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Parents' Separation: What is the Effect on Parents' and Children's Time Investments?*

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Abstract

This paper investigates the effect of parental separation on children's allocation of their time and on the time spent with their parents. Based on detailed time-use diaries from the Panel Study of Income Dynamics – Child Development Supplement, I estimate an individual fixed-effect model and find that being in a single-parent family decreases time with a parent accessible by 18% of a standard deviation (3 hours 30 minutes per week). Time spent with both parents together and alone with the non-custodial parent is greatly affected, but the custodial parent partially compensates for this decrease. The decrease in time with a parent actively engaged in activities is, however, not statistically significant. Younger children continue spending as much time with their parents after separation. Effects on boys and girls differ, but this difference depends on the type of parental time investment we consider. Time spent with a grandparent acts as a recovery channel in single-mother families. Time with a step-parent increases but does not lead to an accumulation of parental time.

I. Introduction

Parental breakup is generally found to have a negative effect on children's outcomes such as labour market outcomes, educational attainment, and child well-being¹. One mechanism

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¹See Ermisch and Francesconi (2001a, 2001b), Hofferth (2006), Gruber (2004), Francesconi, Jenkins and Siedler (2010), Frimmel, Halla and Winter-ebmer (2016); Ribar, Sanders and Thibout (2017), Le Forner (2020);

underlying this effect is a decrease in time spent with parents (Løken, Lommerud and Holm Reiso, 2018), which may be accompanied by a change in children's allocation of their time. A burgeoning literature places maternal or parental time among the most productive inputs to developing both cognitive and socio-emotional skills, especially in early childhood (Aizer, 2004; Cunha and Heckman, 2008; Cunha, Heckman and Schennach, 2010; Fiorini and Keane, 2014; Del Bono *et al.*, 2016; Del Boca, Monfardini and Nicoletti, 2017). Children's time investments also impact their cognitive skills (Funk and Kemper, 2016; Del Boca, Monfardini and Nicoletti, 2017) and their health (Anderson *et al.*, 2017). Yet, little is known about the effect of parental separation on parental time investment and on children's own allocation of their time.

This paper investigates both effects combining an individual fixed-effect model with data from the Panel Study of Income Dynamics (PSID). I use time-use diaries from the Child Development Supplement (CDS), which contain data on the children's activities, their duration, and who was present or involved, for 2,900 children first interviewed in 1997 and followed up in 2002 and 2007. This type of data allows me to reduce measurement errors due to recall biases, likely to be large for children. I consider five activities: (house)work, personal needs and care, education, active and passive leisure. Time with at least one parent is divided into time with the mother alone, with the father alone and with both parents together. Since this data set enables me to distinguish between accessible time and engaged time, I can account for the quality of the time spent with the child.

Five new findings are worthy of note. First, time with at least one parent accessible decreases. Estimations do not, however, suggest a strong effect on engaged time. Second, the decrease in accessible time does not translate into a change in children's allocation of their time (whoever is present): the children do not change their habits. Third, the breakdown of accessible and engaged parental time is highly affected. Time spent with both parents together and alone with the non-custodial parent decreases for most activities. The custodial parent compensates partially for the decrease in time spent with the non-custodial parent, and seeks to maintain the amount of quality time. While there is no strong evidence of a complementarity effect between paternal and maternal time, custodial parents are shown to face strong time constraints, in particular due to loss of production complementarities. Fourth, the effects of family breakup differ according to the children's characteristics. Children who were younger when the separation occurred seem to be less affected by the reduced time spent with at least one parent. In contrast to previous studies (Bibler, 2020), results are not clear-cut regarding children's gender effects. In a single-mother family, boys experience larger reductions in parental engaged time, but it is girls who lose more accessible time. Children who used to spend substantial time with their parents are more affected by the separation. Fifth, time spent with a grandparent acts as a recovery channel in single-mother families; and time with a step-parent increases but does not lead to an accumulation of parental time.

Goisis, Özcan and Van Kerm (2019), Pronzato and Aassve (2019), González and Viitanen (2018). A few papers find no effect of parental separation on child outcomes, including Björklund and Sundström (2006), Björklund, Ginther and Sundström (2007) and Ginther and Pollak (2004) when income is controlled for. For recent literature reviews, see Amato (2010) or McLanahan, Tach and Schneider (2013).

The present paper makes several important contributions to the existing literature. First, I provide new estimates of the effect of a family breakup on time spent with at least one parent, considering both accessible and engaged time. I show that conclusions about the gender gap in time investments differ according to which of these types of parental time investment we consider. Second, by breaking parental time down into time spent with mother only, with father only, and with both parents together, I investigate complementarity in parental time: how each parent adapts the time spent with his/her children to the other parent's time investment. I also investigate this effect when there is a step-parent. In addition, I look at other potential mechanisms regarding the mother's use of time (e.g. her labour supply or her participation in household chores). Third, I explore time spent with other adults, such as grandparents or step-parents, to see whether it mitigates the decrease in parental time. Fourth, I seek to determine whether the decrease in parents' accessible time translates into a change in the children's allocation of time (whoever is present).

Several studies have compared parental time across family structures,² although without accounting for possible unobserved variables which may confound the relationship between parental separation and time investments. There is little research aiming at controlling for omitted variable bias (Grätz, 2017; Mencarini, Pasqua and Romiti, 2019; Bibler, 2020). Using a family fixed-effect model, Grätz (2017) shows that parental separation negatively affects the father-child relationship.³

To the best of my knowledge, the study by Bibler (2020) is closest to my analysis. Focusing on the gender gap in engaged time, he uses a child fixed-effect model on the PSID-CDS. Boys are found to experience a larger decrease in fathers' time investments, with little evidence that mothers increase investments in boys relative to girls after a family breakup. However, Bibler (2020) defines paternal/maternal time investment as the sum of the duration of all activities in the time diary showing paternal/maternal participation, which means that time spent with the two parents together is counted twice. In this study, I consider time spent with at least one parent, divided into time spent with the mother alone, with the father alone, and with both parents together. This enables me to identify whether the decrease in time spent with the father translates into a decrease in time spent with at least one parent, or only less time spent with both parents together. Children's development might be impacted differently in the two cases. I further show that conclusions regarding the gender differential in the effect are sensitive to the type of investment we consider (accessible/engaged time).

Other related research is Mencarini, Pasqua and Romiti (2019). Using a difference-in-differences specification, they show that being in a single-parent household reduces the amount of time spent reading and studying more for boys than for girls. In this study, I consider other activities as potential substitutes for educational activities. Kalil, Ryan

²Looking at parental time from parents' time-use diaries, several studies find that single mothers spend more time with their children, when observed selection is controlled for, but these studies are not able to observe time spent with the non-custodial parent (Le Bourdais and Rapoport, 2001; Kalenkoski, Ribar, and Stratton, 2005, 2007; Kendig and Bianchi, 2008) or shared parenting time (Carlson and Berger, 2013). There is also evidence that children's allocation of time varies across family structures (Kalenkoski, Ribar and Stratton, 2011).

³Using the German Socio-Economic Panel Study (GSOEP), Grätz (2017) looks at parents' involvement, which is measured from 16 questions about the parent-child relationship.

and Chor (2014) define time investment similarly, looking both at time spent with each adult and at shared parenting time across family structures. However, in contrast to their work, my definition of shared parenting is based on parental time exclusively.⁴ When defining time investment, several studies distinguish between accessible time and engaged time, but generally analyse only engaged time. Among the few studies addressing both, Hofferth and Anderson (2003)'s explore the accessible and engaged time provided by biological and non-biological fathers.

The remainder of the paper proceeds as follows. Mechanisms through which a parental separation may affect children's time-use and time spent with parents are presented in the next section. Section III provides a description of the data, main variables, and some descriptive statistics and presents the estimation strategy. Section IV shows results from estimations of the effect of a family breakup on time investments. Section V discusses the results and concludes.

