one child under ten years old. This restriction reduces the sample by 58% but ensures that *time with child* measures effects on the enrolled child and not any potential indirect effects on time with an older child (who is also under ten years).[17] We do not expect the effects to be dramatically different for the dropped households (with further children under ten) since it is enrollment of the youngest child in center-based care that usually makes the key difference in terms of the child care responsibilities of parents. Indeed, in appendix C.2 we use the household survey data that reports activities on a child basis to show that the coefficients for children of the relevant age (three to six years) are similar whether or not we make the one child under ten restriction. After these restrictions, the main sample comprises 4,490 parent-days and 1,818 person observations. Table 1 presents summary statistics of the main sample.

[Table 1 about here]

To illustrate the diary data, Figure 2 plots the number of minutes per hour of the day spent doing different activities by usage of center-based care. In these descriptive plots we focus only on mothers observed on weekdays, since this subsample of parent-days demonstrates the clearest differences in terms of direct and indirect effects.[18] However, in our analysis, the baseline specifications pool mothers and fathers as well as weekdays and weekend days, to give a clearer picture of effects on parenting activities overall. The descriptive plots show that center-based care is associated with mothers spending less time with their children on weekdays during regular care center hours (08:00-

[16] The alternative would be to divide by *time with child* during center hours or non-center hours, respectively. While this gives a measure of the actual share during that part of the day, it results in distortions where *time with child* is very small or zero in these parts of the day (potentially as an outcome of center-based care usage). Thus, we use *time with child* over the whole day as the denominator. The resulting *parenting activities share* measures the contribution of center hours and non-center hours to the *parenting activities share* for the whole day. As such, the direct and indirect effects sum exactly to the overall effect (for the whole day).

[17] In principle, there remains a problem with *parenting activities* since, unlike *time with child*, these may also refer to children older than ten. In appendix C.2, we show that imposing a restriction of one child of any age barely changes the coefficients but it does result in some loss of precision. Therefore, we proceed with the one child under ten as the best compromise between sample size and external validity.

[18] Figure B1 shows a version pooling mothers and fathers on all days. Figure B2 shows the average daily duration of the activities shown in Figure 2 separately for fathers and mothers by sample wave. Note that the decrease in time spent in paid work by mothers after the first sample wave (1991/92) is driven by mothers in East Germany in the aftermath of the German reunification.

16:00), especially in the morning. There is also a lower share of parenting activities, although it is less pronounced and followed by an apparent increase in the late afternoon and evening (16:00-20:00). Time in paid work is higher for center-based care users, while both housework and leisure are lower during center-based care hours. Finally, we see that mothers with their child in center-based care wake up earlier.

[Figure 2 about here]

4.2 The German Family Panel

For an additional analysis of the effects of full-day vs. half-day center-based care, we use the German Family Panel (*pairfam*), which is a longitudinal household survey collected annually since 2008 and used for researching partnership and family dynamics.[19] The survey records the frequency of specific parenting activities, but only for older children (three years and above) and only since 2013. Therefore, we restrict our sample to data between 2013 and 2019 for children between three and six years of age. While the survey does not collect precise diary data, it gives us around ten times as many observations as does the time-use sample for the full-day vs. half-day care analysis, allowing for greater precision in estimation. We cannot use pairfam to examine day-care vs. no day-care since the activity-questions are only available for children aged three and above who nearly all attend center-based care.

For each child of a parent, the survey asks: *How often have you done the following things with your child during the past 3 months?* An overview of frequencies of shared activities for children in half-day and full-day center-based care is shown in Figure B3. We code indicator variables for whether each activity is carried out at least daily as outcome variables. The data also include information on the type of care each child uses, as well as parent, child, and household characteristics. We code children as being in full-day care if they are in center-based care in the morning *and* afternoon and half-day if they are at center-based care in the morning *or* afternoon.[20] Appendix Table B1 shows summary statistics for children attending half-day or full-day care and for their families and households.

[19] See Bürderl et al. (2020) for a data documentation.

[20] As an alternative measure for full-day care, we use the hours spent in center-based care. As the question on hours is available only from survey year 2014, we prefer the morning/afternoon definition, however, the additional results are similar and presented in appendix Table C7.

4.3 Empirical approach

We start with an unconditional model, whereby we regress parenting activities on center-based care usage controlling only for a set of indicators of child age in years.[21] This unconditional model corresponds to the daily sum of the differences plotted in Figure 2. Next we estimate a conditional model that accounts for selection into center-based care based on observable characteristics: child age indicators, plus child gender, parent age, parent age squared, parent gender, parental education indicators for secondary school track (upper, middle, or lower) and for university degree, marital status, single parent status, number of kids in household, as well as an indicator for weekday observations.[22] We also include indicators for survey wave × region (East/West) to control for the different institutional settings described in section 2. Despite having a fairly rich set of controls, it remains possible that selection into usage of center-based care is driven by unobservable parent characteristics that also affect parenting activities. For the conditional model estimates to be interpreted causally, we must assume that, had they not used center-based care, that user-parents would spend a similar amount of time on parenting activities as non-user-parents, controlling for the institutional context and observables characteristics. This may be reasonable if the difference between usage and non-usage is somewhat exogenous due to the pervasive shortages in the period we cover with our data (see Wrohlich, 2008).

To account for possible selection on unobservables, we examine coefficient stability across unconditional and conditional models. We follow Oster (2019) in making assumptions regarding (i) the maximum achievable R^2, i.e. R^2_{max}, and (ii) the extent of selection on unobservables relative to selection on our set of included controls, i.e. δ. Our main specification assumes $R^2_{max} = 1.3\widetilde{R^2}$ where $\widetilde{R^2}$ is the R-squared of the conditional model. We assume that δ is bounded such that $\delta \in [0,1]$. At the most 'optimistic' bound of $\delta = 0$ there is no selection on unobservables. At the most 'pessimistic' bound of $\delta = 1$, selection on unobservables plays an equal role to selection on the included controls. This seems a reasonable upper bound given we have a fairly rich set of controls. The corresponding identified set of estimates gives us the upper and lower bound for the true effect assuming that the real δ falls between the two extremes. Finally, we provide the δ that would be required based on the coefficient movements and R^2_{max} for the true coefficient to be zero. A very large δ here indicates that the true coefficient is zero only if selection on unobservables is very large relative to selection on our

[21] Given near zero usage rates in the first year of center-based care in this age range and near full usage in the last two years, the relationship between child age and usage has a relatively large deterministic component. Therefore, we include it in the unconditional model. Similar choices are made by Oster (2019) to include, for example, weeks of gestation in the unconditional model for birth weight.

[22] Due to the split by maternal education, the upper schooling track dummy drops out for the sample of mothers. We do not include parental employment as a control since it is a potential outcome of center-based care usage.

controls.

To further address potential selection, in appendix C.3 we estimate a fuzzy-DD that makes use of differences in the timing of the roll-out of center-based care by age group over the waves. We compare these estimates to those from our conditional regression.

5 Results

5.1 Effects of center-based care usage

First, we describe the effect of center-based care usage on parenting activities. Table 2 reports the results for all parents together, for mothers only, and for fathers only, each differentiated by the educational attainment of the mother in the household. For the group of households with lower maternal education, center-based care reduces *time with child* for both mothers and fathers (by 113 minutes and 30 minutes, respectively, in the conditional model). The reductions in *parenting activities* by comparison are relatively small (around 13 minutes for mothers and no significant difference for fathers) and, correspondingly, we see that the *parenting activities share* increases by around five percentage points (ppt) for parents of both gender. For households with higher maternal education, conversely, center-based care reduces time with child for mothers only (and by a smaller amount, 70 minutes, compared with mothers from lower education households). Since the reductions in parenting activities are a little higher in absolute size compared with households with lower maternal education, there is no increase in the parenting activities share overall. The lack of an overall effect is due to a relatively small increase for mothers (that is not statistically significant) being completely offset by a larger negative difference for fathers.

[Table 2 about here]

The coefficients are fairly stable to the inclusion of control variables: in most cases, the identified sets suggest relatively tight ranges. While center-based care usage is related to certain observable characteristics (evident in Table 1), the stability of the coefficients in Table 2 suggests that these differences are not, on average, associated with very different patterns of time use. Nevertheless, one may worry that selection on unobservables is, in reality, unrelated to the degree of selection on unobservables, as assumed by the Oster method. As a further check, appendix Figure C5 shows that using exogenous variation in center-based care usage based on differences in the timing of the roll-out by age group does not result in significantly different coefficients. We proceed using the Oster-bounds since the fuzzy-DD estimates are quite imprecise.

In appendix C.1, we explore heterogeneities for mothers and fathers beyond the household split by maternal education. We find that the different effects on parenting activities share are driven mostly through mothers' interactions with daughters outside of care hours. This is consistent with research for the U.S., Canada and the UK that shows evidence of more interaction in same-sex parent-child relationships (e.g. Lundberg et al., 2007; Baker and Milligan, 2016), except that our result relates to changes in activities from center-based care usage. We also find increasing effects over the survey waves, consistent with the increasing time that children spend in center-based care over the period. The effects are also greater during weekdays, as one would expect, but there does appear to be some spillover to the weekends, thus justifying the pooling of these observations for the main analysis.

5.2 Direct and indirect effects

In order to explore the mechanisms, Figure 3a plots estimates (identified sets and 90 percent confidence intervals) by time of the day and maternal education (circles for lower, squares for higher maternal education) for parenting outcomes. The effects during typical care center hours (8am-4pm on weekdays) aim to capture direct effects, whereas changes during non-center hours (all remaining hours, i.e. 4pm-8am on weekdays, and full weekend days) reflect indirect effects. In appendix Table C2, we present the full regression table, which also includes separate effects for the 'night time' (which we define as 8pm-8am) that we refer to where relevant.

The figures illustrate that both direct and indirect effects play an important role in explaining the differences in effects between households with lower and higher maternal education. During center hours, mothers and fathers in households with lower maternal education reduce their *time with child* by more than mothers and fathers in households with higher maternal education (though the differences are not statistically significant), but without reducing their *parenting activities* by as much. As a result, there is no decrease in the *parenting activities share* during center hours for the lower maternal education group but there is a decrease for the higher maternal education group. The latter result represents a negative direct effect.

Indirect effects, however, are just as important. For the lower maternal education group, there are decreases in time with child for both mothers and fathers during non-center hours, but no corresponding decrease in parenting activities, resulting in an increase in the parenting activities share as an indirect effect.[23] It is this positive indirect effect plus the lack of decrease as a direct effect that results in the positive effect overall for this group. In appendix Table C3, we additionally show which

[23] Table C2 reveals that a lot of the decrease in time with child comes from spending less time with the child at 'night' (8pm-8am), which appears to be driven by an earlier bedtime that is not fully outweighed by an earlier alarm clock. An increase in child sleep, therefore, may be an additional benefit beyond the increase in activities share at home.

specific child care activities are affected:[24] for households with less educated mothers, there is an increase in reading to the child outside of center hours and a decrease in primary care at night-time. For the higher maternal education households in Figure 3a, there is an increase in the parenting activities share outside of center hours, but it is smaller and not significant. While mothers increase the parenting activities share by a significant amount that is similar to their lower education counterparts, fathers from these households do not increase their activities share pulling down the overall effect. It is this smaller indirect effect combined with the negative direct effect that results in no overall effect for this group.

[Figure 3 about here]

To gain further understanding of these differences, Figure 3b presents the effects of center-based care for four non-parenting activities: paid work, housework, leisure, and sleep by time of day and maternal education. The figures show that paid work increases during center hours (a direct effect) are largely driven by mothers, with effects that are a little smaller in size to the decreases in time with the child. Further, there are decreases in housework and sometimes other activities (leisure and sleep) that presumably would have been done during time with the child had it been at home. This is consistent with evidence that mothers use day-care to take up paid work (Müller and Wrohlich, 2020) instead of multi-tasking child care and housework. The lower maternal education group, looking at mothers and fathers together, has a similar reduction in housework but a statistically larger reduction in leisure time during center hours. These differences can help explain the smaller reductions in parenting activities for the lower maternal education group as a direct effect since they suggest that center-based care replaces time with child that is not as activity-rich as it is for higher-education parents.

Turning to non-center hours (indirect effects), the figures provide an insight into whether the increases or decreases in parenting activities are driven by effects on parental motivation or by changes to parental time constraints. For the lower maternal education households, there is an increase in paid work outside of center hours that matches a decrease in sleep. The differences are a little larger for mothers than for fathers and may reflect early shifts (before 8am) that require earlier waking.[25] For lower education mothers there is a decrease in housework outside of center hours. This decrease in housework may explain how lower education mothers carry out just as many parenting activities despite spending less time with the child outside of center hours: the time before the child goes to bed

[24] Those specific child care activities are not available in the 1991/92 wave of the survey.
[25] Appendix Table C2 reveal that these changes occur during the 'night' which is defined as 8pm to 8am.

is more concentrated on activities with the child rather than on other activities such as housework. This could reflect either a motivation effect (e.g. a change in priorities) or a time constraints effect (e.g. if there is less housework to do). For the higher maternal education households, there is also an increase in paid work and a decrease in sleep for mothers (albeit less pronounced) but for fathers the differences go in the opposite direction: a decrease in paid work and an increase in sleep outside of center hours. This result suggests a potential easing of time constraints for fathers from households with higher maternal education. Nevertheless, these fathers increase their leisure time outside of center hours suggesting that potential positive motivation effects may be playing less of a role than for other parents.

5.3. Effects of full-day vs. half-day center-based care

Thus far, the analysis has focused on the effects on parenting activities of using center-based care compared with not using it, irrespective of the number of hours of care used per day. The full-day vs. half-day margin may have different effects on parenting activities, which we explore in this section. Knowing the effects of full-day care on parenting activities is important since this is the relevant decision for many parents (i.e. children over three years and older in Germany, nearly all of which use center-based care —see Figure 1). It may also contribute to our understanding of the child development effects for full-day care, which tend to be differently beneficial for children from lower SES households depending which skills are examined (e.g. Loeb et al., 2007; Felfe and Zierow, 2018).

The 2012/13 wave of the German time-use survey contains information on the hours of center-based care normally used. Figure 4 plots the full-day vs. half-day effects (i.e. conditional on usage of center-based care) on parenting (Figure 4a) and non-parenting activities (Figure 4b).[26] As before, we plot estimates by time of day for both parents, mothers and fathers, and by maternal education. Both the higher and lower maternal education groups see slight decreases in the parenting activities share during center hours but no change outside of center hours. For lower maternal education households, the decrease in center hours, which is not statistically significant overall, is made up of a large decrease by mothers and a small increase by fathers. Outside of center hours, mothers spend more time with the child and increase their activities but since fathers decrease their activities there is no effect on activities overall in absolute or relative terms. For higher maternal education households, the decrease during center hours is significant (although similar in size) and reflects mothers spending less time with their child but reducing activities more than proportionally. The decreases in time with child during center hours for higher education mothers coincide with changes to paid work and housework, as before. However, in contrast to usage vs. non-usage, the increase in paid work are

[26] We define full-day care as 31 hours of care per week or more, and half-day as 30 hours per week or less.

similar in size to the reductions in time with child suggesting worsening time constraints, which may help explain the lack of indirect effects.

[Figure 4 about here]

In order to investigate full-day effects with greater precision, along with effects on specific parenting activities, we turn to the German Family Panel (pairfam).[27] Using this data, we estimate effects of full-day vs. half-day care on the probability of carrying out specific parenting activities on at least a daily basis. Table 3 shows the effects of full-day care on specific parenting activities (Panel A). We think of the first four activities (reading, music, art, and playing) as *educational activities* and the last three (outdoors, sports and TV) as *recreational activities*. For households with lower maternal education,[28] reading and playing is negatively affected by usage of full-day care, with effects being mainly driven by fathers. Music and arts are unaffected for mothers and fathers in lower educated households. In higher educated households, in contrast, reading is not reduced, but negative effects for arts and playing come from mothers. Finally, the frequency of musical activities is not reduced for either household type. For recreational activities, daily outdoor activities become less likely with full-day care, but sports and TV are unaffected. The negative effects for higher educated parents come through mothers rather than fathers.

[Table 3 about here]

Consistent with the time-use data, full-day care also allows for an increase in paid work that is larger for mothers with higher educational attainment (Panel B) and non-existent for fathers from either group. We also find that mothers with higher education are more likely to feel stressed and feel that they spend too little time with their child when full-day care is used, this effect is smaller for mothers with lower education. These findings point to greater time constraints faced by mothers whose children are in full-day care compared to half-day care, potentially reducing the capacity to be involved in parenting activities. This effect seems most pronounced for mothers with higher educational attainment. The last three rows of Panel B look at child outcomes. We see evidence for a reduction in children's nightly sleep.[29] Looking at two measures of children's well-being, as reported by parents, we find that irritability is not affected whereas perceived happiness of children of lower

[27] Focusing on one wave and only parents who use center-based care in the time-use data means the sample in the time-use survey is too small to focus on specific parenting activities.

[28] As in the time-use data, the household education level is defined by the mother's or single parent's formal education level.

[29] We were unable to examine children's sleep in the time-use data.

educated households is somewhat reduced. This is in line with evidence of negative effects on socio-emotional behavior of full-day care on disadvantaged children (Loeb et al., 2007, Felfe and Zierow, 2018).