II. Background: potential mechanisms explaining the impact of a parental separation on children's time-use

According to theoretical frameworks (Becker, 1965; Chiappori, 1988; Blundell, Chiappori, and Meghir, 2005), parents rationally choose the amounts of time they spend on different activities, including child-care and the labour market. They also choose the amounts of goods they purchase in such a way as to maximize utility subject to their budget and time constraints. Three potential mechanisms could explain a negative effect of parental breakup on parental time.

First, since there is one parent less in the household, a parental separation may decrease the resources available to be invested in household goods, and therefore in the child's human capital. Children's access to their non-custodial parent's economic and time resources may therefore be reduced, with a particularly strong impact on time spent with the non-custodial parent. Reduced access to economic resources may also indirectly affect children's allocation of time, decreasing time spent on costly activities such as sports, cinema or museums.

Second, separation means parents lose all the consumption and production complementarities they had as a couple. Two singles living apart need about 2 hours 15 minutes more spare time a day to achieve the same utility level as when living in a couple; and a single woman requires on average 55% of a couple's time resources to live as well as when she is in a couple (Couprie, 2007; Couprie and Ferrant, 2015). Thus, the custodial parent may be more time-constrained, with less time for child care. For example, before the separation, one parent may have cooked while the other helped the child with homework; after the separation, the custodial parent has to do both and may substitute one activity for the other. The same reasoning applies to consumption complementarities. Where all household goods expenditures were shared before the separation, the custodial

⁴They define shared parenting time as time spent with all resident adults in the household, while I distinguish between time spent with both parents and time spent with a parent and other adults. Time spent with parents alone might have a stronger effect on children's development than time spent with other adults (Fiorini and Keane, 2014). I further test different possible definitions of parental time in section IV, considering time spent with at least one adult, including time spent with other adults such as a grandparent or a step-parent.

parent now bears the full cost, which may reduce the ability to afford costly extracurricular and leisure activities.

Third, there could also be complementarities between parents' allocation of time: if one parent increases (decreases) the time spent with the child, the other parent may increase (decrease) it too. In this case, a parental separation might translate into less parental time. Empirical studies find a complementarity in leisure time and suggest that parents have a preference for spending leisure time together with children (Pailhé and Solaz, 2004). Cosaert, Theloudis and Verheyden (2020) estimate that households pay at least 2.08 euros per hour (17% of the average wage) to convert individual child-care to joint care. Women may however react less strongly to their spouse's behaviour (Van Soest and Stancanelli, 2012).

On the other hand, several mechanisms would imply either an increase or a null effect on parental time investments after parental breakup. Collective models (Chiappori, 1988; Lundberg and Pollak, 1996; Blundell, Chiappori and Meghir, 2005) consider that the resources allocated to children, including time resources, are jointly decided by both parents according to their relative bargaining power. If both parents are equally altruistic, their relative bargaining power is not a determinant of the child's well-being. However, if the parents differ in their altruism, the child's well-being is positively related to the bargaining power of the most altruistic parent. Consequently, a child living in a household where the most altruistic parent's bargaining power increases will be allocated greater resources⁵. In a parental separation, it can be assumed that the child will stay with the most altruistic parent, whose bargaining power will increase.

Moreover, parents may also compensate for a shock on time resources for children. Under increasing mother's labour supply, several studies find little evidence of a negative effect on the child's emotional outcomes, suggesting a compensation effect through an increase in the other parent's time investment or the adoption of alternative child-care arrangements (Hsin and Felfe, 2014)⁶. When there is parental separation, the custodial parent may also compensate for the decrease in the non-custodial parent's time investment. She may decrease her leisure time or her labour supply to compensate for the reduction in the time her child spends with the non-custodial parent. The effect is however ambiguous, because if she wants to compensate for the decrease in economic resources, she may have to increase her labour supply. I explore these potential mechanisms in section IV.

Most existing studies focus on the difference between single-parent families and two-parent families, with little attention paid to the effect of a step-parent. The presence of a step-parent could act as either a shock or a recovery channel (Evenhouse and Reilly, 2004; Gennetian, 2005). Some adults prefer to have another adult around when spending time with their child (complementarity effect), for instance because going shopping alone with children might be challenging. Thus, having a partner might increase the custodial

⁵For instance, Lundberg, Pollak and Wales (1997) found that switching child support benefits from father to mother in the 1970s increased the amount of expenditure on children's clothing. Bruins (2017) find that a five percentage point increase in women's bargaining power, measured as the wage ratio, raises parents' time with children by one hour per week.

⁶Nevertheless, Agostinelli and Sorrenti (2018) find that an increase in the mother's labour supply negatively affects a child's development by around 6% of a standard deviation, the effect of the decrease in parental time investments overcoming the income effect.

parent's time investment (Cosaert, Theloudis and Verheyden, 2020). On the other hand, if the parent's bargaining power decreases when she starts to live with her new partner, and if this partner is less altruistic about her child, the resources available for the child's development might be 'taxed' by this new partner (see Ginther and Pollak, 2004, for a more detailed discussion). Similarly, higher bargaining power for a non-custodial parent increases both the probability of his paying some child support and the amount of child support relative to household income (Ermisch and Pronzato, 2008). Yet other studies argue for a cumulative effect when both father and step-father contribute resources (White and Gilbreth, 2001). I test and discuss the hypothesis of a complementarity effect against a decrease in the custodial parent's bargaining power in section IV.

III. Data and methods

The following section introduces the PSID and the sample criteria, defining the main variables of interest, family structure, and other controls. It also explains the estimation strategy.

Data

The Arbor, 2017 PSID began in 1968 in the United States with a nationally representative sample. Information on these individuals and their descendants has been collected continuously, providing inter-generational data for all these families. The PSID-CDS follows 3,500 children first interviewed in 1997 (Wave 1), then in 2002 (Wave 2) and 2007 (Wave 3). A large number leave the sample in the third wave due to the age limit of 19 (for the age distribution in my sample, see Figure S1).⁷ While the sample is not large, the survey collects a rich set of information about children's cognitive skills, socio-emotional skills, demographics and parental background, along with time-use diaries for 2 days, one during the week and one at the weekend. Time-use diaries provide information on the activity, where it took place, and with whom.⁸

Sample selection criteria

The PSID-CDS offers a total of 6,915 observations (2,904 in wave 1, 2,569 in wave 2, 1,442 in wave 3) from children who filled in a time-use diary⁹. Not all returned both weekend and weekday diaries, and I exclude such cases to avoid classical measurement error. I further restrict the sample to observations providing information on relevant variables. This leads to a sample of 5,264 observations (2,488 in wave 1, 1,776 in wave 2, 1,000 in wave 3). I also drop outliers where the child was declared as spending the whole day in passive leisure or less than 50 hours a week sleeping, or where no information is

⁷A more detailed description of attrition is given in Section S.3.

⁸The only other panel data using time-use diaries appears to be the Longitudinal Study of Australian Children (LSAC). However, although the LSAC is based on a larger sample and is biannually surveyed, there is no distinction between parent and step-parent in the time-use diary. This makes the PSID-CDS a more appropriate data set for studying the effect of parental separation on both children's time-use and parental time investments (Arbor, 2017).

⁹The response rates are greater than 80%. No explanation for failure to respond is provided in the user guides, but it could be due to the long time required to fill in a time-use diary (Juster, Ono and Stafford, 2003)

provided on who was present for more than 130 hours a week.¹⁰ This yields a sample of 5,153 observations (2,478 in wave 1, 1,730 in wave 2, 945 in wave 3). Also excluded from the sample are those families whose status as single-mother families (with or without a step-parent) or single-father families does not change throughout the three waves¹¹. This allows me to interpret the effect of being in a single-parent relative to a two-parent family. Besides, remaining in a single-parent family may reflect a very different situation from remaining in a two-parent family; a homogeneous group eases interpretation of the results. This criterion leads to a sample of 4,029 observations (1,830 in wave 1, 1,399 in wave 2, 800 in wave 3). Finally, I restrict the sample to children for whom there are at least two observations; this reduces the sample to 3,687 observations (1,508 in wave 1, 1,386 in wave 2, 793 in wave 3) from 1,522 children, observed at least twice.

Table 1 reports summary statistics: column 1 for the sample providing all relevant information, column 2 excluding outliers in terms of child's time allocation, column 3 excluding families remaining single-parent families throughout the three waves, and column 4 for the sample providing at least two observations, which is my final sample. I also report the marginal effects of a logit regression, where the dependent variable is a dummy equal to one if the child is in the sample and zero otherwise (see Table S1).¹²

Excluding outliers does not greatly alter the sample, although it reduces the number of single-parent families (see Table S1, column 1). Obviously, this is further reduced by excluding families remaining single-parent families throughout the three waves (though keeping those remaining two-parent families) (see Table S1, column 2). Restricting the sample to children observed in at least two waves produces a sample with slightly older children, though the effect is very small (see Table S1, column 3). African American and Asian children are less likely to remain in this sample, relative to white children. Girls are more likely to remain in the sample, as are Hispanics (*ceteris paribus*, see Table S1). Children whose primary care-giver (PCG) is more highly educated and earns more are also more likely to remain in the sample (*ceteris paribus*, see Table S1), though the effects are very small.

Time investment variables

The PSID-CDS interviewers ask older children to complete the time-use diary themselves, with the assistance of the PCG if needed. Young children are interviewed together with the PCG, to ensure the most accurate data. Adolescents produce the diary without the primary caregiver's help if they can clearly recall the day. The time-use diary covers

¹⁰More precisely, I exclude children declared as spending more than 130 hours a week doing an activity intended to be performed alone (such as sleeping or attending school), denoted as 'non relevant' in Panel A of Table 3.

¹¹Children who experience a family breakup before the first wave remain in the sample if they experience at least one transition in the subsequent waves (e.g. a new partner for their mother). Unfortunately, we are not able to see the effect of their transition from a two-parent family to a single-parent family because we do not have any retrospective information on their allocation of time before the first wave, that is when they were living with both parents.

¹²I build a dummy variable equal to one when the criterion is applied and zero otherwise. Each sample criterion's effect is tested separately by considering the sample where the previous criterion is applied. For example, say sample 1 excludes time allocation outliers and sample 2 requires variation in family structure by excluding children who remain in a single-parent family throughout the three waves. I test whether the latter criterion affects the characteristics of my sample by building a dummy that takes one for a child in sample 2 and 0 for a child exclusively in sample 1.

TABLE 1
Sample selection: descriptive statistics

	(1) <i>No missing data</i> <i>Mean</i>	(2) <i>Excluding outliers</i> <i>Mean</i>	(3) <i>Enough variation in family structure</i> <i>Mean</i>	(4) <i>At least two observations</i> <i>Mean</i>
Age	10.42	10.34	10.36	10.54
Female	0.50	0.50	0.51	0.52
White	0.68	0.68	0.73	0.74
African american	0.13	0.13	0.08	0.08
Hispanic	0.13	0.13	0.14	0.14
Asian Pacific	0.02	0.02	0.02	0.02
American Indian	0.00	0.00	0.00	0.00
Other	0.04	0.04	0.03	0.03
Two Parents	0.71	0.71	0.85	0.84
Single Mother	0.18	0.18	0.07	0.08
Single Mother (step-parent)	0.05	0.05	0.05	0.05
Single Father	0.03	0.02	0.02	0.02
Other	0.03	0.03	0.01	0.02
PCG - Worker	0.68	0.68	0.69	0.70
PCG - Looking for work	0.04	0.04	0.04	0.03
PCG - Housewife	0.24	0.24	0.25	0.24
PCG - Student	0.02	0.02	0.02	0.02
PCG - Other	0.01	0.01	0.01	0.01
PCG education	13.04	13.03	13.13	13.18
Earnings	18,045.97	17,948.64	18,411.03	18,980.71
Observations	5,264	5,153	4,029	3,687

Notes: This table reports the summary statistics for the sample for whom we have all the relevant information (column 1), for the sample excluding outliers in terms of allocation of time (column 2) and, for the sample with sufficient change in family structure (i.e. excluding all families remaining single-mother families, with a step-parent or not, or single-father families, or others throughout the three waves) to enable us to perform a child fixed-effect analysis (column 3) and, for the sample where there are at least two observations (column 4). See section III for more details. For all samples, weighting is used to ensure the initial sample is representative of the US population. *Source:* Estimation samples drawn from the PSID-CDS.

one day during the week and one day at the weekend, picked randomly at the beginning of the survey; no substitution is possible. It is filled in on a 24-hour continuous basis, to avoid measurement errors, and lists the activity, its duration, the location, who was present during the activity, and who was involved.¹³ This can be used to measure time investments in each activity for a representative week (in hours), using a weighted average of time investments during the week and at the weekend.

Children may be more subject to recall errors, and time spent with parents is socially valuable and therefore subject to a bias towards over-estimation in stylized measures. Compared to other measures of time investment, time-use diaries lead to far less frequent recall errors; socially valuable activities are also less likely to be over-estimated. But this comes at the cost of day-to-day variation bias. Since filling in a time-use diary is time-consuming (18 minutes according to Juster, Ono and Stafford, 2003), the data set used here only provides diaries for 2 days and therefore, except for routine activities,

¹³An example of the time-use diary is provided here.

TABLE 2
Summary statistics – weekly time (in hours) on each activity

	<i>First wave</i>				<i>Second wave</i>				<i>Third wave</i>			
	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
(House)work	5.63	5.94	0	49	7.35	9.41	0	84	6.62	7.86	0	81
Personal needs	94.99	16.47	52	155	83.91	11.40	52	133	79.12	11.16	51	133
Education	22.44	18.79	0	78	33.80	16.44	0	78	36.24	12.77	0	71
Active leisure	23.21	12.46	0	81	19.52	11.88	0	78	22.09	12.45	0	68
Passive leisure	21.72	11.34	0	86	23.31	11.48	1	88	23.91	12.12	1	79
Observations	1,508				1,386				793			

Notes: This table shows the summary statistics on time-use for all children for each wave. Weighting is used to ensure the initial sample is representative of the US population.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

could lead to classical measurement errors. Further biases could arise from the presence of the parent during the survey: for example, adolescents may under-estimate the time spent on an activity their parents consider less valuable, such as watching TV. Moreover, there is a risk of measurement errors regarding time spent with the non-custodial parent, which the child may seek to minimize in front of the custodial parent.

I use five activity categories: Work and housework; Personal needs and care including sleeping time; Education including reading time; Active leisure (sports, dance, going to the theatre); and Passive leisure (Watching TV, Arguing). Note that the study focuses on the primary activity. Table 2 shows how the children divide their week among these activities. They spend a small part of their time on housework and work activities, half the day on personal needs and care (including sleeping), and the rest of the representative day on educational activities and active and passive leisure.

For each activity, I distinguish time spent alone from time with at least one parent, the latter further broken down into three types of parental time: time with the mother only, time with the father only and time with both parents together. A distinction is made between time spent with a parent involved in the activity (engaged time) or simply present during the activity (accessible time) (see Hofferth and Anderson, 2003). Time with other adults, such as step-parents and grandparents, is also measured (see Table 3).

Table 3 breaks down time according to who is involved in the activity. Panel A of Table 3 gives a breakdown of time for a representative day. 'Not relevant' activities are those that children are assumed to do without the presence of a parent (e.g. sleeping, which covers half the representative day, or school). 'Alone' means that an activity that could involve at least one adult (e.g. playing) is done alone. Activities shared with someone else ('other'), a sibling, a half-sibling, another relative or non-relative are excluded from time spent with at least one adult because of lack of information (age, sex, etc.) on these individuals.