6 Conclusion

This paper asks: what is the effect of using center-based care on parenting activities? We outline a framework of potential mechanisms that involve direct effects occurring during center hours and indirect effects outside of those hours. Overall, our analysis shows that using center-based care results in relatively small decreases in parenting activities in absolute terms and an increase in relative terms. The positive effect on the activities share is driven by mothers and fathers from households with lower maternal education increasing their concentration of parenting activities outside of center hours (indirect effect). For households with higher maternal education the indirect effects are smaller because a positive effect for mothers is attenuated by no effect for fathers. The small indirect effect is balanced against a negative direct effect, since day care replaces relatively activity-rich time with the child, resulting in no effect overall.

Our analysis of non-parenting activities sheds some light on these different findings. In terms of direct effects, the reductions in time with child during center hours tend to coincide with increases in paid work, and reductions in housework and leisure for mothers of both education levels. Thus, center based care is used to take up paid wok instead of multi-tasking child care with other activities. Lower education households see a greater reduction in housework and leisure, which helps explain why they have smaller reductions in parenting activities since it suggests that center-based care replaces time with child that is not as activity-rich as it is for higher-education parents. In terms of indirect effects, decreases in sleep and time spent on housework allow lower education parents to maintain a high concentration of activities with children outside of care hours, consistent with either motivation or time constraints explanations. The decrease in activities share for higher education fathers outside of care hours, however, comes together with a decrease in paid work and an increase in leisure and sleep, suggesting that motivation effects may not be as strong.

A specific analysis of the full-day vs. half-day margin finds that using center-based care for 31 hours or more does not seem to be associated with increased parenting activities in relative terms. In fact, it appears to reduce the activities share slightly, due to a negative direct effect and a lack of positive indirect effects. Analysis using survey data shows small reductions in the frequency of certain activities (e.g. 5-12 ppt reduction of daily playing) as a result of using full-day care over half-day care, as well as increases in parental stress and some evidence for reduced happiness for children from households with lower maternal education.

Our findings imply a need for greater awareness that development effects of center-based care may come through changes in the home environment not just through the usage of center-based care *per se* or through quality of this care. Thus, policymakers may want to consider strengthening the home environment channel through the following five measures: (1) Allowing center-based care to ease parental time-constraints. Our analysis covers a period when usage of center-based care was expected to facilitate paid employment, and, in the earlier years, this was even the condition for a place. While such conditions may increase the employment effects of center-based care, they may do so at the expense of child development by shutting out one of the mechanisms, i.e. the easing of parental time-constraints. (2) Placing a policy focus on the interaction between parents and child care center staff. Care center teachers can help to advise parents with regards to their child's specific developmental progress and challenges. This may be strengthened by ensuring that care center teachers have adequate time for interaction with parents. One implication of our results for higher maternal education households is that it may be beneficial to specifically encourage participation of fathers in such interactions with day care staff. The data in appendix Table B6 reveal that most parents have either never sought advice from care center teachers or have done so just once or twice, despite 84 percent of parents reporting a high desire to exchange information about the child (see also Camehl et al., 2015). (3) Encouraging usage of center-based care by households with lower educational backgrounds. Our findings imply that the home environment channel is strongest for these households, however, these households are less likely to be enrolled in center-based care with children under 3 years. Research suggests that enrollment gaps with respect to maternal education are best addressed in Germany by improving availability of places and a reduction of parental fees (Jessen et al., 2020). (4) Improving the quality of center-based care. While our findings highlight an alternative channel for child development effects of center-based care, they should not detract from the importance of child care center quality as one policy priority. Instead, they suggest a complementary way of achieving similar policy goals. Indeed, there is evidence that qualitatively good center-based care can have positive effects on the quality of the home environment (e.g. Kuger et al. 2019). (5) Funding targeted programs to improve the home environment. Examples of existing programs are the Nurse Family Partnership Program, Incredible Years, Triple P, and Strengthening Families, Strengthening Communities (for a recent overview see e.g. Camehl et al., 2020). Such programs may strengthen the home environment channel if they help parents to become more engaged with teachers and more receptive to their children's learning needs. Evidence shows that home environment programs are most effective if they are combined with other programs that improve the quality of center-based care (e.g. Heckman and Mosso, 2014).

Data acknowledgments

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Further analyses in this paper are based on data from the first eleven waves of the German Family Panel (pairfam), release 11.0 (Brüderl et al., 2020). A detailed description of the study can be found in Huinink et al. (2011).

This paper also uses data from the National Educational Panel Study (NEPS): Starting Cohort Kindergarten, doi:10.5157/NEPS:SC2:8.0.1. From 2008 to 2013, NEPS data was collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network.

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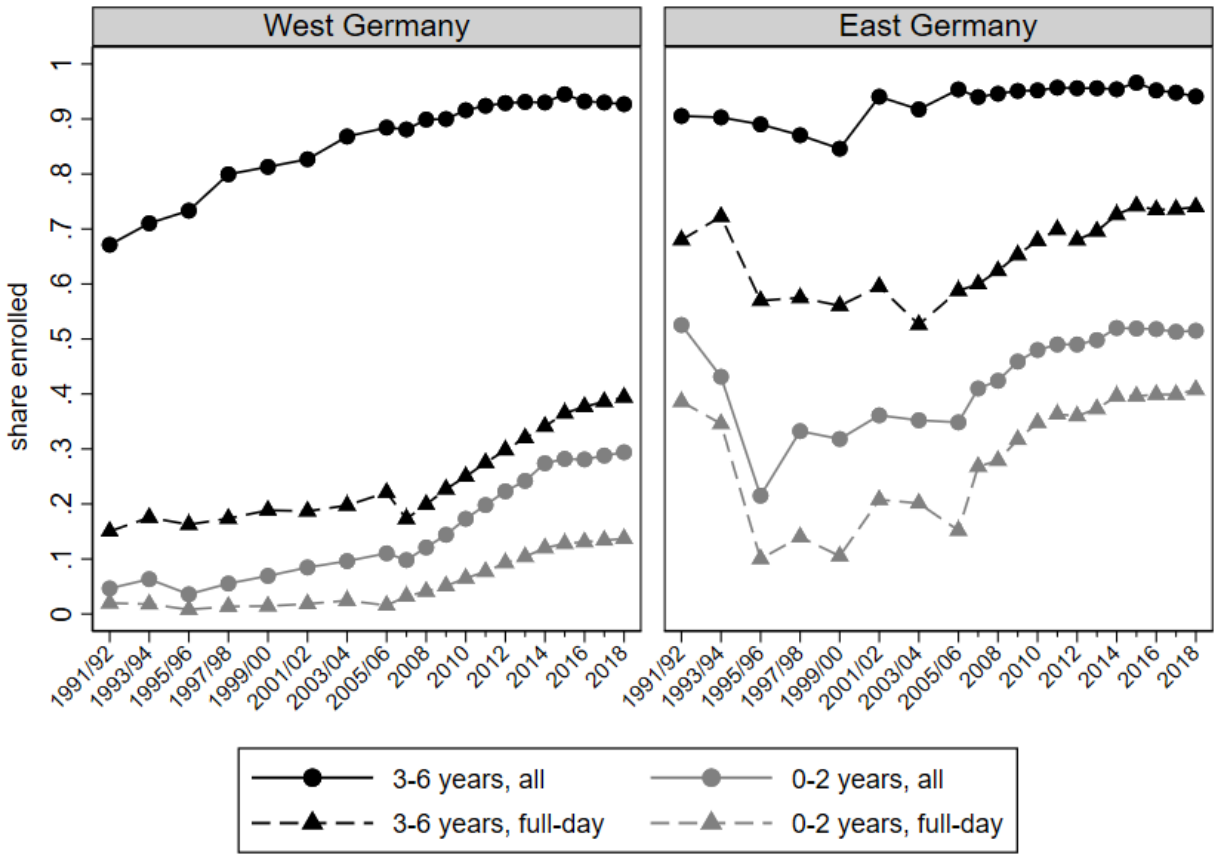
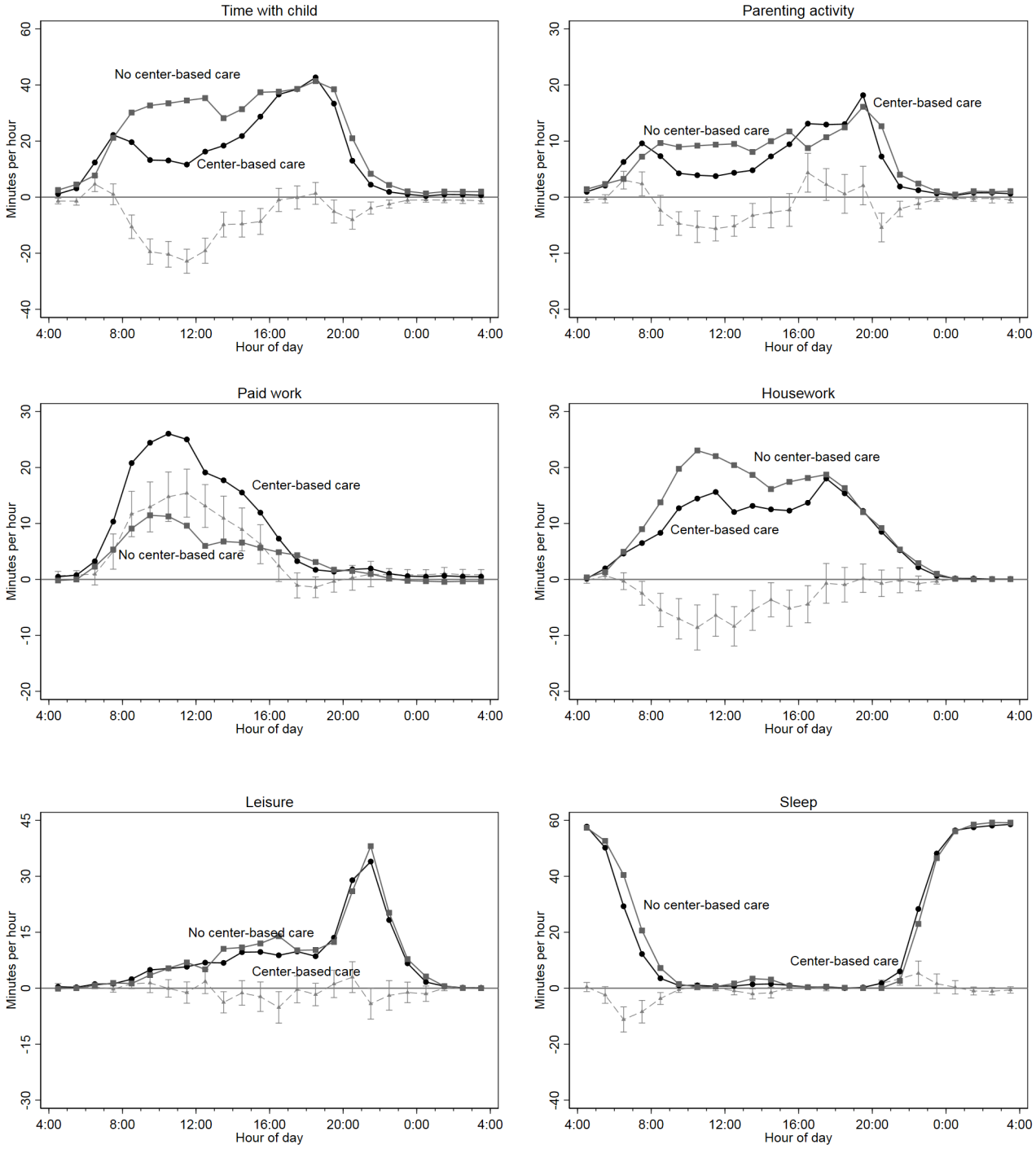
Figures

Figure 1: Share of children enrolled in center-based care by region, age group, and time



Note: Figure shows the share of children aged 0-6 years enrolled in center-based care and in full-day care by region (West vs. East Germany) and age group over time. Enrollment includes formal child care centers and care by qualified publicly funded child minders. Data for 1991/92-2005/06 from the German Socio-Economic Panel (SOEP v35), which is a long-running household survey containing information on about 15,000 households per year (Goebel et al., 2019). For precision, data is pooled in two-year bins. Annual statistics since 2007 from the German Federal Statistical Office (starting that year, official administrative data contain the share in full-day care).

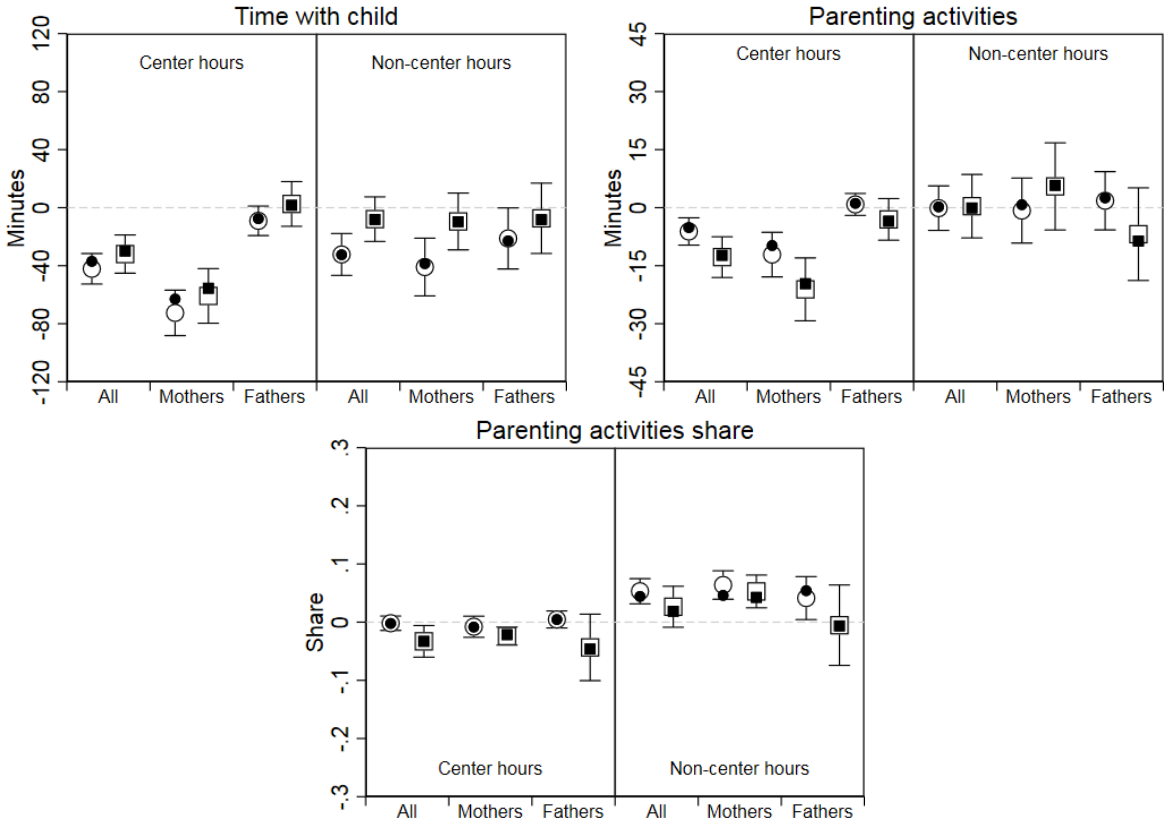
Figure 2: Mothers' activities on weekdays by usage of center-based care



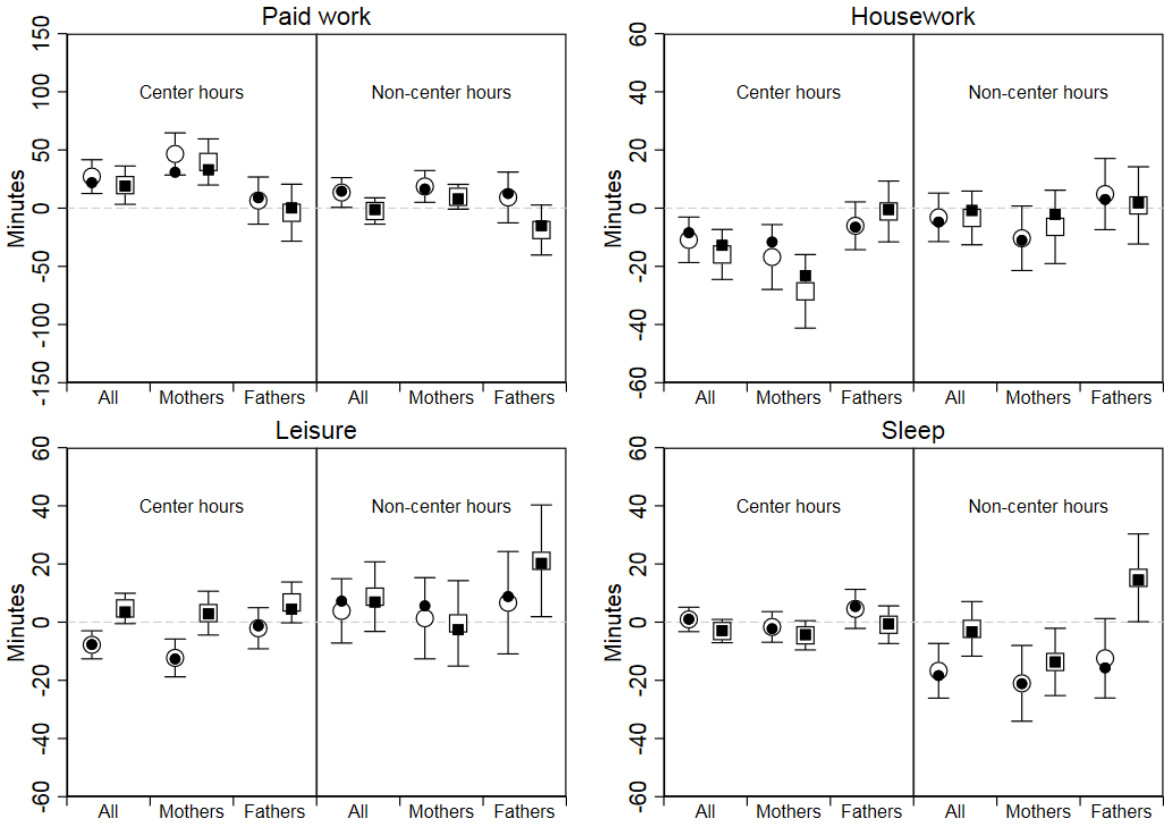
Notes: Circles denote mothers with a child in center-based care, squares those without. Differences and averages are estimated in weighted regressions with indicators for child age and evaluated at mean values. Whiskers indicate 95% confidence intervals. Data consists of time slots in ten minute intervals (five in the first survey wave), which then are aggregated by hour of day. Sample includes mothers on weekdays only. Figure B1 shows the same plots but with fathers and mothers pooled over all days. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Figure 3: Effects by time of day and education