Panel B of Table 3 gives a breakdown of time spent with at least one adult. This consists mainly of time with at least one parent, with a grandparent alone or other parental time defined as time with one parent and someone else (grandparent or step-parent). Panel C of Table 3 shows a breakdown of time with at least one parent. Half of the parental time investment is time with the mother only, and more than 75% of the time with at least one

TABLE 3
Summary statistics – weekly time (in hours) according to who is involved with the child

	<i>First wave</i>				<i>Second wave</i>				<i>Third wave</i>			
	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Panel A: Breakdown of a child's weekly time according to who is involved with the child												
At least one adult	33.49	18.16	0	101	21.90	13.89	0	92	18.25	13.07	0	101
Alone	11.17	11.08	0	70	17.12	14.07	0	76	20.03	12.72	0	73
Not Relevant	79.23	10.13	45	127	104.65	13.67	62	129	104.67	11.79	49	129
Other	44.11	23.01	0	115	24.33	15.31	0	93	25.05	14.93	0	81
Observations	1,508				1,386				793			
Panel B: Breakdown of a child's weekly time with at least one adult												
At least with one parent	29.60	16.49	0	101	19.80	13.42	0	92	15.50	11.14	0	71
Other parental time	1.89	5.46	0	87	1.21	4.07	0	57	1.98	7.53	0	95
With the grandparent (alone)	1.98	6.60	0	83	0.76	3.41	0	42	0.69	3.55	0	49
With the stepmother (alone)	0.02	0.65	0	46	0.03	0.62	0	18	0.01	0.38	0	13
With the stepfather (alone)	0.01	0.17	0	7	0.10	1.31	0	32	0.06	0.66	0	15
Other Adult Time	0.00	0.00	0	0	0.00	0.01	0	2	0.00	0.06	0	2
Observations	1,508				1,386				793			
Panel C: Breakdown of a child's weekly time with at least one parent												
With the mother (alone)	15.72	13.30	0	76	8.80	9.38	0	62	7.13	7.92	0	71
With the father (alone)	5.56	7.53	0	59	3.61	5.61	0	39	3.07	5.24	0	34
With both parents together	8.32	8.23	0	72	7.39	9.23	0	88	5.30	7.21	0	48
Other parental time	1.89	5.46	0	87	1.21	4.07	0	57	1.98	7.53	0	95
Observations	1,508				1,386				793			

Notes: This table shows the summary statistics on time-use for all children for each wave. Weighting is used to ensure the initial sample is representative of the US population. In Panel A, 'Not Relevant' means that the child is supposed to do the activity on his own; and 'Other' means that the child is doing the activity with a relative or a non-relative whose age is unknown. In Panels B and C, 'other parental time' means that at least one parent is involved, together with someone else (e.g. a grandparent or a stepparent); 'other adult time' denotes time spent with an adult (other than a parent) and someone else. 'Not relevant' activities are those that children are assumed to do without the presence of a parent (e.g. sleeping). 'Alone' means that an activity that could involve at least one adult (e.g. playing) is done alone.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

parent consists of time with at least the mother. In the main analysis, other parental time (time spent with at least one parent and someone else) is not included in parental time due to uncertainties over the effect on a child's well-being of time spent with a step-parent. I test the sensitivity of my results to this restriction in section IV.

Tables S2 and S3 show, respectively, the accessible and engaged time spent with each parent on each activity. The pattern for accessible time use is one of maternal time mainly spent on active and passive leisure, with substantial time also spent on personal needs. Maternal time spent on personal needs and active leisure, however, decreases in the latter waves. The pattern is the same for time spent with both parents together. Time spent with the father alone differs in that it is mainly time spent on leisure and little on personal needs, even in the first wave. Engaged time use patterns are the same.

Children's age is also taken into account; as children grow older, they become more likely to experience a parental separation. Moreover, children of different ages have differing requirements in terms of parental time (see e.g. Del Boca, Monfardini and Nicoletti, 2017). Hence, time investment variables are standardized by age group

(across waves) to a mean of zero and a standard deviation of one for the rest of the analysis.¹⁴

Family structure

Family structure is defined from the following questions: 'Does CHILD live with (his/her) biological/adoptive mother?' and 'Does CHILD live with (his/her) biological/adoptive father?'. While I do not distinguish between adoptive and biological parents, I distinguish adoptive/biological parents from a step-parent who is a parent's new partner. I use five family types: children living with both parents¹⁵; with their mother only; with a mother whose partner may or may not live with the child; with their father only; and with others (children not living either with their mother or with their father). However, there are too few observations for these two latter groups to allow conclusions to be drawn. Dummies are also included to control for the death of parents.

Table 4 shows the transition matrices for family structure from Wave 1 to Wave 2 and from Wave 2 to Wave 3. As noted in section III, all families remaining single-mother families, with a step-parent or not, or single-father families, or others (on the diagonal) throughout the three waves are excluded from the analysis. The rest of the observations are used to identify the effect of parental separation relative to remaining in a two-parent family. It should be noted that most of the transitions represent family breakups rather than parents being reunited. A large number of the children also experience transitions from being in a single-mother family to being in a single-mother family with a step-parent.

To check whether I have enough variation, I conduct a statistical power analysis. First, I determine the minimum detectable effect in the sample under a fixed-effect model. For a power of 0.80, the minimum detectable effect is around 0.12 points of standard deviation for single mothers, 0.18 for single mothers with a step-parent, 0.31 for single fathers and 0.26 for other types of families. Second, I compute the power for a given true value of the effect in my sample, for a fixed-effect analysis. If the true value of the effect is around 0.15, the probability of making an error of type II (i.e. not rejecting H_0 , which should be rejected) is around 0.10 for single mothers, 0.38 for single mothers with a step-parent, and greater than 0.65 for single fathers and other types of families. Given the small number of observations and of changes for single-father families and other types of families, and given the risk of making an error of type II, the results for these families are not reported but are kept in the sample, which enhances the precision of the estimation of the effect of controls. Note that there is also a strong risk of making an error of type II for single mothers with a step-parent when the estimated effect is below 0.18 of a standard deviation.

¹⁴The six age groups and their numbers of observations in the estimation sample are: 0–3 years with 511 observations; 4–6 years with 539 observations, 7–9 years with 677 observations, 10–12 years with 855 observations, 13–15 years with 654 observations, and older than 16 with 451 observations.

¹⁵Several studies have distinguished between cohabiting and married couples (Barg and Beblo, 2012; Carlson and Berger, 2013; Bianchi *et al.*, 2014). Men's and women's time allocated to non-market work is generally more similar among cohabiting couples than among married couples (Bianchi *et al.*, 2014); the same pattern is found for child-care (Barg and Beblo, 2012). However, couples generally marry before the birth and parents' gender norms are not expected to change over time. Therefore, the individual fixed effect already accounts for these differences.

TABLE 4
Transitions in family structures from 1997 to 2002 and from 2002 to 2007

	Two parents	Single mother	Single mother with SP	Single father	Other	Attrition	Total
Family structure in wave 1							
Two parents	1033	107	20	21	5	106	1,292
Single mother	29	18	61	6	13	17	144
Single mother with a step parent	5	15	2	0	5	4	31
Single father	3	0	4	0	3	4	14
Other	2	10	7	1	2	5	27
New individuals	14	0	0	0	0		14
Total	1,086	150	94	28	28	136	1,522
Family structure in wave 2							
Two parents	460	41	5	9	5	566	1086
Single mother	13	24	19	1	6	87	150
Single mother with a step parent	1	11	31	0	5	46	94
Single father	2	2	0	10	1	13	28
Other	0	4	3	0	4	17	28
Unknown (A_13)	67	26	24	6	13		136
Total	543	108	82	26	34	729	1522

Notes: This table shows the number of observations by family structure, according to their family structure in the previous wave. Children who are observed only in first and third waves are counted in the attrition column.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

Other controls

I include controls on individual and family characteristics: age, PCG's employment status, education and earnings, and number of siblings. As pointed out above, children's time investment needs may change as they get older. This is partially addressed by standardizing the time variables, but controlling for age (in months) will capture any remaining variation within the 3-year age window used to standardize the time variables.

Table 5 shows the summary statistics for these control variables on the whole sample, for each wave. The average ages in Waves 1-3, respectively, are around 6 years old, 12 years old, and 14.5 years old. 74% of my sample is white. The proportion of children living with both parents is around 89% in the first wave, but only around 76% in the last wave, an increasing proportion of children living with their mother alone.