(a) Parenting



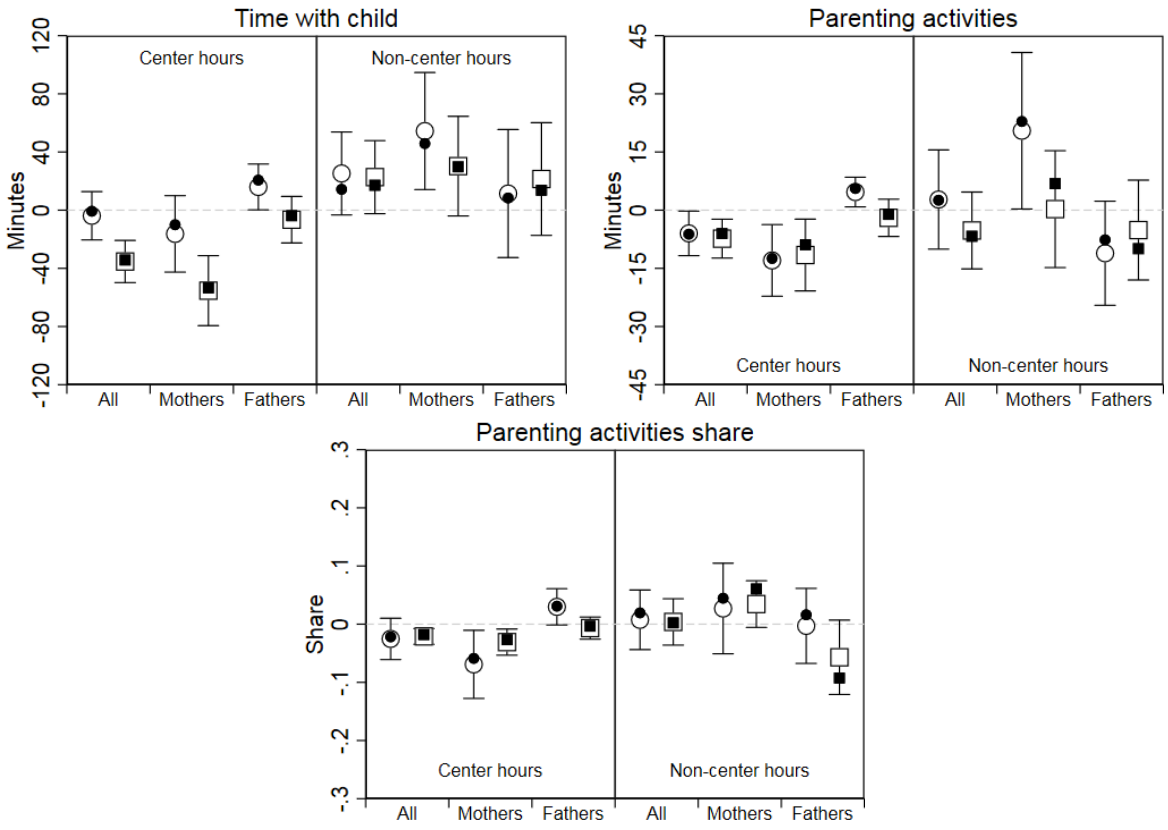
(b) Other activities



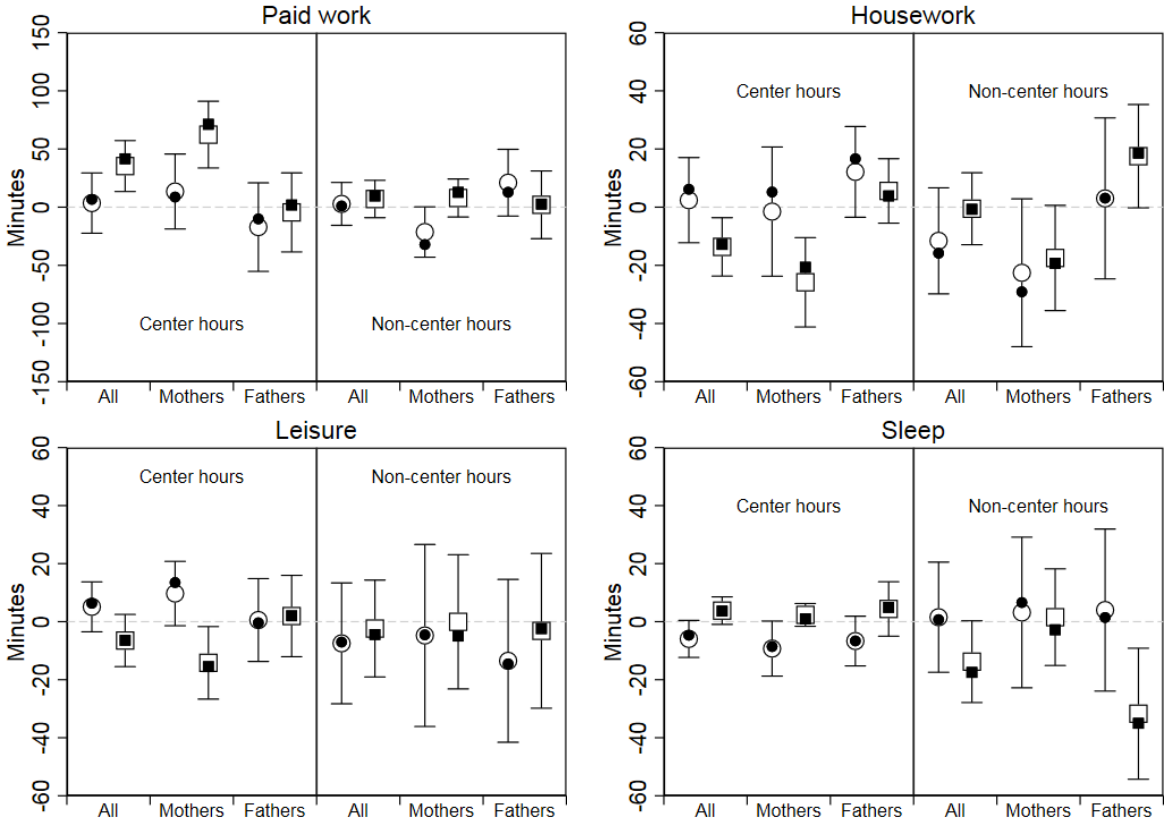
Notes: Center hours are from 8am-4pm on weekdays, non-center hours are the remaining hours on weekdays (12am-8am and 4pm-12am) and the entire weekend days. Circles denote lower education households, and squares denote higher education. Education level of the household is based on whether the mother in the household (or the single parent) has a secondary school degree from the higher track (*Abitur*). The plots show the conditional difference in outcome variables by center-based care usage. Each estimate is based on a separate regression of the outcome summed over center hours or non-center hours on an indicator for usage of center-based care and controls (see notes to Table 2 for details) using all three waves of the time-use survey (1991/02, 2001/02 and 2012/13). The hollow shapes and whiskers indicate the conditional coefficient ($\delta = 0$) and the 90% confidence intervals. The filled shapes indicate estimates under the assumption of $\delta = 1$, i.e. equally large selection on unobservables as on observables. The filled and hollow shapes together indicate the identified set. Table C2 reports coefficients along with means of the outcome variables, and the δ required for zero coefficient, as well as separating out effects occurring at 'night' (which we define as 8pm-8am). Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Figure 4: Full-day vs half-day care effects by time of day and education, wave 3 only (2012/13)

(a) Parenting



(b) Other activities



Notes: Each estimate is based on a separate regression of the outcome summed over center hours or non-center hours on an indicator for usage of full-day center-based care (> 30 vs. 10-30 hours per week) and controls (as in Table 2) using the sample of center-based care users. Circles denote lower education households, and squares denote higher education. The filled and hollow shapes together indicate the identified set. See Figure 3 for further notes. Table C4 reports coefficients along with means of the outcome variables, and the δ required for zero coefficient. Source: German Time-Use Survey (2012/13)

Tables

Table 1: Characteristics of German Time-use Survey subsample by enrollment in center-based care

	(1)	(2)	(3)
	Center-based care		
Variable	No	Yes	Difference
Parent characteristics			
Female (0/1)	0.54	0.55	0.006
	(0.02)	(0.01)	(0.024)
Age in years	33.37	36.27	2.904***
	(0.26)	(0.21)	(0.332)
Higher educated (0/1)	0.37	0.41	0.048**
	(0.02)	(0.01)	(0.024)
Married (0/1)	0.82	0.79	-0.030
	(0.02)	(0.01)	(0.019)
Single parent (0/1)	0.08	0.09	0.016
	(0.01)	(0.01)	(0.014)
Economically active (0/1)	0.57	0.66	0.089***
	(0.02)	(0.01)	(0.024)
Economically part-active (0/1)	0.10	0.15	0.053***
	(0.01)	(0.01)	(0.016)
East Germany (0/1)	0.13	0.36	0.237***
	(0.01)	(0.01)	(0.019)
Child characteristics			
Girl (0/1)	0.49	0.52	0.024
	(0.02)	(0.01)	(0.024)
Age in years	1.30	3.61	2.310***
	(0.05)	(0.04)	(0.060)
Person-day observations	1588	2902	4490
Person observations	647	1171	1818

Robust standard errors in parentheses.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Table 2: Effects of center-based care on parenting activities

	Households with lower maternal education			Households with higher maternal education		
	All parents	Mothers only	Fathers only	All parents	Mothers only	Fathers only
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Time with child (minutes per day)						
Unconditional	-86.3***	-141***	-29.2*	-44.4***	-81.6***	-.157
	(12.9)	(16.1)	(16)	(15.1)	(18.2)	(20.8)
Conditional	-74.4***	-113***	-30.3**	-39.9***	-70.3***	-4.8
	(11.5)	(16.6)	(14.9)	(13.3)	(18.1)	(18.9)
Mean	336.475	427.119	227.138	360.388	444.836	258.904
Identified set	[-74.390, -69.609]†	[-113.481, -91.122]†	[-30.682, -30.281]†	[-39.895, -37.911]†	[-70.345, -60.650]†	[-6.729, -4.797]†
δ for 0 coefficient	8.68	3.08	33.4	9.83	3.96	-3
Observations	2482	1357	1125	2008	1096	912
Outcome: Parenting activities (minutes per day)						
Unconditional	-8.96**	-17.7***	.311	-12.5**	-18.3**	-5.91
	(4.49)	(6.27)	(4.93)	(6.28)	(8.4)	(7.9)
Conditional	-6.29	-12.9**	2.62	-12.4**	-15.6*	-9.9
	(4.26)	(6.45)	(4.98)	(6.19)	(8.95)	(8.27)
Mean	90.520	125.380	48.471	106.688	140.370	66.212
Identified set	[-6.289, -4.637]†	[-12.878, 4.597]	[2.620, 3.774]†	[-12.397, -12.313]†	[-15.627, 1.088]	[-13.466, -9.895]†
δ for 0 coefficient	3.2	.797	-2.75	11.4	.964	-4.24
Observations	2482	1357	1125	2008	1096	912
Outcome: Parenting activities share						
Unconditional	.0604***	.0802***	.0335*	.00281	.0377**	-.0407
	(.0153)	(.0216)	(.0198)	(.0242)	(.017)	(.0498)
Conditional	.0514***	.0561***	.0461**	-.00639	.0289	-.0486
	(.0151)	(.0197)	(.0223)	(.0275)	(.0186)	(.056)
Mean	0.297	0.327	0.259	0.317	0.339	0.290
Identified set	[0.044, 0.051]†	[0.037, 0.056]†	[0.046, 0.058]†	[-0.013, -0.006]†	[0.022, 0.029]†	[-0.053, -0.049]†
δ for 0 coefficient	4.41	2.5	-6.85	-1.22	3.04	-43.2
Observations	2370	1334	1036	1925	1072	853

Notes: Table shows coefficients from OLS regressions of the outcome variables on an indicator variable for usage of center-based care. Parenting activities share has a lower observation count since some observations are lost when dividing by zero time with child, as discussed in the data section. Unconditional coefficients are from a regression that includes only indicators for child age in years. The conditional coefficients are from regressions that include the child age dummies, and additionally child gender, parent age (linear / squared), parent gender, parental education indicators for upper, middle, or lower secondary school track (upper drops out for sample of mothers due to split by maternal education) and for university degree, marital status, single parent status, number of kids in household, a weekday indicator, and wave × region indicators. Households with higher maternal education are where the mother in the household (or single parent) was in the upper secondary school track (required to enroll in university) and those with lower educated mothers are where the mother took the lower or middle track. The identified set shows coefficients obtained using the method developed by Oster (2019), where $R^2_{max} = min\left\{1.3 \times \tilde{R}^2, 1\right\}$ assuming selection on unobservables is between zero ($\delta = 0$) and a level equal to selection on observables ($\delta = 1$). † denotes that the identified set excludes zero. The last row for each outcome variable shows how large the relative selection on unobservables must be to obtain a coefficient of 0. Appendix Table C1 shows the identified set for $R^2_{max} = min\left\{2.2 \times \tilde{R}^2, 1\right\}$. Robust standard errors reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Table 3: The effect of full-day care on parenting and non-parenting activities

	Households with lower maternal education			Households with higher maternal education		
	All parents (1)	Mothers (2)	Fathers (3)	All parents (4)	Mothers (5)	Fathers (6)
Panel A: Parenting activities						
Education activities						
Reading books or telling stories (daily)	-0.050***	-0.040*	-0.073**	0.001	0.005	-0.011
	(0.019)	(0.023)	(0.031)	(0.015)	(0.016)	(0.026)
Singing or playing instruments (daily)	-0.004	0.019	-0.035	-0.016	-0.013	-0.023
	(0.017)	(0.024)	(0.022)	(0.017)	(0.024)	(0.021)
Painting, building or drawing (daily)	-0.018	-0.029	0.003	-0.043***	-0.082***	0.003
	(0.017)	(0.024)	(0.023)	(0.016)	(0.023)	(0.022)
Playing games together (daily)	-0.095***	-0.082***	-0.116***	-0.055***	-0.121***	0.021
	(0.019)	(0.024)	(0.030)	(0.017)	(0.023)	(0.026)
Recreational activities						
Outdoor activities (daily)	-0.069***	-0.093***	-0.026	-0.054***	-0.088***	-0.012
	(0.019)	(0.024)	(0.029)	(0.017)	(0.024)	(0.025)
Gymnastics, sports (daily)	-0.011	0.004	-0.029	-0.009	0.008	-0.035
	(0.019)	(0.025)	(0.031)	(0.018)	(0.024)	(0.027)
Watching television or videos (daily)	-0.030	-0.043*	-0.010	0.009	-0.001	0.024
	(0.020)	(0.025)	(0.032)	(0.019)	(0.025)	(0.027)
Panel B: Non-parenting activities and other outcomes						
Parental outcomes						
Paid work (at least 10 h/w)	0.115***	0.170***	0.027	0.105***	0.185***	0.000
	(0.016)	(0.024)	(0.017)	(0.014)	(0.023)	(0.013)
Weekly hours in paid work	3.821***	6.123***	0.451	4.384***	8.232***	-0.244
	(0.582)	(0.754)	(0.914)	(0.547)	(0.752)	(0.786)
Personal monthly net income	164.487***	261.447***	24.083	227.728***	419.873***	48.345
	(33.305)	(37.959)	(58.274)	(60.269)	(51.238)	(126.902)
Too little time with child (0/1)	0.066***	0.092***	0.026	0.082***	0.186***	-0.050
	(0.024)	(0.029)	(0.042)	(0.022)	(0.028)	(0.033)
Feeling stressed (1-5)	0.007	0.057	-0.088	0.145***	0.264***	-0.005
	(0.047)	(0.060)	(0.080)	(0.041)	(0.052)	(0.065)
Hours of sleep (parent)	-0.008	-0.002	-0.041	0.001	-0.049	0.049
	(0.047)	(0.061)	(0.075)	(0.035)	(0.050)	(0.050)
Child outcomes						
Hours of sleep (child)	-0.174***	-0.193***	-0.131*	-0.129***	-0.153***	-0.110*
	(0.051)	(0.067)	(0.078)	(0.041)	(0.054)	(0.064)
Child is happy and content (1-5)	-0.071**	-0.094**	-0.032	0.041*	0.018	0.064*
	(0.028)	(0.037)	(0.043)	(0.023)	(0.031)	(0.034)
Child is irritable and cries often (1-5)	-0.032	-0.035	-0.026	-0.033	-0.005	-0.074
	(0.044)	(0.059)	(0.067)	(0.039)	(0.052)	(0.058)
Observations	2864	1764	1100	3137	1725	1412

Notes: Table shows conditional coefficients from OLS regressions of the outcome variables on an indicator variable for full-day care (defined as attending center-based care in the morning *and* afternoon) for the sample of center-based care users. Additional controls: dummies for child age, number of children in family, parent and child gender, age of parent, indicator for migrant status, single parent indicator, and an indicator for higher secondary schooling track (for the sample of mothers this drops out due to the split). See appendix Tables C5 and C6 for unconditional coefficients and Oster-bounds. Appendix Table C7 shows coefficients for an alternative full-day assignment (by hours of usage). Source: pairfam survey 2013-2019.

APPENDIX (FOR ONLINE PUBLICATION)

A Stylized examples of adjustment mechanisms

Figure A1 presents some stylized examples to illustrate various adjustment effects discussed in section 3. For simplicity of exposition, we focus the illustration on weekdays and waking hours (7:00 until to 20:00). Effects are illustrated by comparing the 'no center-based care' timeline (i.e. the baseline) to the other timeline where center-based care is used. In the 'no center-based care' baseline, the parent spends 13 hours with the child, and four of these are spent on parenting activities throughout the day. As a result, parenting activities in the home environment occur over the day with a share of $4/13 = 0.31$. In scenario 1, the child attends center-based care from 08:00 until 16:00. As a result the child is no longer present with the parent during these hours.[1] The direct effect is a decrease in parenting activities in absolute terms of one hour. As parenting activities outside day care hours are unchanged, there is no indirect effect. In relative terms, there is an overall increase in the share of parenting activities from 0.31 to $3/5 = 0.6$ equaling an increase of 0.29. The increase comes about because center-based care occurs during a time of day when parenting activities are less-concentrated in the counterfactual.

Scenarios 2 and 3 illustrate the indirect effect, i.e. changes outside of center hours. If center-based care is a complement for parenting activities (scenario 2), it results in an increase of parenting activities in the evening period by one hour in absolute terms. This corresponds to a positive effect in relative terms, too and the share of parenting activities increases for the whole day from 0.31 to 0.8.[2]

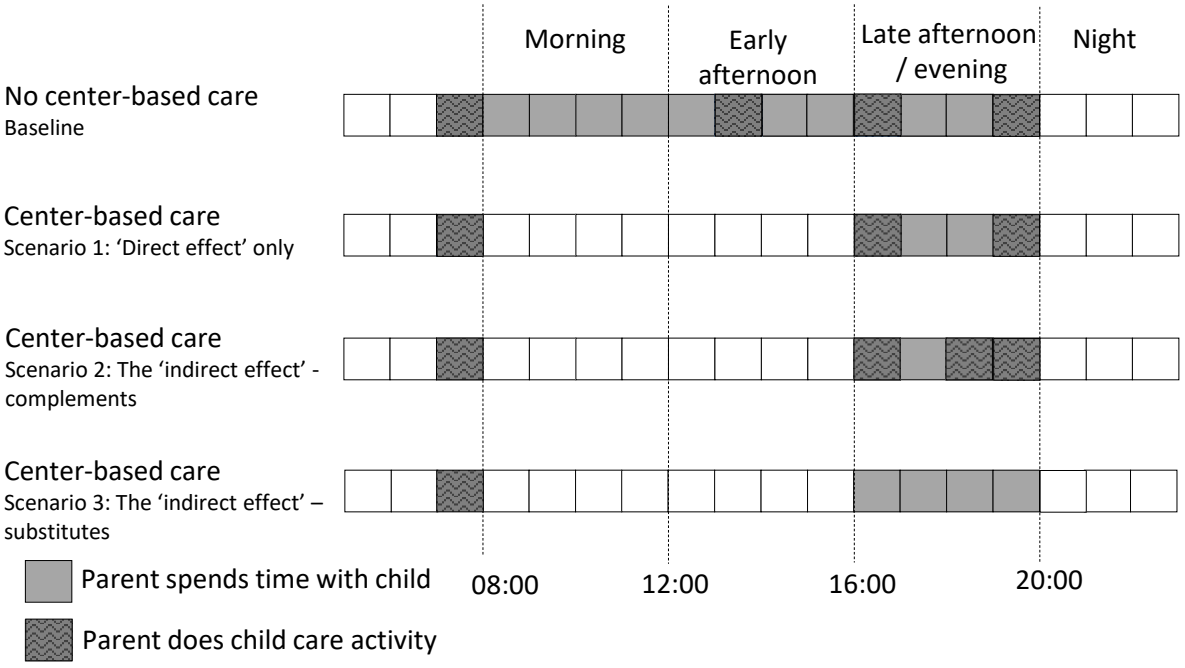
Scenario 3 shows the indirect effect in the substitute case, where there is a reduction by 2 hours in the evening. The overall absolute effect then is a reduction of parenting activities by 3 hours. Furthermore, the relative effect is also negative with the share of parenting activities decreasing from 0.31 to 0.2 (and from 0.23 to 0.2 during non-center hours only).

Another aspect not covered by the examples—besides night and weekend adjustments—is that center-based care may affect the *type of parenting activities*: Parents might change the share of specific types of parenting activities that are most greatly associated with child development (e.g. reading to the child, see Kalb and van Ours, 2014; Price and Kalil, 2018) This change could work in ways similar to the previous two effects. The usage of center-based care may displace parenting activities of a certain type from one period of the day to another (e.g. if reading is done before sleep rather than during the day). Likewise, usage of center-based care may result in positive or negative indirect effects on particular activities.

[1] In this simplified framework, we assume a direct relationship between usage of center-based care and time spent with the child. As discussed though, in reality the relationship may be less strong, e.g. in cases where center-based care displaces informal care, e.g. by grandparents.

[2] Looking at the (wake) non-center hours only, i.e. the one pre-day care hour in the morning and the four hours in the late afternoon / evening, the parenting activities share increases from 0.23 to 0.8. Note that, as discussed in the data section, when calculating the parenting activities share, the total time a parent spends with the child during the days is used as the denominator.

Figure A1: Adjustment of parenting activities with use of center-based care



Notes: Figure illustrates adjustments of time with the child and of parenting activities when center-based care is being used under different scenarios. The upper line shows time use when no center-based care is being used, the bottom three lines show different scenarios when the child is in center-based care. See text for additional details.

B Data

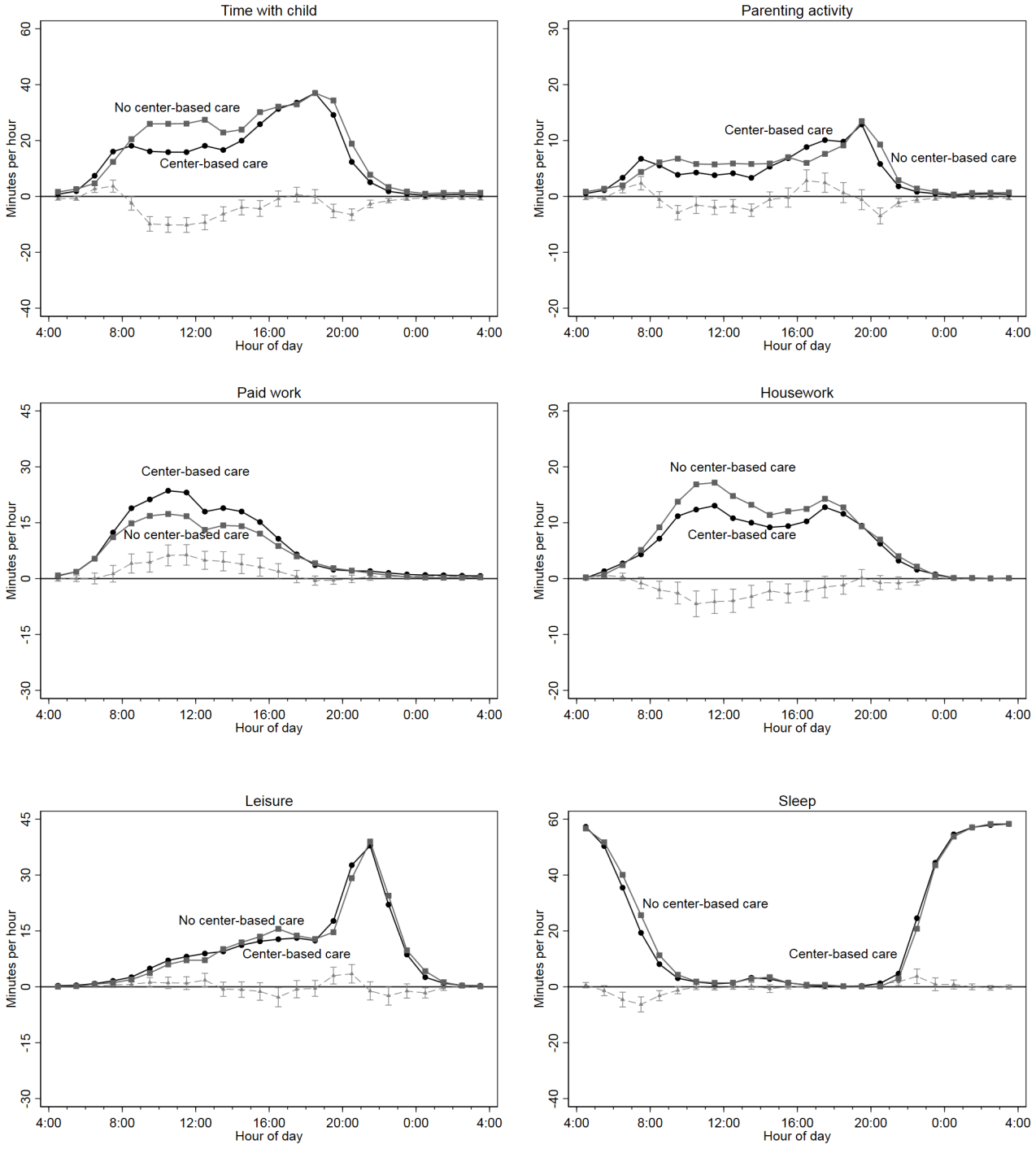
B.1 Additional descriptives for time-use data and pairfam

Table B1: Characteristics of pairfam subsample

	(1)	(2)	(3)
	Amount of center-based care		
Variable	Half-day	Full-day	Difference
Parental characteristics			
Female (0/1)	0.58	0.58	-0.005
			(0.013)
Age in years	35.72	36.15	0.422***
			(0.135)
Migration background (0/1)	0.22	0.19	-0.037***
			(0.010)
Higher educated (0/1)	0.46	0.53	0.076***
			(0.013)
Married (0/1)	0.81	0.70	-0.106***
			(0.011)
Paid work (at least 10 h/w, 0/1)	0.71	0.83	0.117***
			(0.011)
Weekly hours in paid work	25.66	30.81	5.151***
			(0.477)
Personal net income (in Euro)	1426.15	1602.27	176.113***
			(40.560)
Household net income (in Euro)	3538.35	3638.63	100.281*
			(59.046)
Child characteristics			
Girl (0/1)	0.49	0.50	0.013
			(0.013)
Age in years	4.52	4.57	0.052**
			(0.022)
Number of siblings	1.43	1.28	-0.153***
			(0.025)
Observations	3345	2660	6005

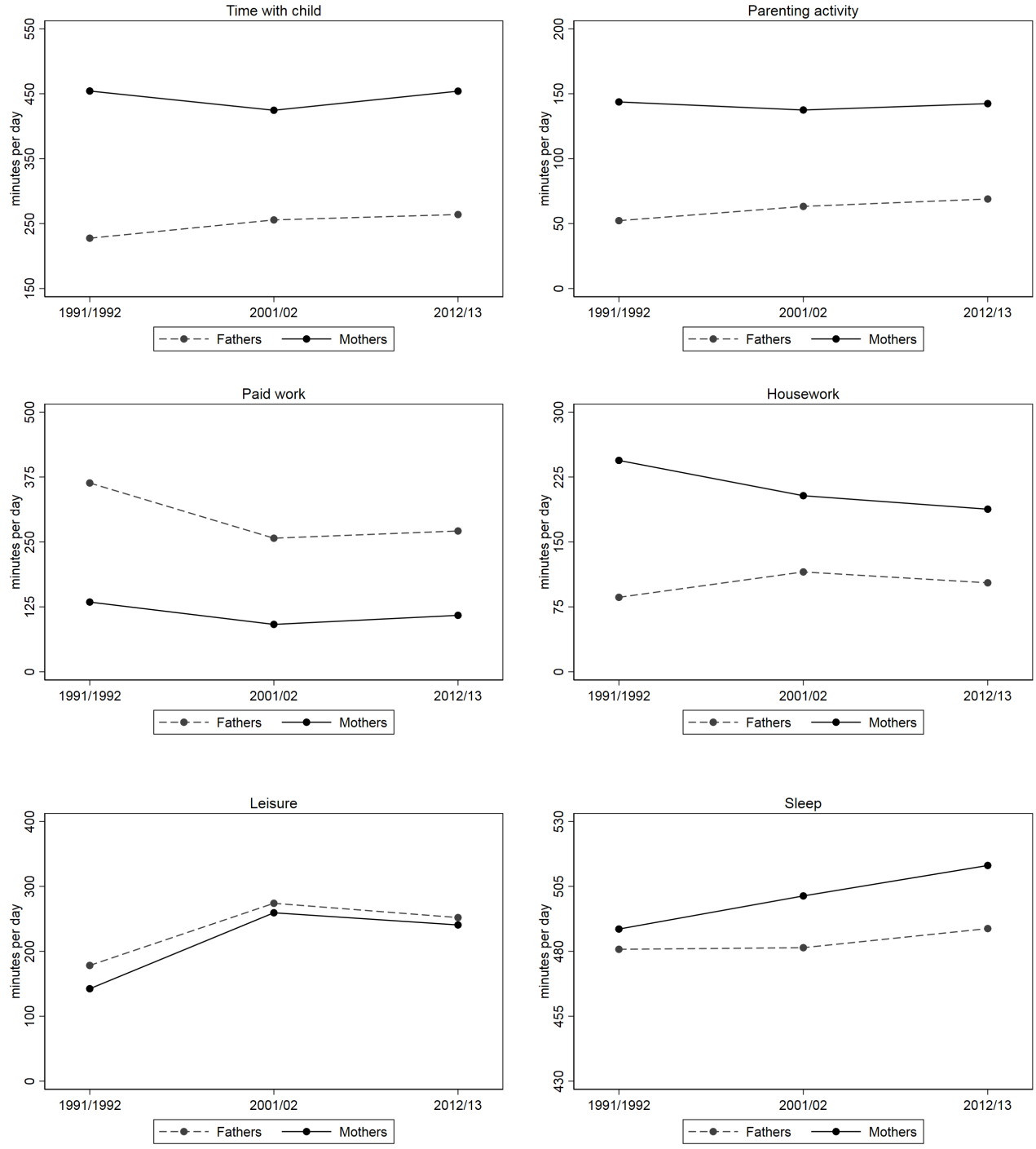
Notes: Full-day child care indicates usage of center-based care in the morning *and* afternoon. Half-day care morning *or* afternoon. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: pairfam, 2013-2019