Estimation strategy

I estimate the effect of a family breakup on child and parental time investment using an individual fixed-effect analysis at the child level. A common identification problem comes from the correlation between family structure and unobserved variables that may affect both child and parental time investment. When dealing with separation, selection has long been recognized as an estimation issue by economists (see McLanahan, Tach and Schneider, 2013, for a literature review). A child fixed-effect model copes with selection due to time-invariant variables, observed or not.

Let TI_{it}^k be a vector of time inputs measured by the total amount of time spent on activity k at time t (no matter who was there); and PTI_{it}^k a vector of parent P's time inputs spent on activity k . As mentioned in section III, for sake of comparability across age, these two variables are standardized for a mean of zero and a standard deviation of one by age group (across waves). FS_{it} is a set of dummies indicating family structure at time t . The two-parent families are the reference category. X_{it} denotes all control variables described above such as child's age, PCG's working status and earnings, and number of siblings. The child fixed-effect is denoted α_i , and absorbs the remaining time invariant controls, such as child's sex, ethnicity, or personality traits. For each activity k , the effect of a change in family structure can be estimated according to 1:

$$(P)TI_{it}^k = \delta_1^k FS_{it} + \delta_2^k X_{it} + \alpha_i^k + \epsilon_{it}^k, \quad (1)$$

where δ_1 measures the effect on time spent on the activities, in deviation from the mean for a given age. As mentioned in Family structure section, most of the transitions are family breakups, rather than family reconciliations (see Table 4), hence δ_1 mainly identifies the effect of parental separation. In the rest of the paper, I use the term parental separation, even though these transitions may include some from a single-parent family to a two-parent family.¹⁶ The effect of being in a single-parent family

¹⁶Fifty nine children in my sample experience a transition from another type of family to a two-parent family. The experience of parents getting back together may not have the same effect as experiencing a family breakup. Other papers have documented asymmetries when using a fixed effect (e.g. in terms of gain or loss of income, see Banks *et al.*, 2013). However, when I check for this by excluding children whose parents get back together, results are qualitatively similar to the main results, even if the coefficients are less precisely estimated. These results are available upon request.

TABLE 5
Summary statistics

	First wave			Second wave			Third wave		
	Mean	SD	Max	Mean	SD	Max	Mean	SD	Max
Age	6.32	3.67	0	12.08	3.76	6	14.43	2.24	19
Female	0.52	0.50	0	0.52	0.50	0	0.51	0.50	0
White	0.74	0.44	0	0.73	0.44	0	0.75	0.44	0
African american	0.08	0.27	0	0.08	0.26	0	0.07	0.25	0
Hispanic	0.13	0.34	0	0.14	0.35	0	0.14	0.35	0
Asian Pacific	0.02	0.13	0	0.02	0.13	0	0.02	0.15	0
American Indian	0.00	0.03	0	0.00	0.04	0	0.00	0.00	0
Other	0.03	0.17	0	0.03	0.18	0	0.02	0.15	0
Two parents	0.89	0.31	0	0.83	0.37	0	0.76	0.43	0
Single mother	0.07	0.26	0	0.08	0.26	0	0.09	0.29	0
Single mother (step-parent)	0.02	0.12	0	0.06	0.24	0	0.09	0.28	0
Single father	0.01	0.08	0	0.02	0.14	0	0.03	0.18	0
Other	0.01	0.10	0	0.01	0.11	0	0.03	0.17	0
PCG - Worker	0.64	0.48	0	0.71	0.46	0	0.78	0.42	0
PCG - Looking for work	0.04	0.19	0	0.03	0.17	0	0.04	0.19	0
PCG - Housewife	0.29	0.45	0	0.23	0.42	0	0.17	0.38	0
PCG - Student	0.03	0.16	0	0.02	0.12	0	0.01	0.08	0
PCG - Other	0.00	0.07	0	0.02	0.14	0	0.00	0.06	0
PCG education	13.13	2.85	0	13.13	2.93	0	13.36	3.01	17
Earnings	14,280.64	20,986.72	0	20,721.59	26,577.36	0	23,299.81	26,141.60	0
Observations	1,508			1,386			793		

Notes: This Table shows the summary statistics for all individuals for each wave. Weighting is used to ensure the initial sample is representative of the US population.
Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

with a step-parent is also mainly identified with reference to family breakups rather than reconciliations. Observing transitions from a single-mother family to a single-mother family with a step-parent (or vice-versa) also helps to identify these two effects (see Table 4).

The fixed-effect model rules out endogeneity issues due to correlation between parental separation and time-invariant variables at the child level, such as child's time-invariant characteristics or any variable whose effect is constant over time. Nevertheless, the fixed-effect estimator still relies on strong assumptions. (i) Measurement errors on time investments should not be correlated with parental separation. For example, it is possible that children's allocation of time, and in particular time spent with the father, is less accurately measured for children living in single-parent families. To avoid this, children are asked to fill in the time-use diaries for two randomly selected days per week and no substitution is possible. This reduces the likelihood of their consistently filling in the time-use diary when they are with the custodial parent. While this practice prevents large measurement errors, the assumption is still very strong. (ii) The fixed-effect estimator does not deal with unobserved time-varying variables, of which there are many examples: parents' characteristics such as behaviour (alcohol addiction), mental health, or parental conflict may be correlated with parental separation. How far this assumption is violated is uncertain. (iii) Reverse causality might also be a source of endogeneity. The parents may be separating because one of them is not sufficiently present in the home. (iv) Anticipation effects may also bias the estimates; parents might have changed their time investments prior to the separation (see Bargain *et al.*, 2012; Genadek, Stock and Stoddard, 2007; Özcan and Breen, 2012, for a literature review).

If one of these assumptions is not correct, the fixed-effect estimator will only indicate suggestive associations between parental separation and parental time investments, rather than causal relationships.

To check if assumptions (iii) and (iv) hold, parental time investments before and after the separation are compared. An event study shows whether time spent with parents is affected before the parental separation. More precisely, I focus on parental time in two groups: individuals living with both their parents throughout the survey and individuals changing to a single-mother family (with a step-parent or not). Due to insufficient observations, individuals living for a time in a single-father family or in 'other' types of families are excluded. Since behaviours in single-mother families and single-father families differ, grouping all these categories together could also be misleading. I run an event study controlling for an individual fixed effect. The effect of parental separation one period before is set to 0. There is no evidence of an effect of parental separation on time investments two periods before, suggesting that assumptions (iii) and (iv) hold (see Figure 3 in section IV).

IV. Results

In this section, I first provide estimates of the effect of a family breakup on parental time and whether it translates into a change in children's time allocation. Second, I explore whether these effects differ according to three variables of interest: gender, age at separation, and parental time investment prior to separation. Third, I investigate potential

mechanisms. Finally, I extend the analysis to time spent with other adults as possible mitigating channels.

Average effect of a parental separation on children's and parents' time investments

Table 6 gives the results on whether a parental separation affects parents' and children's time investments. Standard errors are clustered at the individual level. Models include individual fixed effects and controls such as age, number of siblings, PCG's education, employment status and earnings. Dummies indicating whether the child has a deceased parent are included. Amounts of time are standardized to a mean of 0 and a standard deviation of 1 by age group (across waves). Panels A and B show the estimation results for parental time investments measured as time spent with at least one parent, accounting for accessible time (Panel A), when the parent is (at least) present during the activity; and engaged time (Panel B), when the parent is involved during the activity. Panel C of Table 6 shows the estimation results for total child time investments, whoever is present. Note that, as there are too few transitions involving single-father families and 'other' types of families (see Table 4) for conclusions to be drawn, these results are not reported.

Panels A and B report the estimates for the effect of family breakup on, respectively, accessible and engaged time spent with at least one parent. Column 6 shows the estimates for the effect of family breakup on time spent with at least one parent, whatever the activity. Being in a single-mother family leads to a decrease of around 18% of a standard deviation in accessible time, equivalent to 3h30m per week. By comparison, having a PCG who is a housewife leads to an increase of 25% of a standard deviation (5h24m per week). Accessible time decreases in all activities except active leisure, especially in single-mother families. This is even more pronounced when there is a step-parent.