Figure B1: Parents' activities by usage of center-based care



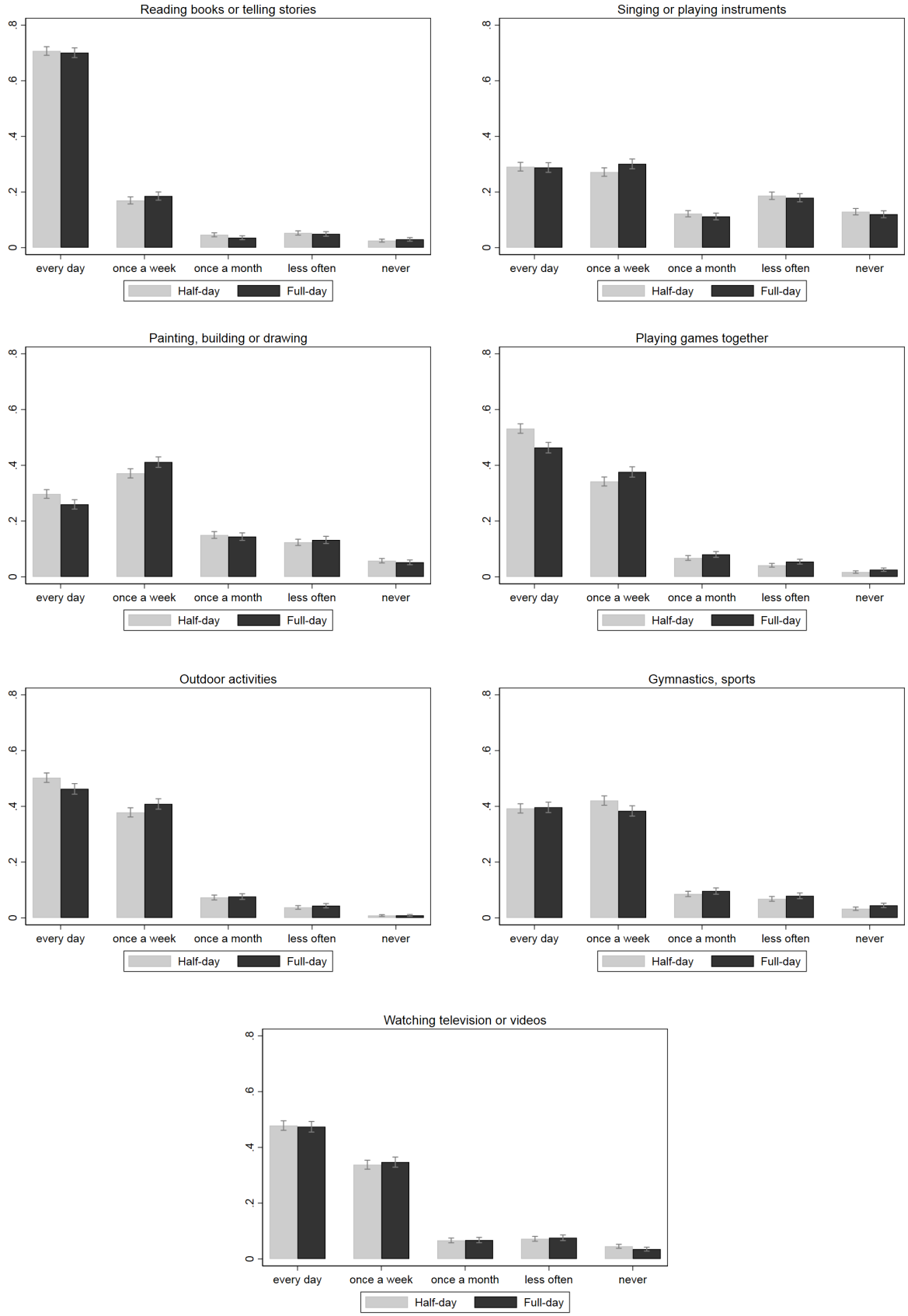
Notes: Circles denote parents with a child in center-based care, squares those without. Differences and averages are estimated in weighted regressions with indicators for child age and evaluated at mean values. Whiskers indicate 95% confidence intervals. Data consists of time slots in ten minute intervals (five in the first survey wave) which then are aggregated by hour of day. Sample includes weekdays (68%) and weekend days (32%), pools mothers and fathers. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Figure B2: Average time use for mothers and fathers by survey wave



Notes: Coefficients are obtained by regressing activities on an indicator for mothers (vs. fathers) with child-age indicators and then evaluating means at average values (regressions are weighted). Sample consists of weekdays and weekend days. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Figure B3: Shared activities with the child by half- or full-day usage of center-based care



Notes: Figure shows the frequency of activities of mothers or fathers with their children (in the previous three months). Whiskers show 95% confidence intervals. Source: pairfam, 2013-2019.

B.2 Activities categories in time-use data

Table B2: Overview of activities in time-use data, 2012/13 wave

Broad activity (1-digit)	German title of 1-digit activity	# of 3-digit activities	Examples of 3-digit activities
Personal care	"Persönlicher Bereich / Physiologische Regeneration"	5	Sleep, eating and drinking, washing and dressing, ...
Paid work	"Erwerbstätigkeit"	9	Main work, secondary work, On-the job training, ...
Qualifications / Education	"Qualifikation / Bildung"	29	German lessons, higher education, training outside of work hours, ...
Household and family care	"Haushaltsführung und Betreuung der Familie"	43	Preparing meals, shopping, small repairs, ...
Voluntary work	"Ehrenamtliche Tätigkeit / Freiwilligenarbeit / Unterstützung für andere Haushalte / Teilnahme an Versammlungen"	5	Voluntary work, supporting other households, political events, ...
Social life and entertainment	"Soziales Leben und Unterhaltung"	14	Talking (with friends), cinema, relaxation, ...
Sport, hobbies and games	"Sport / Hobbys / Spiele"	20	Going for a walk, hunting / fishing, computer games, ...
Media usage	"Mediennutzung"	13	Reading newspaper, watching TV, communication with computer or smartphone, ...
Travel time	"Zweckbestimmte Wegezeiten und Hilfscodes"	27	Travel time to main work, travel time to school, travel time to visit friends, ...

Notes: Table summarizes the broad (1-digit) activities that are reported in the German time-use data set. The English-language activity labels are our own translation from the tables available with the time-use survey data for 2012/2013. Full tables for each wave (in German) can be accessed at the website from the research data center of the German Federal Statistical Office:
`https://www.forschungsdatenzentrum.de/de/haushalte/zve`

Table B3: List of detailed parenting activities in time-use data, 2012/13 wave

Code	Activity	German (original)
2-digit category		
47	Child care	"Kinderbetreuung im Haushalt"
3-digit category		
471	Primary care, hygene and supervision	"Körperpflege und Beaufsichtigung"
472	Assisting homework / giving instructions to child	"Hausaufgabenbetreuung/Anleitungen geben"
473	Playing and doing sports with child	"Spielen und Sport mit Kindern"
474	Talking with child	"Gespräche mit Kindern im Haushalt"
475	Accompanying child / realising appointments with child	"Kind begleiten/Termine mit dem Kind wahrnehmen"
476	Reading to child / telling stories	"Kindern vorlesen/Geschichten erzählen"
479	Other activities with child	"Sonstige Aktivitäten im Bereich Kinderbetreuung"

Notes: Table reports the detailed (3-digit) parenting activities reported in the time-use data set, 2012/13 wave. The English-language activity labels are our own translation from the tables available with the time-use survey data for 2012/2013. Full tables for each wave (in German) can be accessed at website for the research data center of the German Federal Statistical Office:
`https://www.forschungsdatenzentrum.de/de/haushalte/zve`

B.3 Data on informal care

Table B4: Weekly hours in care - SOEP

Variable	Obs	Mean	Std. Dev.	P25	P50	P75
All care types	14311	21.447	20.145	1	20	37
Informal care (outside the household)	14311	5.055	9.433	0	2	6
>0 hours (0/1)	14311	.554	.497	0	1	1
>20 hours (0/1)	14311	.05	.217	0	0	0
>30 hours (0/1)	14311	.02	.141	0	0	0
Family	14311	4.622	8.943	0	1	6
Other informal	14311	.433	3.114	0	0	0
Center-based care	14311	16.392	17.28	0	15	30
>0 hours (0/1)	14311	.52	.5	0	1	1
>20 hours (0/1)	14311	.416	.493	0	0	1
>30 hours (0/1)	14311	.243	.429	0	0	0
Center-based care	14311	15.614	16.846	0	0	30
Center-based care (conditional on usage)	7218	31.325	8.784	25	30	40
Age of child (in months)	14311	33.588	23.072	12	31	63

Notes: Sample consists of children aged 0-72 months. Averages are calculates using survey weights. All care types include all forms of care indicated besides care provided by the respondent or the partner. Family care consists of care by the partner (if not living in the household), grandparents, older siblings and other relatives. Other informal care arrangements are nannies or a residual *other* category. Formal care reflects hours spent at either center-based care (95.1% in our data) or with publicly funded family day care (4.9%). Sample covers survey years 2010-2018. Data from the German Socio-Economic Panel (SOEP v35), which is a long-running household survey containing information on about 15,000 households per year (Goebel et al., 2019).

Table B5: Usage of formal and informal care

	Below 3		Above 3		Below 3		Above 3		All
	Center-based care				Full-day care				
	No	Yes	No	Yes	No	Yes	No	Yes	
Weekly hours at center-based care	0.00	28.56	0.00	28.80	23.60	33.71	24.93	33.61	21.26
	(0.00)	(12.06)	(0.00)	(11.01)	(11.27)	(10.62)	(9.76)	(10.57)	(15.91)
Family care in morning	0.18	0.03	0.14	0.03	0.05	0.02	0.03	0.03	0.07
	(0.39)	(0.18)	(0.35)	(0.16)	(0.21)	(0.15)	(0.16)	(0.16)	(0.25)
Family care in afternoon	0.23	0.25	0.21	0.28	0.28	0.22	0.31	0.24	0.26
	(0.42)	(0.43)	(0.41)	(0.45)	(0.45)	(0.42)	(0.46)	(0.43)	(0.44)
Family care - any time	0.25	0.26	0.24	0.28	0.29	0.22	0.31	0.24	0.27
	(0.44)	(0.44)	(0.43)	(0.45)	(0.45)	(0.42)	(0.46)	(0.43)	(0.44)
Other informal care in morning	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01
	(0.12)	(0.05)	(0.16)	(0.05)	(0.05)	(0.06)	(0.05)	(0.04)	(0.08)
Other informal care in afternoon	0.02	0.03	0.04	0.04	0.03	0.03	0.04	0.04	0.03
	(0.14)	(0.17)	(0.20)	(0.20)	(0.18)	(0.16)	(0.20)	(0.19)	(0.18)
Other informal care - any time	0.02	0.03	0.04	0.04	0.03	0.03	0.04	0.04	0.03
	(0.14)	(0.17)	(0.20)	(0.20)	(0.18)	(0.16)	(0.20)	(0.19)	(0.18)
Observations	2560	1871	226	5991	963	908	3336	2655	10648

Notes: Sample consists of children aged 0-72 months. Columns are split by age of the child (0-2 vs. 3-5 years) and by usage of center-based care. Full-day care is defined as using center-based care in the morning and afternoon in contrast to only one of these (thus conditional on day care usage). Family care includes grandparents, siblings and other relatives. Other informal care arrangements consist of friends, a nanny in-house, and other non-relatives. Source: pairfam, 2013-2019.

B.4 Center-based care activities with children

This appendix section examines the activities children are exposed to at center-based care.[3] We use two data sets for this; first, the National Educational Panel Study *NEPS*, in which the Starting Cohort Kindergarten (SC2) contains interviews with educators and heads of child care centers (Blossfeld and von Maurice, 2011). This allows for looking at the regularity of various activities performed at the institutions. As a second data source we use the data set *Educational Processes, Competence Development and Selection Decisions in Preschool and School Age (BiKS-3-10)*, which started in two German states (Hesse and Bavaria) in 2005. The starting sample of BiKS consisted of 550 children from 97 child care centers (Weinert et al., 2013). Educators were (among other aspects) asked about the regularity and duration of extracurricular activities as well as the broader institutional environment. Parents were further asked detailed questions about their children and their assessment of the child care centers.

In Panel A of Table B6 the frequency of regular activities are shown. The activities listed are all arguably enhancing cognitive development (e.g. books, puzzles, number games, musical activities) or motor skills (e.g. tinkering, sports). Although no information on the minutes per activity are included in the data, it is evident that the educational content is relatively high, as many activities are being performed daily or even several times per day. Panel B displays the frequency of extracurricular activities and — conditional on offerings — the average length of these. Most institutions offer extra activities, usually once or twice a week. Although these findings are not nationally representative, as the BiKS-3-10 data stems from two West German states, it suggests that children are not merely being supervised at center-based care but that they are often exposed educational activities.

[3]There are some obvious caveats to this; we do not know how often and how long children take part in activities if they are performed at the group level and they will less frequently experience one-to-one interactions in center-based care (Clarke-Stewart et al., 1994). Many activities can also be less beneficial for children if they are conducted in groups rather than in one-on-one interactions (thus perhaps requiring more exposure time at center-based care compared to at home).

Table B6: Activities in center-based care

	(1)	(2)	(3)	(4)
Panel A: NEPS SC2				
Frequency of regular activities (share)	Several times per day	Daily	Several times per week	Weekly
Books / letter games	0.445	0.086	0.102	0.009
Puzzles	0.515	0.065	0.067	0.003
Number games	0.408	0.089	0.127	0.015
Building things / tinkering	0.581	0.046	0.027	0.001
Musical activities	0.195	0.241	0.173	0.039
Sports	0.203	0.160	0.202	0.082
Experiencing nature	0.091	0.134	0.183	0.071
Observations	2775	2775	2775	2775
Panel B: BiKS-3-10				
Extra curriculum activities	Offered (share)	Weekly frequency	Minutes per offering	Minutes per week
Any activity	0.919			
Sport	0.760	1.205	29.338	32.891
Foreign languages	0.349	1.377	11.446	9.422
Craft activities	0.327	1.688	11.774	17.008
Nature studies	0.524	1.015	36.868	24.610
School preparation	0.837	2.018	60.583	79.240
Musical activities	0.645	1.705	16.100	19.800
Observations	172	172	172	172
Panel C: BiKS-3-10				
Parental responses to center-based care attendance				
		No	Yes	
Center-based care attendance enriched relationship with child		0.297	0.703	
		Never	Once or twice	Several times
Have sought advice for child rearing by care center staff		0.334	0.417	0.248
		Unwilling	Rather high	High
Desire to exchange information about child		0.025	0.139	0.836
Observations		438	438	438

Notes: Panels A shows the frequency of regular group activities in child care centers. Activities are coded on a seven point scale from less than once a month to several times a day. Panel B shows extra curriculum activities offered at child care centers. Columns (2) and (3) in Panel B are conditional on offerings. Panel C show parental reactions to care center enrollment of their child. Source: NEPS SC2 (2011-2012) and BiKS-3-10 (2005-2006).

C Results

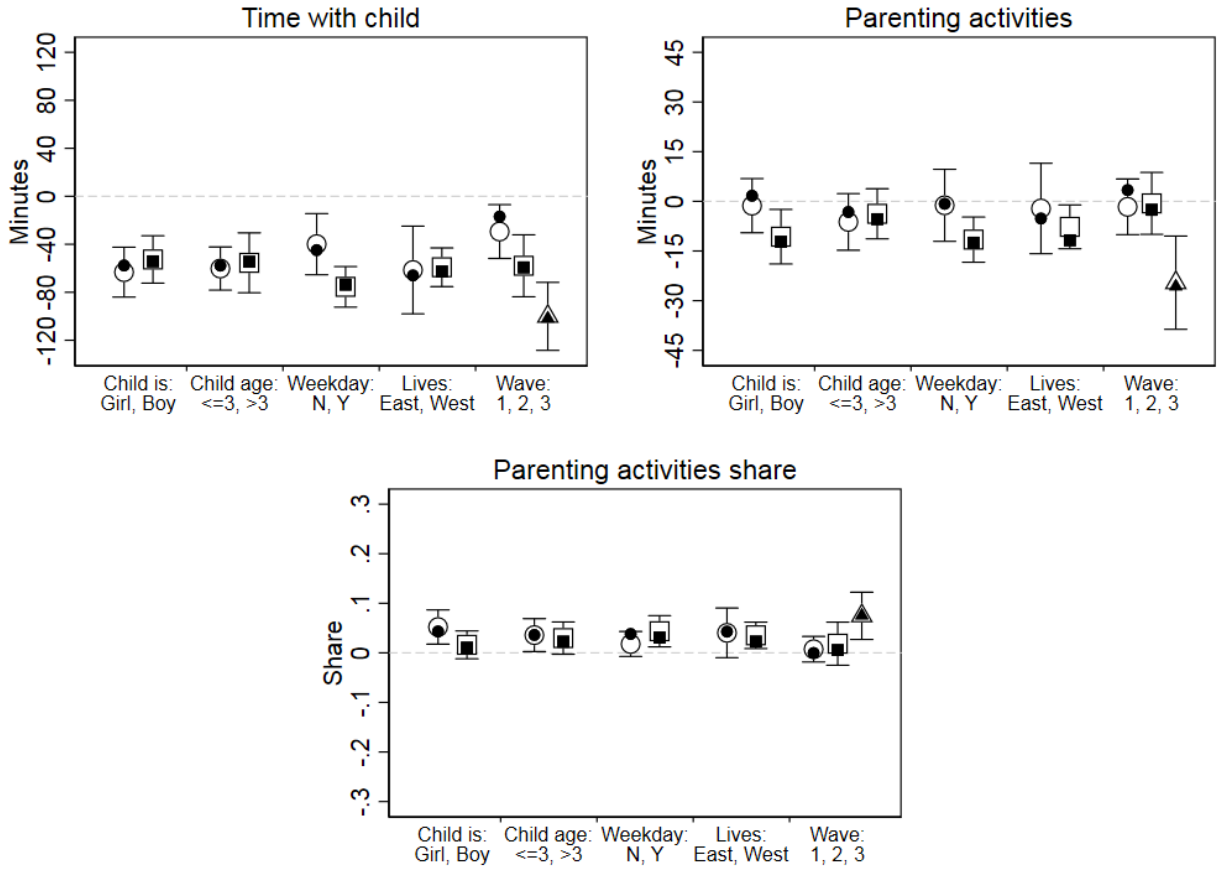
C.1 Heterogeneous effects

We explore further heterogeneities of the effect of center-based care on parenting activities. In Figure C1, we split the sample by sex of the child, (male/female), by child age (under and over three years), by day of the week (weekdays, weekend days) by location (East/West Germany), and by survey wave (1991/92, 2001/02, 2012/13). Some of these sample splits are motivated by the different center-based care environments for different age groups, different regions and over time (see section 2): in East Germany enrollment rates have always been substantially higher and, since the mid-2000s, the whole of Germany has seen a strong increase in enrollment for under threes and in full-day care for all age groups (Jessen et al., 2018).

The heterogeneity analysis reveals that a larger part of the overall effects on the share of parenting activities come through girls. For both boys and girls, using center-based care reduces parents' time spent with the child but for boys there is a nearly proportionate decrease in parenting activities whereas, for girls, parents continue to maintain the same absolute level of child care. In Figure C2, we investigate this further, finding that the effect for girls is driven by positive indirect effects. In particular, there is a significant increase in parenting activities by mothers outside of center hours despite a decrease in time spent with the child in those hours. For boys there are small increases in the activities share both as an indirect effects that comes through both mothers and fathers. Overall, same-sex interactions appear to be positively effected by center-based care usage. This result may be explained by, e.g., research from the U.S. that shows mothers spend more time on activities with daughters and fathers spend more time on activities with sons (Lundberg et al., 2007).

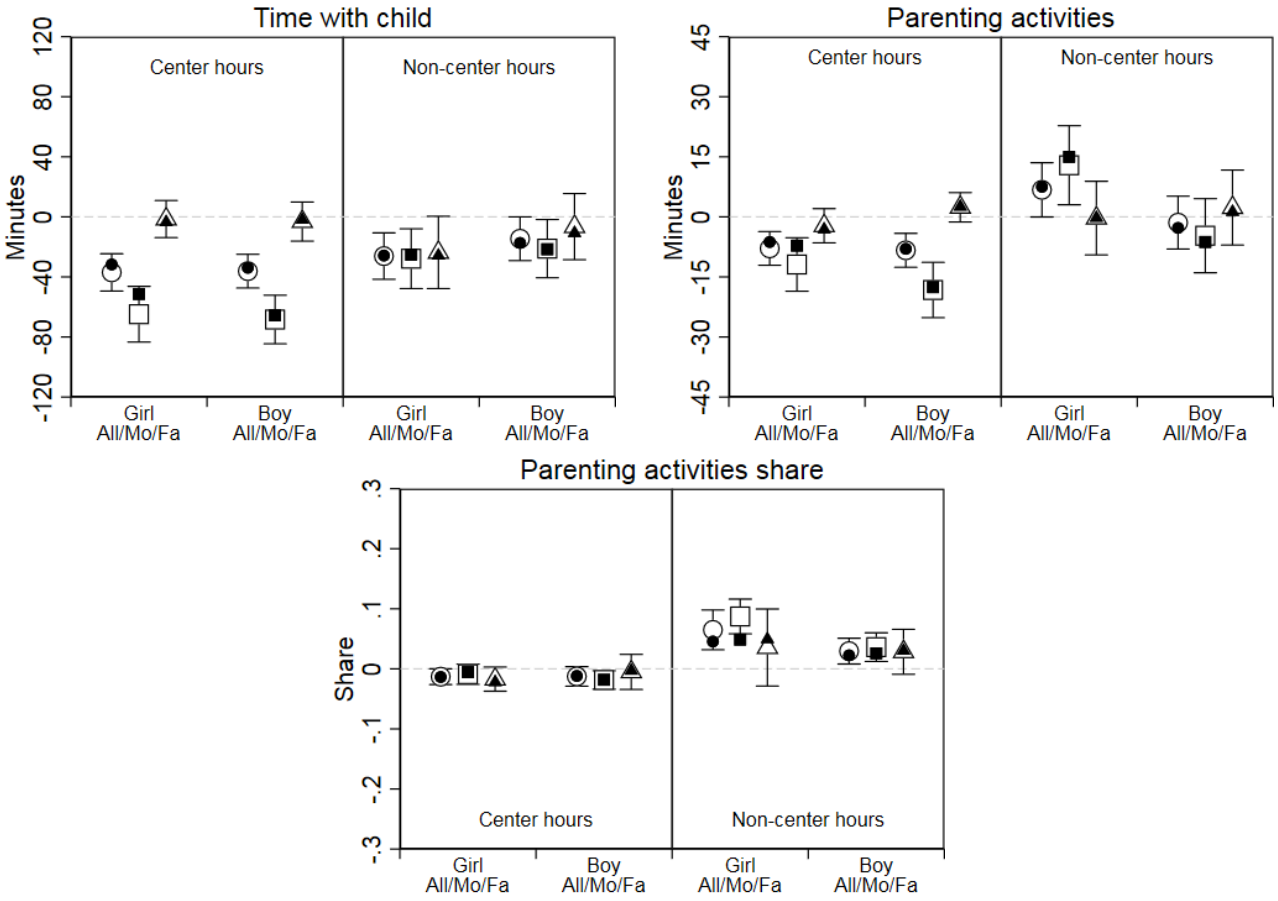
In Figure C1 there is little heterogeneity by child age, nor by region. For survey wave, we observed increased magnitude of effects for later waves, consistent with more child care center places and longer average hours of care in more recent years.

Figure C1: Heterogeneity in overall effects on parenting activities – mothers and fathers pooled



Notes: Plots show heterogeneities in effects of center-based care on parenting activities. Circles denote the respective first, squares the second and triangles (if applicable) the third group. Estimates are based on separate sub-sample regressions of the outcome variable on a center-based care indicator and controls (see notes to Table 2 for details). Waves 1, 2, and 3 correspond to the time-use survey waves 1991/92, 2001/02, and 2012/13 respectively. The hollow shapes and whiskers indicate conditional coefficient ($\delta = 0$) and the 90% confidence intervals. The filled shapes indicate estimates under the assumption of $\delta = 1$, i.e. equally large selection on unobservables as on observables. The filled and hollow shapes indicate the identified set. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Figure C2: Effects of center-based care on parenting activities for boys and girls

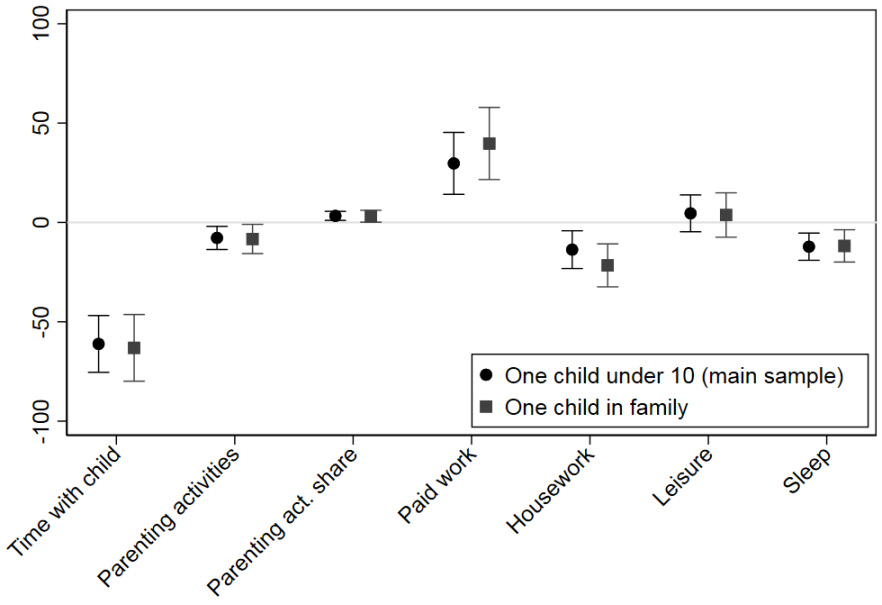


Notes: Plots show heterogeneities by gender of child in effects of center-based care on parenting activities. Circles denote mothers and fathers pooled, squares denote mothers and triangles fathers. See Figure 3 for further notes. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

C.2 Tests of sample restrictions

In this appendix section, we compare coefficients when different sample restrictions are imposed. Our main analysis sample with the time-use data is restricted to families with one child *under 10 years*. In Figure C3, we compare coefficients when we tighten the requirement and impose that only one child *of any age* is in the family (this reduces the observation number from 4,295 to 2,984). The reason for this is that although we know that the outcome *time with child* is constructed in the survey such that it only refers to children under 10, other parenting activities could still be conducted with older children (although these are arguably mostly performed with younger children and not with those of secondary school age). Coefficients in Figure C3 from both samples are remarkably similar and statistically indistinguishable.

Figure C3: Comparison of coefficients by sample restrictions

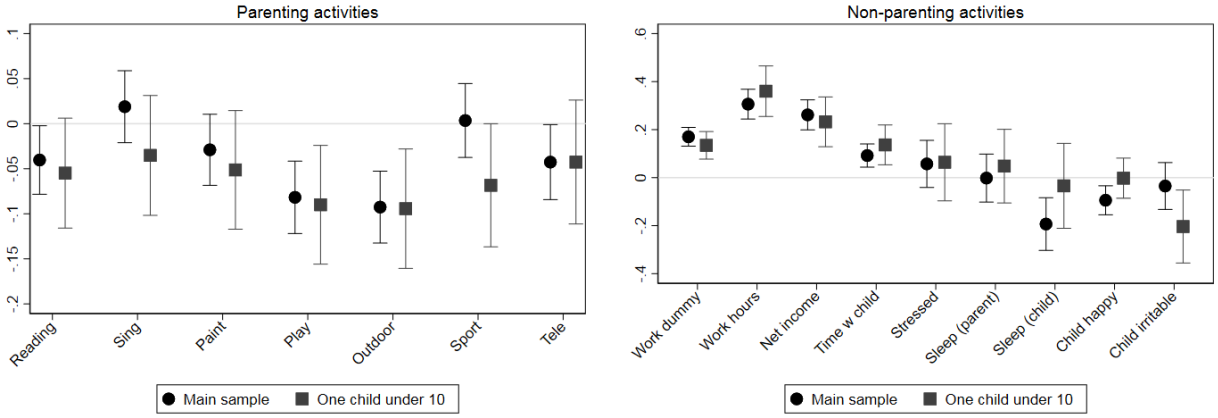


Notes: Figure shows coefficients and 95% confidence intervals for the main analysis sample (one child under 10 years) and for a tighter sample restriction of one child of *any age* in families. Estimates refer to mothers and fathers pooled, and concern the whole day. Coefficients based on conditional specification with control variables as indicated in Table 2. Coefficients for *parenting activities share* are multiplied by 100 and indicated the effect in percent. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

In Figure C4, we investigate to what degree the data driven sample restriction in the time-use data of one child under 10 years reduces the external validity of the findings, i.e. would the findings also hold for households with more children under 10? The household survey (pairfam) does not require the same sample restriction as the time-use survey as questions are child-specific (but it contains the information needed to impose the same sample restriction). Thus we compare the coefficients shown in Table 3 obtained using the unrestricted sample (i.e. with potentially several children in this age group in one household) and apply the same restriction that we use in the time-use data. Figure C4 shows that, for parenting activities (left panel), coefficients are quite similar and all confidence intervals overlap. For non-parenting

activities and other outcomes (right panel) coefficients are again comparable. Overall this suggests that the sample restriction imposed do not severely threaten the generalizability of the findings.

Figure C4: Comparison of coefficients by sample restriction



Notes: Figure shows coefficients and 95% confidence intervals for the unrestricted sample (*main sample)* and when applying the same sample restriction as in the time-use data (*one child under 10*). Estimates refer to mothers, i.e. the main sample estimates correspond to column (2) of Table 3. For presentation purposes coefficient and confidence intervals for working hours and net income are rescaled by a factor of 20 and 1000, respectively. $N = 6,005$ for the main sample and $N = 1,866$ for the one child under 10 sample. Source: pairfam, 2013-2019.

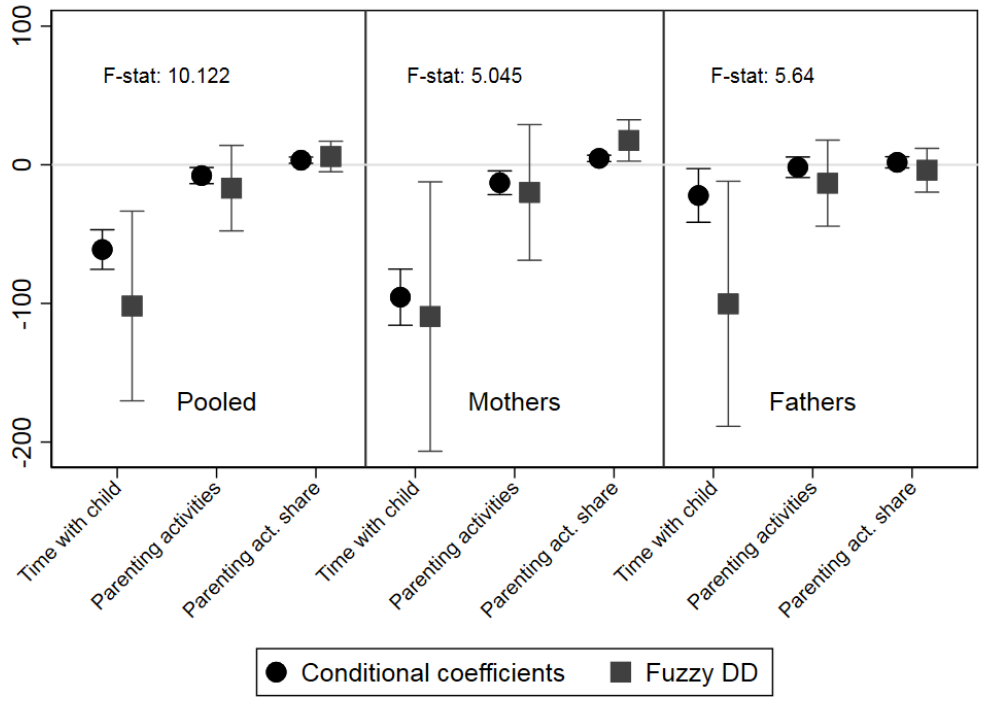
C.3 Fuzzy DD

In this section, we compare the conditional coefficients for parenting activities from the time-use survey presented in the paper to estimates obtained from an instrumental variable approach. The main estimates are based on a rich set of covariates and coefficients were generally stable across unconditional and conditional models, requiring an exceptionally large role played by unobservables to be the driver of our results (Oster, 2019). As an additional validation of our estimates, we use a 2SLS approach that is a type of fuzzy difference-in-differences (de Chaisemartin and D'Haultfœuille, 2018), where we exploit differences in the timing of roll-out of center-based care by age group across regions. To do this, we instrument usage of center-based care with all interactions of wave $\times$ region $\times$ child-age that indicate roll-out groups, and, as seen in Figure 1 and Table 1, these provide a strong first stage. We furthermore include the full set of controls as well as wave $\times$ region indicators in the regression to account for time and region-specific time-use patterns. This approach is comparable to e.g. Felfe and Lalive (2018), who analyze the effect of center-based care on child development.

Results are presented in Figure C5. For comparison we first plot (black circles) conditional coefficients for the full sample and separately for mothers and fathers with a specification as described in Table 2. Estimates obtained from the fuzzy DD are shown in gray squares. Point estimates are generally very close to those from the conditional coefficients (time with child of fathers as an exception), but estimates are far less precise yielding relatively large confidence intervals.[4] Regardless, we see little evidence that our estimates are heavily biased due to selection on unobservables. As estimates obtained from the conditional model are far more precise, we use this as our main specification and provide bounds of the estimates throughout.

[4]For the pooled estimation the F-statistic suggests that the instrument just about reaches the commonly used thresholds (Stock and Yogo, 2005), separately for mothers and fathers however, the instrument is weak.