However, the decrease in accessible time does not reflect a decrease in engaged time. Estimation results on engaged time (Panel B) reveal only a slight impact from a family breakup. Estimated coefficients are negative (5% of a standard deviation decrease for single mothers), but not significant even at a 10% level. This effect is driven by a decrease in time spent on (house)work with at least one parent involved in single-mother families, and by a decrease in time spent on passive leisure and educational activities in single-mother families with a step-parent.

To clarify these findings, I break this impact down into time spent with the mother only, the father only, and both parents together. Figures 1 and 2 show the breakdown of accessible and engaged parental time, respectively. One pattern emerges from these results. The custodial parent increases time spent alone with the child, but does not manage to compensate for the double decrease in time the child spends with both parents together and in time spent alone with the non-custodial parent. Looking at accessible time, time with the custodial parent actually decreases, since she does not perfectly compensate for the decrease in time with both parents together.¹⁷ A possible explanation is the time constraints of the mother who, being single, may face a decrease in production complementarities (Couprie, 2007; Couprie and Ferrant, 2015) that makes her spend more

¹⁷These results however do not hold when I consider a broader definition of maternal time that includes time spent with the mother and someone else, see section IV.

TABLE 6
Effect of parental separation on child and parental time investments

	(House) work	Personal needs	Education	Active leisure	Passive leisure	All
Panel A: Time with at least one parent: accessible time						
Single mother	-0.20*	-0.14*	-0.19*	0.03	-0.11	-0.18*
	(0.09)	(0.07)	(0.08)	(0.08)	(0.09)	(0.08)
Single mother (step-parent)	-0.11	-0.12	-0.31**	-0.20†	-0.39**	-0.43***
	(0.13)	(0.13)	(0.11)	(0.11)	(0.12)	(0.12)
Constant	-0.11	0.25	0.07	-0.28	-0.58	-0.43
	(0.34)	(0.47)	(0.34)	(0.41)	(0.42)	(0.42)
Observations	3,687	3,687	3,687	3,687	3,687	3,687
Number of clusters	1,522	1,522	1,522	1,522	1,522	1,522
Panel B: Time with at least one parent: engaged time						
Single mother	-0.19†	-0.01	-0.01	0.04	0.01	-0.05
	(0.10)	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)
Single mother (step-parent)	-0.09	-0.02	-0.15	-0.00	-0.21†	-0.16
	(0.12)	(0.11)	(0.12)	(0.12)	(0.12)	(0.12)
Constant	-0.05	0.23	-0.23	0.33	-0.35	-0.08
	(0.35)	(0.46)	(0.34)	(0.40)	(0.35)	(0.43)
Observations	3,687	3,687	3,687	3,687	3,687	3,687
Number of clusters	1,522	1,522	1,522	1,522	1,522	1,522
Panel C: Total time (whoever was present)						
Single mother	-0.02	0.05	-0.10	0.07	-0.03	
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	
Single mother (step-parent)	0.07	-0.08	0.11	-0.00	-0.14	
	(0.12)	(0.12)	(0.11)	(0.12)	(0.11)	
Constant	0.19	-0.44	0.70†	-0.42	0.05	
	(0.31)	(0.37)	(0.41)	(0.39)	(0.41)	
Observations	3,687	3,687	3,687	3,687	3,687	
Number of clusters	1,522	1,522	1,522	1,522	1,522	

Notes: Individual Fixed-Effect Model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, PCG's working status and earnings are included, along with a dummy indicating a deceased parent. Clustered standard errors in parentheses.

† $P < 0.1$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

time on household chores. Moreover, to compensate for decreased economic resources due to reduced access to the non-custodial parent's economic resources, custodial parents may work longer hours to cope with the cost of separation, reducing time resources for the child. I investigate these mechanisms in section IV.

Another explanation is a complementarity effect. One parent increases (decreases) the time spent with the child if the other parent increases (decreases) theirs. For example, instead of going to the supermarket as a family, the custodial parent may prefer to go on her own and leave the child at home alone or with another adult. In single-mother families, the breakdown of engaged time reveals that custodial parents aim to compensate at least for the time previously spent with both parents. This especially applies to activities considered essential to the child's development, such as personal needs and care,

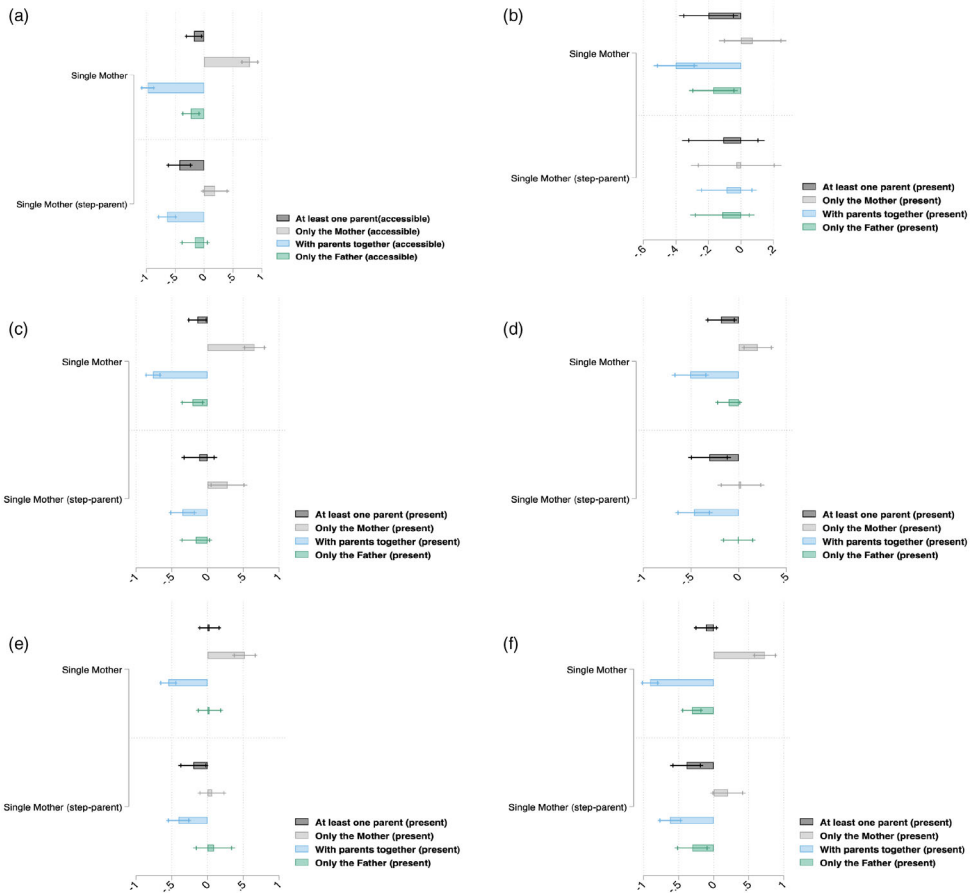


Figure 1. Breakdown of the effect of a parental separation on time with at least one parent (Accessible Time) for each activity.

Notes: Results from a child fixed-effect model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver’s working status and earnings are included, along with a dummy indicating a deceased parent

educational activities, and active leisure. Hence, the estimations do not suggest strong complementarity effects.

The next question is whether the decrease in accessible time with at least one parent translates into a change in children’s allocation of their time. Estimations in Panel C of Table 6 show that a child’s allocation of time (whoever is present or involved) is not affected by a family breakup: children spend the same amount of time on the activities considered, although they slightly substitute active leisure for educational activities in single-mother families. There is also a slight tendency to substitute educational activities and housework for passive leisure and personal needs when there is a step-parent. Children do not seem to change their habits much after a parental separation.