Figure C5: Comparison of coefficients by empirical model



Notes: Figure shows coefficients and 95% confidence intervals for two empirical models. Coefficients in black circles correspond to those shown in Table 2 but are pooled by household education. Fuzzy DD coefficients in gray squares are obtained by instrumenting usage of center-based care, see text in this section for details. For illustration, parenting activities share is multiplied by 100, thus showing the effect in percent. F-statistic is the Kleibergen-Paap F-statistic from the first-stage regression. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

C.4 Further result tables

Table C1: Effects of center-based care on time spent on parenting activities — $R^2_{max} = min\left\{2.2 \times \tilde{R}^2, 1\right\}$

	Households with lower maternal education			Households with higher maternal education		
	All parents	Mothers only	Fathers only	All parents	Mothers only	Fathers only
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Time with child (minutes per day)						
Unconditional	-86.3***	-141***	-29.2*	-44.4***	-81.6***	-.157
	(12.9)	(16.1)	(16)	(15.1)	(18.2)	(20.8)
Conditional	-74.4***	-113***	-30.3**	-39.9***	-70.3***	-4.8
	(11.5)	(16.6)	(14.9)	(13.3)	(18.1)	(18.9)
Mean	336.475	427.119	227.138	360.388	444.836	258.904
Identified set	[-74.390, -52.236]†	[-113.481, -0.077]†	[-32.124, -30.281]†	[-39.895, -30.398]†	[-70.345, -11.557]†	[-13.966, -4.797]†
δ for 0 coefficient	2.35	1	8.56	2.51	1.11	-.751
Observations	2482	1357	1125	2008	1096	912
Outcome: Parenting activities (minutes per day)						
Unconditional	-8.96**	-17.7***	.311	-12.5**	-18.3**	-5.91
	(4.49)	(6.27)	(4.93)	(6.28)	(8.4)	(7.9)
Conditional	-6.29	-12.9**	2.62	-12.4**	-15.6*	-9.9
	(4.26)	(6.45)	(4.98)	(6.19)	(8.95)	(8.27)
Mean	90.520	125.380	48.471	106.688	140.370	66.212
Identified set	[-6.289, 2.094]	[-12.878, 272.092]	[2.620, 8.216]†	[-12.397, -11.943]†	[-15.627, 907.041]	[-30.798, -9.895]†
δ for 0 coefficient	.803	.202	-.691	2.88	.246	-1.09
Observations	2482	1357	1125	2008	1096	912
Outcome: Parenting activities share						
Unconditional	.0604***	.0802***	.0335*	.00281	.0377**	-.0407
	(.0153)	(.0216)	(.0198)	(.0242)	(.017)	(.0498)
Conditional	.0514***	.0561***	.0461**	-.00639	.0289	-.0486
	(.0151)	(.0197)	(.0223)	(.0275)	(.0186)	(.056)
Mean	0.297	0.327	0.259	0.317	0.339	0.290
Identified set	[0.012, 0.051]†	[-0.041, 0.056]	[0.046, 0.111]†	[-0.039, -0.006]†	[-0.013, 0.029]	[-0.074, -0.049]†
δ for 0 coefficient	1.18	.662	-1.87	-.305	.788	-11.3
Observations	2370	1334	1036	1925	1072	853

Notes: The identified set shows coefficients obtained using the method developed by Oster (2019), whereas $R^2_{max} = min\left\{2.2 \times \tilde{R}^2, 1\right\}$ in contrast to $R^2_{max} = min\left\{1.3 \times \tilde{R}^2, 1\right\}$ in Table 2. See Table 2 for further notes. Robust standard errors are in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Table C2: Effects of center-based care on parents' time spent on parenting and non-parenting activities, by time of day and education

	Households with lower maternal education			Households with higher maternal education		
	Center hrs	Evening and weekend	Night	Center hrs	Evening and weekend	Night
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Time with child (in minutes)						
Unconditional	-54.5***	-15.7	-16***	-37.3***	-3.41	-3.77
	(7.67)	(10)	(4.24)	(9.63)	(12)	(4.09)
Conditional	-42.1***	-14.6**	-17.6***	-32***	-6.13	-1.76
	(6.39)	(6.93)	(4.21)	(8.01)	(7.82)	(4.25)
Mean	81.777	202.865	51.833	87.844	214.340	58.205
Identified set	[-42.123, -37.005]†	[-14.637, -14.245]†	[-18.309, -17.630]†	[-32.000, -29.890]†	[-7.148, -6.133]†	[-1.763, -0.784]†
δ for 0 coefficient	5.78	15.3	88.3	8.65	-8.81	1.72
Outcome: Parenting activities (in minutes)						
Unconditional	-8.2***	3.58	-4.34***	-13.7***	5.51	-4.31**
	(2.28)	(3.27)	(1.35)	(3.51)	(4.51)	(2.03)
Conditional	-6.16***	3.72	-3.85***	-12.8***	4.3	-3.92*
	(2.14)	(3.07)	(1.39)	(3.2)	(4.33)	(2.07)
Mean	21.475	48.515	20.530	24.636	57.923	24.128
Identified set	[-6.159, -5.146]†	[3.724, 3.791]†	[-3.854, -3.578]†	[-12.779, -12.316]†	[3.706, 4.304]†	[-3.921, -3.662]†
δ for 0 coefficient	4.7	29	7.65	10.1	5.26	7.06
Outcome: Parenting activities share						
Unconditional	-.000852	.0536***	.00761	-.0328**	.026*	.00967
	(.00798)	(.0106)	(.00582)	(.0155)	(.0133)	(.0115)
Conditional	-.00181	.047***	.0062	-.0329**	.0186	.00793
	(.00754)	(.0114)	(.00567)	(.0165)	(.0141)	(.0139)
Mean	0.061	0.165	0.071	0.064	0.178	0.076
Identified set	[-0.002, -0.002]†	[0.042, 0.047]†	[0.006, 0.006]†	[-0.033, -0.033]†	[0.014, 0.019]†	[0.007, 0.008]†
δ for 0 coefficient	-5.59	4.49	6.38	18	2.92	6.51
Outcome: Paid work (in minutes)						
Unconditional	41.2***	-3.04	13.5***	21.8*	-1.27	-4.4
	(10.9)	(4.68)	(4.87)	(11.9)	(4.64)	(3.95)
Conditional	27.1***	-.271	13.8***	19.8**	-.551	-1.9
	(8.83)	(4.82)	(5.05)	(10)	(4.8)	(3.9)
Mean	151.320	35.234	34.718	140.418	32.194	26.917
Identified set	[21.943, 27.143]†	[-0.271, 0.748]	[13.763, 13.849]†	[19.035, 19.799]†	[-0.551, -0.262]†	[-1.900, -0.950]†
δ for 0 coefficient	4.41	.274	26.5	12.1	1.82	1.91
Outcome: Housework (in minutes)						
Unconditional	-17.7***	3.07	-1.67	-24.4***	-9.37	-1.04
	(5.74)	(5.14)	(1.81)	(5.88)	(5.81)	(1.94)
Conditional	-10.9**	-1.07	-2.09	-15.9***	-3.28	-.0766
	(4.75)	(4.45)	(1.89)	(5.22)	(4.98)	(1.96)
Mean	61.557	87.069	23.618	55.077	81.546	22.814
Identified set	[-10.893, -8.424]†	[-2.537, -1.075]†	[-2.245, -2.094]†	[-15.915, -12.766]†	[-3.280, -1.066]†	[-0.077, 0.289]
δ for 0 coefficient	3.85	-.788	-33.1	4.19	1.45	.217
Outcome: Leisure (in minutes)						
Unconditional	-8.08***	-3.29	-2.28	7.97**	11.3*	2.45
	(3.01)	(5.53)	(4.13)	(3.51)	(6.22)	(4.19)
Conditional	-7.79***	.441	3.44	4.71	7.52	1.25
	(2.93)	(4.64)	(4.26)	(3.17)	(5.44)	(4.27)
Mean	23.670	77.361	106.861	28.005	83.611	104.325
Identified set	[-7.791, -7.683]†	[0.441, 1.766]†	[3.440, 5.514]†	[3.490, 4.712]†	[6.149, 7.520]†	[0.736, 1.247]†
δ for 0 coefficient	17.4	-.35	-1.79	3.4	4.57	2.27
Outcome: Sleep (in minutes)						
Unconditional	.8	-1.85	-10.4*	-3.44	-3.1	3.47
	(2.35)	(2.52)	(5.34)	(2.63)	(2.22)	(5.32)
Conditional	.948	-1.08	-15.6***	-3.05	-2.69	.392
	(2.55)	(2.24)	(5.51)	(2.43)	(2.07)	(5.37)
Mean	10.705	15.711	463.680	9.335	13.755	464.920
Identified set	[0.948, 1.010]†	[-1.081, -0.802]†	[-17.643, -15.647]†	[-3.054, -2.896]†	[-2.693, -2.544]†	[-0.847, 0.392]
δ for 0 coefficient	-60.9	3.48	-10.9	9.71	10.3	.327
Observations [act. share]	2482 [2370]	2482 [2370]	2482 [2370]	2008 [1925]	2008 [1925]	2008 [1925]

Notes: Center hours are from 8am-4pm on weekdays, evening and weekend consists of 4pm-8pm on weekdays and entire weekend days (8am-8pm). Nights are from 8pm-8am. Number of observations for parenting activities is indicated in square brackets and for all other variables before the brackets at the bottom of the table. Parenting activities share has a lower observation count since some observations are lost when dividing by zero time with child, as discussed in the data section. Table shows coefficients from OLS regressions of the outcome variables on an indicator variable for center-based care usage. Figure 3 shows the conditional coefficients and and the coefficient under the assumption of equally large selection on observables as on unobservables ($\delta = 1$). See Table 2 for other table notes and section 4 for details on the empirical specification. Source: German Time-Use Survey (1991/92, 2001/02 and 2012/13)

Table C3: Effects of center-based care on parents' time spent on specific parenting activities, by time of day and education

	Households with lower educated mothers			Households with higher educated mothers		
	Center hrs	Evening and weekend	Night	Center hrs	Evening and weekend	Night
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Reading (in minutes)						
Unconditional	-.0188	1.61**	-.661	-.114	.182	.638
	(.201)	(.739)	(.425)	(.351)	(.603)	(.393)
Conditional	.00923	1.33*	-.72	.0102	-.347	.557
	(.25)	(.788)	(.452)	(.343)	(.6)	(.427)
Mean	0.286	1.818	0.774	0.538	2.227	1.121
Identified set	[0.009, 0.021]†	[1.138, 1.327]†	[-0.755, -0.720]†	[0.010, 0.074]†	[-0.646, -0.347]†	[0.505, 0.557]†
δ for 0 coefficient	-.814	4.54	81.3	-.169	-1.27	6.55
Outcome: Playing (in minutes)						
Unconditional	-3.38*	-2.03	.866	-5.12**	1.42	-2.05*
	(1.76)	(3.77)	(.833)	(2.39)	(4.25)	(1.12)
Conditional	-2.88*	-2.95	1.22	-5.32**	.766	-1.54
	(1.72)	(3.71)	(.844)	(2.33)	(4.15)	(1.18)
Mean	6.330	23.224	1.827	7.706	27.242	3.318
Identified set	[-2.877, -2.634]†	[-3.357, -2.946]†	[1.220, 1.430]†	[-5.425, -5.324]†	[0.417, 0.766]†	[-1.540, -1.135]†
δ for 0 coefficient	7.48	-10.9	-6.72	31.5	2.07	3.02
Outcome: Talking (in minutes)						
Unconditional	-.185	-.486	.0854	.215	-.773	.071
	(.444)	(.456)	(.181)	(.221)	(.721)	(.274)
Conditional	-.299	-1.07**	-.285	.392	-.895	-.147
	(.483)	(.504)	(.218)	(.257)	(.778)	(.264)
Mean	0.614	1.263	0.766	0.688	1.009	0.703
Identified set	[-0.343, -0.299]†	[-1.333, -1.072]†	[-0.537, -0.285]†	[0.392, 0.465]†	[-0.957, -0.895]†	[-0.340, -0.147]†
δ for 0 coefficient	-9.33	-3.89	-1.21	-6.71	-40.4	-.815
Outcome: Primary care (in minutes)						
Unconditional	-4.01*	4	-5.12***	-7.23***	5.89**	-1.51
	(2.08)	(2.69)	(1.67)	(2.56)	(3)	(2.1)
Conditional	-3.36	3.5	-5.95***	-7.65***	5.18*	-1.37
	(2.11)	(2.6)	(1.65)	(2.4)	(2.86)	(2.08)
Mean	9.175	21.103	15.337	11.405	26.338	18.752
Identified set	[-3.357, -2.928]†	[3.193, 3.500]†	[-6.403, -5.954]†	[-7.923, -7.649]†	[4.738, 5.177]†	[-1.365, -1.256]†
δ for 0 coefficient	5.41	6.99	-44.2	36.2	7.24	7.03
Observations	1338	1338	1338	1188	1188	1188

Notes: Center hours are from 8am-4pm on weekdays, evening and weekend consists of 4pm-8pm on weekdays and entire weekend days (8am-8pm). Nights are from 8pm-8am. Table shows coefficients from OLS regressions of the outcome variables on an indicator variable for center-based care usage. See Table 2 for other table notes and section 4 for details on the empirical specification. Source: German Time-Use Survey (2001/02 and 2012/13)

Table C4: Effects of full-day vs. half-day center-based care on parenting and non-parenting activities using one wave (2012/13), by time of day and education

	Households with lower maternal education			Households with higher maternal education		
	Center hrs	Evening and weekend	Night	Center hrs	Evening and weekend	Night
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Time with child (in minutes)						
Unconditional	-12.2	35.3	18.6***	-37.9***	29.5*	9.08*
	(10.2)	(22.1)	(6.1)	(10.2)	(16.9)	(5.11)
Conditional	-3.87	10.9	14.4**	-35.3***	9.53	13.2**
	(10.1)	(14.4)	(6.12)	(8.81)	(13)	(5.29)
Mean	58.7	196	47	70.9	204	53.5
Identified set	[-3.87, -.737]†	[1.81, 10.9]†	[11.7, 14.4]†	[-35.3, -34.2]†	[2.54, 9.53]†	[13.2, 14.8]†
δ for 0 coefficient	1.22	1.19	3.65	11.9	1.35	-7.47
Outcome: Parenting activities (in minutes)						
Unconditional	-5.49	-.722	3.92	-10.4***	1.38	-3.86
	(3.55)	(6.84)	(2.93)	(3.45)	(5.68)	(2.4)
Conditional	-5.99*	-1.56	4.31	-7.35**	-2.25	-2.99
	(3.48)	(6.98)	(2.94)	(3.04)	(5.46)	(2.32)
Mean	13.4	41.6	15.9	16.4	51.6	19.2
Identified set	[-6.19, -5.99]†	[-1.92, -1.56]†	[4.31, 4.47]†	[-7.35, -6.03]†	[-4.09, -2.25]†	[-2.99, -2.52]†
δ for 0 coefficient	53	-6.09	61.7	4.37	-1.36	4.78
Outcome: Parenting activities share						
Unconditional	-.0338	-.0191	-.00412	-.0286***	.0116	-.00638
	(.0281)	(.0246)	(.0209)	(.00945)	(.0176)	(.016)
Conditional	-.0253	-.00403	.0115	-.021**	.00761	-.00374
	(.0215)	(.0222)	(.0167)	(.00825)	(.0178)	(.0158)
Mean	.0476	.16	.0683	.0482	.172	.0724
Identified set	[-.0253, -.0218]†	[-.00403, .00327]	[.0115, .018]†	[-.021, -.0178]†	[.002, .00761]†	[-.00374, -.00228]†
δ for 0 coefficient	5.28	.564	-1.94	4.74	1.29	2.32
Outcome: Paid work (in minutes)						
Unconditional	-4.93	13.4	-6.92	17.3	-4.88	4.81
	(20.1)	(8.31)	(7.72)	(16.3)	(6.89)	(5.6)
Conditional	3.51	7.24	-4.45	35.3***	.441	6.56
	(15.7)	(8.24)	(6.31)	(13.3)	(6.99)	(5.6)
Mean	172	36.3	38	156	34.6	28.5
Identified set	[3.51, 6.71]†	[4.67, 7.24]†	[-4.45, -3.19]†	[35.3, 41.6]†	[.441, 2.6]†	[6.56, 7.21]†
δ for 0 coefficient	-1.21	2.52	3.03	-6.63	-.213	-15.9
Outcome: Housework (in minutes)						
Unconditional	-7.41	-5.72	5.28*	-15.9**	7.75	-7.8**
	(9.98)	(11.6)	(2.71)	(6.65)	(7.6)	(3.06)
Conditional	2.41	-14.1	2.53	-13.6**	5.53	-6.06**
	(8.87)	(10.1)	(3)	(6.08)	(6.44)	(2.84)
Mean	58.1	88.6	23.2	51	79.6	23.2
Identified set	[2.41, 6.14]†	[-17.2, -14.1]†	[1.03, 2.53]†	[-13.6, -12.8]†	[4.71, 5.53]†	[-6.06, -5.24]†
δ for 0 coefficient	-.697	-5.77	1.6	9.54	5.6	4.69
Outcome: Leisure (in minutes)						
Unconditional	2.06	4.48	-13.1*	-6.77	-1.32	4.64
	(6.27)	(11.6)	(7.92)	(6.16)	(10.1)	(5.97)
Conditional	5.11	4.06	-11.5	-6.51	-6.58	4.21
	(5.22)	(9.69)	(7.73)	(5.46)	(8)	(5.87)
Mean	20.8	76.8	108	27.5	84.7	107
Identified set	[5.11, 6.32]†	[3.91, 4.06]†	[-11.5, -10.8]†	[-6.51, -6.41]†	[-8.45, -6.58]†	[4.01, 4.21]†
δ for 0 coefficient	-5.45	12.1	7.75	19.5	-4.11	11
Outcome: Sleep (in minutes)						
Unconditional	-8.81**	-.704	3.87	4.18	1.05	-5.19
	(4.43)	(5.39)	(10.3)	(2.73)	(3.58)	(7.91)
Conditional	-5.94	-1.11	2.64	3.81	-2.48	-11.3
	(3.86)	(5.41)	(9.54)	(2.88)	(3.08)	(7.69)
Mean	9.17	15.1	461	8.61	13.4	463
Identified set	[-5.94, -4.67]†	[-1.27, -1.11]†	[1.92, 2.64]†	[3.66, 3.81]†	[-3.71, -2.48]†	[-14.1, -11.3]†
δ for 0 coefficient	3.62	-11.2	3.08	11.8	-2.21	-4.59
Observations [act. share]	351 [338]	351 [338]	351 [338]	507 [471]	507 [471]	507 [471]

Notes: Center hours are from 8am-4pm on weekdays, evening and weekend consists of 4pm-8pm on weekdays and entire weekend days (8am-8pm). Nights are from 8pm-8am. Number of observations for parenting activities is indicated in square brackets and for all other variables before the brackets at the bottom of the table. Parenting activities share has a lower observation count since some observations are lost when dividing by zero time with child, as discussed in the data section. Table shows coefficients from OLS regressions of the outcome variables on an indicator variable for center-based care usage. Figure 4 shows the conditional coefficients and and the coefficient under the assumption of equally large selection on observables as on unobservables ($\delta = 1$). See Table 2 for other table notes and section 4 for details on the empirical specification. Source: German Time-Use Survey (2012/13)

Table C5: The effect of full-day care on parenting activities (Oster bounds)

	Households with lower maternal education			Households with higher maternal education		
	All parents	Mothers	Fathers	All parents	Mothers	Fathers
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Reading books or telling stories (daily)						
Unconditional	-0.049***	-0.047**	-0.042	0.003	-0.003	0.001
	(0.019)	(0.022)	(0.031)	(0.015)	(0.016)	(0.025)
Conditional	-.0529***	-.0457**	-.0735**	-.000586	.00389	-.0124
	(.0185)	(.0232)	(.0314)	(.0146)	(.0158)	(.0263)
Mean	.615	.718	.455	.773	.879	.645
Identified set	[-.0542, -.0529]†	[-.0457, -.0452]†	[-.085, -.0735]†	[-.00175, -.000586]†	[.00389, .00615]†	[-.0172, -.0124]†
δ for 0 coefficient	73	19.4	-8.15	-.534	-1.89	-3.07
Outcome: Musical activities (daily)						
Unconditional	-0.006	0.018	-0.034	-0.012	-0.029	-0.002
	(0.017)	(0.023)	(0.021)	(0.017)	(0.024)	(0.021)
Conditional	-.00906	.0116	-.038*	-.0176	-.0155	-.0248
	(.0173)	(.0244)	(.0216)	(.0167)	(.0246)	(.0213)
Mean	.254	.326	.136	.32	.436	.18
Identified set	[-.0103, -.00906]†	[.00933, .0116]†	[-.0394, -.038]†	[-.0194, -.0176]†	[-.0155, -.0104]†	[-.0331, -.0248]†
δ for 0 coefficient	-10.7	4.42	61.5	-15	2.82	-3.2
Outcome: Painting, building or drawing (daily)						
Unconditional	-0.029*	-0.040*	-0.002	-0.043***	-0.107***	0.031
	(0.017)	(0.024)	(0.023)	(0.016)	(0.023)	(0.021)
Conditional	-.0202	-.0329	.000965	-.0438***	-.083***	.0037
	(.0171)	(.024)	(.0232)	(.0162)	(.0231)	(.0222)
Mean	.287	.367	.161	.274	.348	.184
Identified set	[-.0202, -.0172]†	[-.0329, -.0303]†	[.000965, .0021]†	[-.0442, -.0438]†	[-.083, -.0732]†	[-.0062, .0037]
δ for 0 coefficient	5.54	8.43	-.925	31.5	5.68	.383
Outcome: Playing games together (daily)						
Unconditional	-0.091***	-0.078***	-0.104***	-0.057***	-0.122***	0.014
	(0.019)	(0.024)	(0.029)	(0.018)	(0.023)	(0.026)
Conditional	-.1***	-.0911***	-.12***	-.0578***	-.125***	.0189
	(.0188)	(.0245)	(.0299)	(.0177)	(.0234)	(.0265)
Mean	.479	.553	.364	.516	.594	.422
Identified set	[-.104, -.1]†	[-.096, -.0911]†	[-.126, -.12]†	[-.0582, -.0578]†	[-.126, -.125]†	[.0189, .0207]†
δ for 0 coefficient	199	-60.4	-428	29.8	21.9	-18.6
Outcome: Outdoor activities (daily)						
Unconditional	-0.060***	-0.082***	-0.012	-0.022	-0.072***	0.026
	(0.019)	(0.024)	(0.028)	(0.018)	(0.023)	(0.025)
Conditional	-.0727***	-.1***	-.027	-.0562***	-.0903***	-.0138
	(.0187)	(.0244)	(.0293)	(.0173)	(.0236)	(.0255)
Mean	.487	.606	.301	.484	.623	.316
Identified set	[-.0773, -.0727]†	[-.107, -.1]†	[-.0325, -.027]†	[-.0682, -.0562]†	[-.0974, -.0903]†	[-.0279, -.0138]†
δ for 0 coefficient	-35.2	-27.7	-6.19	-5.49	-21.2	-1.03
Outcome: Gymnastics, sports (daily)						
Unconditional	0.007	0.014	-0.007	0.005	0.010	0.001
	(0.019)	(0.024)	(0.030)	(0.017)	(0.023)	(0.026)
Conditional	-.0157	-.0034	-.0338	-.00991	.00543	-.0357
	(.0195)	(.025)	(.0316)	(.0178)	(.0239)	(.0267)
Mean	.406	.399	.417	.386	.349	.431
Identified set	[-.0235, -.0157]†	[-.00966, -.0034]†	[-.0435, -.0338]†	[-.0151, -.00991]†	[.00377, .00543]†	[-.0486, -.0357]†
δ for 0 coefficient	-2.19	-.573	-4.04	-2.1	3.01	-3.11
Outcome: Watching television or videos (daily)						
Unconditional	-0.019	-0.030	0.002	0.024	0.011	0.038
	(0.019)	(0.024)	(0.031)	(0.018)	(0.024)	(0.026)
Conditional	-.0302	-.0442*	-.0112	.00941	-.00116	.0243
	(.0197)	(.0252)	(.032)	(.0186)	(.0254)	(.0274)
Mean	0.518	0.564	0.446	0.435	0.459	0.406
Identified set	[-0.034, -0.030]†	[-0.049, -0.044]†	[-0.016, -0.011]†	[0.004, 0.009]†	[-0.006, -0.001]†	[0.019, 0.024]†
δ for 0 coefficient	-11	-11.4	-2.75	1.75	-.28	3.98
Observations	2852	1757	1095	3114	1712	1402

Notes: Table shows coefficients from OLS regressions of the outcome variables (binary indicator that equals one if the activity is being performed daily) on an indicator variable for full-day care. Unconditional coefficients stem from a regression which only includes the full-day indicator and dummies for child age. The conditional coefficients are from regressions that additionally include wave dummies and the set of controls described in the table notes of Table 3. See Table 2 and section 4 for other notes on the Oster-method. Source: pairfam, 2013-2019.

Table C6: The effect of full-day care on non-parenting activities and other parent- and child-related outcomes; pairfam - Oster bounds

	Households with lower maternal education			Households with higher maternal education		
	All parents	Mothers	Fathers	All parents	Mothers	Fathers
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Working (at least 10 h/w)						
Unconditional	0.113***	0.161***	0.022	0.105***	0.201***	-0.002
	(0.017)	(0.023)	(0.016)	(0.014)	(0.021)	(0.012)
Conditional	.116***	.173***	.0275	.105***	.185***	.000318
	(.0161)	(.0238)	(.0169)	(.0139)	(.0225)	(.0134)
Mean	.684	.571	.866	.801	.684	.943
Identified set	[.116, .118]†	[.173, .179]†	[.0275, .0294]†	[.105, .105]†	[.174, .185]†	[.000318, .00121]†
δ for 0 coefficient	30.8	32.4	-41.2	18.2	4.45	-.38
Outcome: Working hours (per week)						
Unconditional	4.509***	7.053***	-0.617	4.919***	9.824***	-0.235
	(0.717)	(0.747)	(0.888)	(0.634)	(0.719)	(0.740)
Conditional	3.83***	6.16***	.466	4.38***	8.24***	-.251
	(.581)	(.749)	(.915)	(.547)	(.751)	(.787)
Mean	24.3	15.8	38	30.1	20.7	41.4
Identified set	[3.58, 3.83]†	[5.61, 6.16]†	[.466, .862]†	[4.18, 4.38]†	[6.73, 8.24]†	[-.256, -.251]†
δ for 0 coefficient	9.79	4.2	-1.27	11.1	2.53	51.4
Outcome: Personal monthly net income						
Unconditional	107.146**	265.750***	-221.252***	112.236*	462.932***	-271.337**
	(44.057)	(38.633)	(71.421)	(64.929)	(49.950)	(118.409)
Conditional	165***	261***	27.5	229***	420***	50.7
	(33.2)	(37.6)	(58.2)	(60)	(51.1)	(126)
Mean	1124	611	1949	1807	1099	2677
Identified set	[165, 185]†	[258, 261]†	[27.5, 115]†	[229, 270]†	[397, 420]†	[50.7, 172]†
δ for 0 coefficient	-11.7	9.83	-.325	-6.93	5.57	-.433
Outcome: Too little time with child (0/1)						
Unconditional	0.076***	0.113***	0.007	0.092***	0.185***	-0.016
	(0.023)	(0.028)	(0.038)	(0.021)	(0.026)	(0.032)
Conditional	.0661***	.0945***	.0255	.0824***	.187***	-.0495
	(.0239)	(.0292)	(.0414)	(.0217)	(.0281)	(.0335)
Mean	.36	.276	.498	.397	.303	.51
Identified set	[.0624, .0661]†	[.0847, .0945]†	[.0255, .0325]†	[.0786, .0824]†	[.187, .188]†	[-.0613, -.0495]†
δ for 0 coefficient	8.64	4.31	-4.6	9.36	5.79	-4.55
Outcome: Feeling stressed (1-5)						
Unconditional	-0.022	0.061	-0.142*	0.152***	0.263***	0.007
	(0.045)	(0.056)	(0.074)	(0.039)	(0.050)	(0.060)
Conditional	.00643	.0552	-.0871	.145***	.265***	-.00481
	(.0472)	(.0595)	(.0796)	(.0407)	(.0522)	(.0645)
Mean	3.23	3.32	3.09	3.3	3.37	3.21
Identified set	[.00643, .0163]†	[.0531, .0552]†	[-.0871, -.0658]†	[.142, .145]†	[.265, .267]†	[-.00915, -.00481]†
δ for 0 coefficient	-.685	12.7	3.38	11	7.32	-1.21
Outcome: Hours of sleep (parent)						
Unconditional	-0.034	-0.045	-0.014	-0.013	-0.050	0.025
	(0.044)	(0.058)	(0.067)	(0.034)	(0.047)	(0.048)
Conditional	-.00699	-.0000499	-.0348	.00322	-.0454	.0495
	(.0469)	(.0605)	(.0751)	(.0355)	(.0498)	(.0495)
Mean	6.77	6.81	6.71	6.84	6.86	6.81
Identified set	[-.00699, .00252]	[-.0000499, .0158]	[-.0432, -.0348]†	[.00322, .00879]†	[-.0454, -.0438]†	[.0495, .0588]†
δ for 0 coefficient	.741	.00327	-5.37	-.611	14.2	-6.86
Outcome: Hours of sleep (child)						
Unconditional	-0.255***	-0.274***	-0.224***	-0.190***	-0.208***	-0.170***
	(0.048)	(0.062)	(0.074)	(0.038)	(0.049)	(0.059)
Conditional	-.181***	-.2***	-.138*	-.131***	-.154***	-.112*
	(.0506)	(.0665)	(.0782)	(.041)	(.0539)	(.064)
Mean	10.3	10.3	10.3	10.5	10.5	10.4
Identified set	[-.181, -.147]†	[-.2, -.167]†	[-.138, -.1]†	[-.131, -.105]†	[-.154, -.129]†	[-.112, -.0881]†
δ for 0 coefficient	3.81	4.12	2.98	3.72	3.94	3.66

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Outcome: Child is happy and content (1-5)						
Unconditional	-0.064**	-0.090***	-0.025	0.031	0.002	0.065**
	(0.026)	(0.034)	(0.041)	(0.022)	(0.029)	(0.033)
Conditional	-.0734***	-.0963***	-.0337	.0396*	.017	.0631*
	(.0278)	(.0366)	(.0427)	(.023)	(.0312)	(.034)
Mean	4.54	4.53	4.54	4.55	4.58	4.52
Identified set	[-.0771, -.0734]†	[-.0991, -.0963]†	[-.0373, -.0337]†	[.0396, .0426]†	[.017, .0221]†	[.0623, .0631]†
δ for 0 coefficient	-74.9	31.3	-17.4	-23.5	-3.78	15.6
Outcome: Child is irritable and cries often (1-5)						
Unconditional	-0.053	-0.011	-0.112*	-0.052	-0.006	-0.104*
	(0.043)	(0.057)	(0.063)	(0.037)	(0.050)	(0.054)
Conditional	-.0321	-.0373	-.0261	-.0335	-.00797	-.0733
	(.0444)	(.0592)	(.0668)	(.0386)	(.0524)	(.0576)
Mean	2.295	2.326	2.247	2.226	2.147	2.318
Identified set	[-0.032, -0.025]†	[-0.047, -0.037]†	[-0.026, 0.005]	[-0.033, -0.027]†	[-0.009, -0.008]†	[-0.073, -0.061]†
δ for 0 coefficient	3.82	-4.58	.838	4.35	-15.2	4.7
Observations	2859	1763	1096	3135	1725	1410

Notes: Table shows coefficients from OLS regressions of the outcome variables on an indicator variable for full-day care. Unconditional coefficients stem from a regression which only includes the full-day indicator and dummies for child age. The conditional coefficients are from which regressions that additionally include wave dummies and the set of controls described in the table notes of Table 3. See Table 2 and section 4 for further notes on the Oster-method. Source: pairfam, 2013-2019.

Table C7: The effect of full-day care on parenting activities - alternative full-day assignment

	Households with lower maternal education			Households with higher maternal education		
	All parents	Mothers	Fathers	All parents	Mothers	Fathers
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Parenting activities						
Reading books or telling stories (daily)	-0.021	-0.035	-0.018	-0.013	-0.001	-0.026
	(0.023)	(0.028)	(0.039)	(0.016)	(0.016)	(0.030)
Singing or playing instruments (daily)	-0.004	0.000	0.002	-0.018	-0.025	-0.023
	(0.022)	(0.032)	(0.030)	(0.020)	(0.029)	(0.026)
Painting, building or drawing (daily)	-0.019	-0.014	-0.020	-0.023	-0.058**	0.010
	(0.023)	(0.033)	(0.033)	(0.020)	(0.028)	(0.027)
Playing games together (daily)	-0.082***	-0.069**	-0.108***	-0.021	-0.054**	0.027
	(0.025)	(0.032)	(0.041)	(0.021)	(0.027)	(0.032)
Outdoor activities (daily)	-0.073***	-0.094***	-0.027	-0.074***	-0.150***	0.019
	(0.024)	(0.031)	(0.040)	(0.020)	(0.027)	(0.031)
Gymnastics, sports (daily)	-0.020	0.006	-0.059	-0.042**	-0.050*	-0.033
	(0.025)	(0.032)	(0.042)	(0.021)	(0.028)	(0.032)
Watching television or videos (daily)	0.006	-0.016	0.042	0.038*	-0.002	0.090***
	(0.026)	(0.033)	(0.042)	(0.022)	(0.030)	(0.032)
Panel B: Non-parenting activities and other outcomes						
Working (at least 10 h/w)	0.142***	0.204***	0.044*	0.136***	0.270***	-0.026*
	(0.021)	(0.030)	(0.023)	(0.016)	(0.025)	(0.015)
Working hours (per week)	6.296***	9.084***	1.993*	5.263***	11.496***	-2.215**
	(0.747)	(0.962)	(1.210)	(0.620)	(0.814)	(0.890)
Personal monthly net income	256.669***	409.269***	23.678	222.188***	559.758***	-168.564
	(42.882)	(50.097)	(75.848)	(66.036)	(57.916)	(134.647)
Too little time with child (0/1)	0.076***	0.081**	0.065	0.120***	0.221***	-0.006
	(0.027)	(0.033)	(0.046)	(0.023)	(0.028)	(0.035)
Feeling stressed (1-5)	0.092	0.058	0.135	0.170***	0.300***	0.012
	(0.061)	(0.077)	(0.101)	(0.047)	(0.061)	(0.075)
Hours of sleep (parent)	-0.134**	-0.106	-0.186*	-0.048	-0.111*	0.037
	(0.059)	(0.076)	(0.097)	(0.042)	(0.058)	(0.060)
Hours of sleep (child)	-0.290***	-0.252***	-0.312***	-0.240***	-0.185***	-0.317***
	(0.064)	(0.084)	(0.101)	(0.045)	(0.056)	(0.074)
Child is happy and content (1-5)	-0.064*	-0.081*	-0.067	-0.018	-0.048	0.019
	(0.036)	(0.045)	(0.060)	(0.026)	(0.034)	(0.040)
Child is irritable and cries often (1-5)	0.012	-0.004	0.056	0.092**	0.161***	0.007
	(0.056)	(0.073)	(0.091)	(0.044)	(0.060)	(0.066)
Observations	1972	1209	763	2338	1295	1043

Notes: Table shows coefficients from OLS regressions of the outcome variables (binary indicator that equals one if the activity is being performed daily) on an indicator variable for full-day care. Additional controls; dummies for child age, number of children in family, parental sex (if applicable), age of parent, indicator for migration status, single parent indicator, education dummies (if applicable). Full-day care indicates whether the child attends center-based care 30+ vs. 15-30 hours per week. See Table 3 for other table notes. Source: pairfam, 2013-2019.