The time-event study performed to verify assumptions (iii) and (iv) is reported in Figure 3. The results for accessible time, based on individual fixed-effect analysis, show the evolution of pre- and postseparation parental time investments. Before the separation,

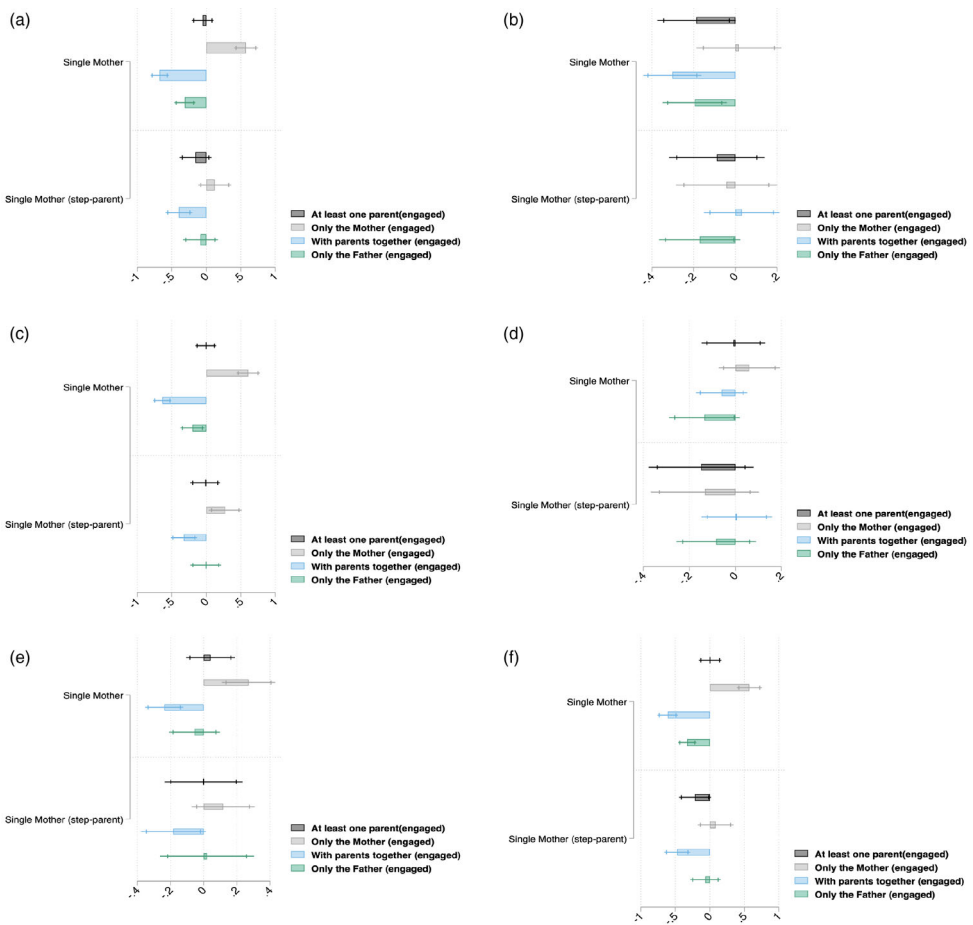


Figure 2. Breakdown of the effect of a parental separation on time with at least one parent (Engaged Time) for each activity.

Notes: Results from a child fixed-effect model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver's working status and earnings are included, along with a dummy indicating a deceased parent

parental time investments are similar in both family types. This is less clear for time spent with fathers, but the effect is small and not statistically significant. Results do not suggest that the separation is caused by less available parental time, that is reverse causality does not seem to be an issue. Therefore, assumption (iii) is reasonable. Nor do results suggest the existence of anticipation effects; parental time does not start to decrease before separation, so assumption (iv) also holds. I also provide these estimations for engaged time (Figure S3) and for each activity for parental time (Figures S4 and S5) and children's time allocation, whoever is present (Figure S6).

To sum up, estimation results show a decrease in accessible parental time after a family breakup. In addition, the breakdown between accessible and engaged parental time is greatly affected: time spent with both parents together and alone with the non-custodial parent both decrease for most activities. This does neither seem to result in a re-allocation

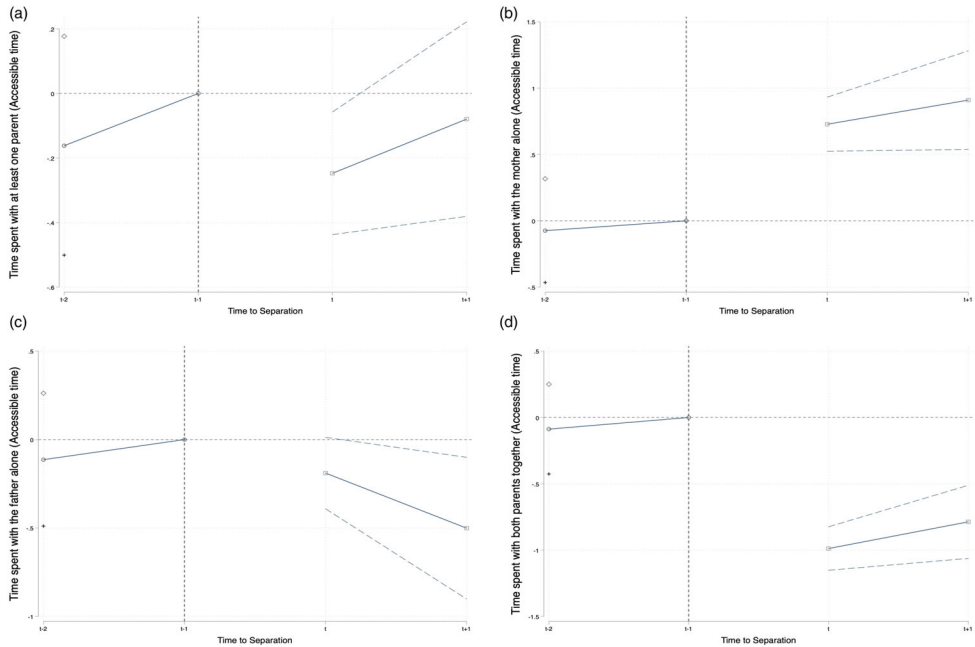


Figure 3. Parental investments before and after the separation.

Notes: Results of a time-event study, using an individual fixed-effect analysis. These figures show the evolution of parental investments before and after the separation in single-mother families

of children's time across activities (whoever is present), nor is there a clear impact on engaged time. To explore whether this average effect of a family breakup on children's and parents' time investments is the same for all families and for all children, I now look at three variables of interest: child's gender, child's age at separation, and parental time investment prior to separation.

Heterogeneity analysis

Heterogeneity according to gender

The literature documents especially poor outcomes for boys in broken families (Bertrand and Pan, 2013; Mencarini, Pasqua and Romiti, 2019; Bibler, 2020). Mencarini, Pasqua and Romiti (2019) show that living in a single-parent family has a more detrimental effect on boys' than on girls' time investment in studying. Bibler (2020) show that boys lose a larger amount of paternal engaged time than girls, with little evidence of compensation by mothers. However, Bibler (2020) does not conclude that time spent with at least one parent automatically decreases. Actually, the decrease in time spent with the father may represent either reduced time with the father alone, which would greatly impact time spent with at least one parent, or reduced time with both parents together, which would leave time with one parent unchanged. Here, I first examine whether the effect of a parental separation on time spent with at least one parent differs according to the child's gender. Second, I investigate whether a separation affects the child's allocation of time differently according to gender. Table 7 reports the results. Although there are few changes in each

TABLE 7

Effect of parental separation on child and parental time investments: heterogeneity according to gender

	<i>(House) work</i>	<i>Personal needs</i>	<i>Education</i>	<i>Active leisure</i>	<i>Passive leisure</i>	<i>All</i>
Panel A: Time with at least one parent: accessible time						
Single mother	-0.22*	-0.05	-0.06	0.11	-0.09	-0.09
	(0.10)	(0.10)	(0.10)	(0.12)	(0.13)	(0.11)
Single mother = 1 × Female = 1	0.04	-0.19	-0.27†	-0.18	-0.04	-0.18
	(0.18)	(0.14)	(0.16)	(0.15)	(0.17)	(0.15)
Single mother (SP)	-0.10	-0.13	-0.33*	-0.12	-0.40*	-0.41**
	(0.14)	(0.15)	(0.16)	(0.15)	(0.16)	(0.15)
Single mother (SP) = 1 × Female = 1	-0.03	0.03	0.04	-0.16	0.02	-0.04
	(0.25)	(0.23)	(0.21)	(0.20)	(0.23)	(0.22)
Observations	3,687	3,687	3,687	3,687	3,687	3,687
Number of clusters	1,522	1,522	1,522	1,522	1,522	1,522
Panel B: Time with at least one parent: engaged time						
Single mother	-0.26*	-0.01	0.04	-0.09	-0.03	-0.17†
	(0.11)	(0.11)	(0.10)	(0.10)	(0.11)	(0.10)
Single mother = 1 × Female = 1	0.15	0.01	-0.09	0.28*	0.08	0.25
	(0.19)	(0.14)	(0.14)	(0.14)	(0.15)	(0.15)
Single mother (SP)	-0.07	-0.10	-0.17	-0.24	-0.32*	-0.37*
	(0.14)	(0.16)	(0.17)	(0.17)	(0.16)	(0.16)
Single mother (SP) = 1 × Female = 1	-0.04	0.16	0.03	0.47*	0.22	0.42†
	(0.22)	(0.20)	(0.22)	(0.22)	(0.22)	(0.22)
Observations	3,687	3,687	3,687	3,687	3,687	3,687
Number of clusters	1,522	1,522	1,522	1,522	1,522	1,522
Panel C: total time (whoever was present)						
Single mother	-0.10	0.11	-0.06	0.10	-0.09	
	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)	
Single mother = 1 × Female = 1	0.16	-0.12	-0.07	-0.05	0.12	
	(0.17)	(0.15)	(0.16)	(0.16)	(0.15)	
Single mother (SP)	0.01	-0.11	0.07	0.15	-0.11	
	(0.13)	(0.15)	(0.14)	(0.15)	(0.16)	
Single mother (SP) = 1 × Female = 1	0.12	0.06	0.09	-0.29	-0.06	
	(0.23)	(0.22)	(0.21)	(0.22)	(0.22)	
Observations	3,687	3,687	3,687	3,687	3,687	
Number of clusters	1,522	1,522	1,522	1,522	1,522	

Notes: Individual Fixed-Effect Model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver's working status and earnings are included, along with a dummy indicating a deceased parent. Clustered standard errors in parentheses.

† $P < 0.1$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

cell, these results provide some insights into how the child's gender conditions the effect of a parental separation.

Girls experience a larger decrease in accessible time for most of the activities (Panel A) when they are in a single-mother family. There is a gender gap of around 0.18 standard deviation (1 hour and 36 minutes per week), particularly pronounced for educational activities and statistically significant at a 10% level. The gender gap for single-mother families with a step-parent is smaller. However, different results are found for engaged

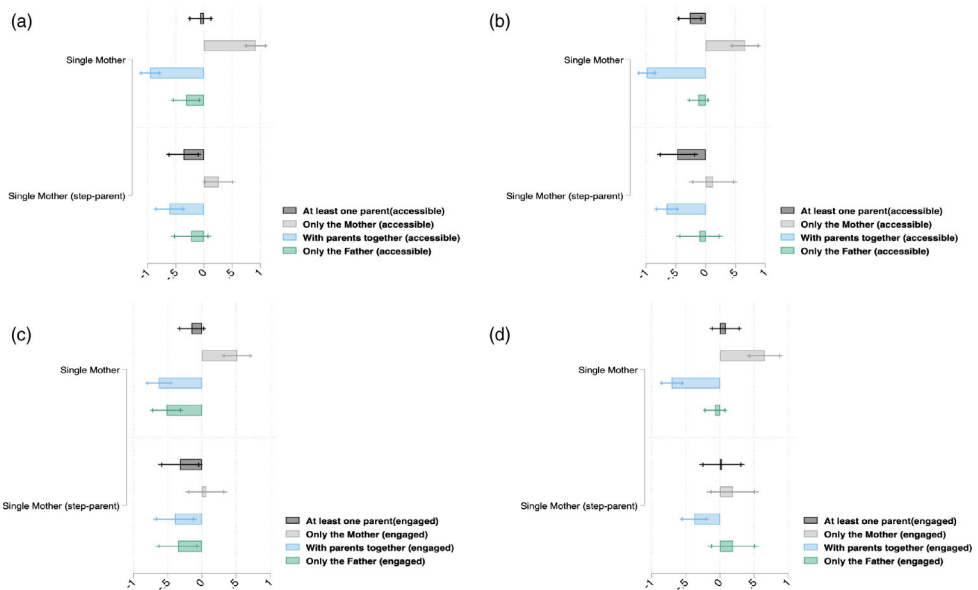


Figure 4. Breakdown of the effect of a parental separation on time with at least one parent by gender, for accessible time and engaged time

Notes: Results from a child fixed-effect model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver's working status and earnings are included, along with a dummy indicating a deceased parent

time (Panel B). Girls are much less affected than boys by a parental separation, except for educational activities when there is no step-parent. Educational activities with parents have been found to have the largest effect on children's cognitive skills (Fiorini and Keane, 2014). The results are consistent with Bibler (2020)'s hypothesis that the decrease in paternal time translates into a decrease in time spent with at least one parent.

To confirm these findings, I break this impact down into time spent with the mother only, the father only, and both parents together, by gender (see Figure 4). I find that boys systematically experience a larger decrease in time spent with the father only than girls do, for both accessible and engaged time. Mothers tend to compensate regarding accessible time, but not where engaged time is concerned.¹⁸ It should be noted, however, that boys spend more time than girls with the father alone before the separation. Hence, what is observed here is not fathers compensating more for their daughters, but a greater impact on boys due to their pre-separation advantage in time spent with their fathers (see Figure S2).

The gender difference in effect for parental time may extend to total time, whoever is present (Panel C). Boys seem to substitute passive leisure and (house)work for personal

¹⁸To see whether the gender gap in parental time investment has begun to increase before the separation (assumption iii or iv), I perform an event study. Results confirm that assumptions iii and iv hold, and are available in section S.2. None of the estimated effect of the pretrend is statistically significant. However, accessible time shows signs of a pretrend for both time spent with the mother and time spent with both parents together. Results are the same for engaged time. These results do not challenge the main finding that boys systematically experience a larger decrease than girls in time spent with the father only, for both accessible and engaged time.

needs and active leisure. Girls seem to experience a larger decrease than boys in time spent on educational activities, substituting for this active leisure and (house)work. This latter result echoes Briole, Le Forner and Lepinteur (2020)'s findings that girls spend more time on household chores after an increase in family size, while boys are unaffected. This reallocation may translate into poorer outcomes for girls.

To sum up, the differential effect of a family breakup according to child's gender depends on the definition of parental time investment. In terms of accessible time, girls experience a larger decrease following the parental separation, while the effect is reversed where engaged time is concerned.

Heterogeneity according to age at separation

Given the evidence that parental time input matters, especially in early childhood (Cunha and Heckman, 2007, 2008; Cunha, Heckman and Schennach, 2010; Del Bono *et al.*, 2016; Del Boca, Monfardini and Nicoletti, 2017), an interesting question is whether parental behaviour differs when the child is young at the time of the separation. Since the child's age at separation is not always available, the sample for this analysis is smaller. Table 8 reports the effect of a family breakup according to child's age at parental separation. Although there are few observations in each cell, these results provide some indication of how a child's age at separation conditions the impact of a parental separation.

Regarding accessible time (Panel A), children under six at separation are less affected, but the effect is still negative. Time spent on educational activities is not affected. Looking at engaged time (Panel B), across activities, the effect is close to zero for children under six, except for work and housework in single-mother families. Time spent on educational activities tends to increase. In terms of total time, whoever was present (Panel C), children under six are less affected by a parental separation, whereas after the age of six, children experiencing a separation seem to substitute personal needs and active leisure for educational activities and passive leisure, in single-mother families.

Taken together, these results suggest that children who are younger at separation are less affected by a parental separation. This is consistent with the idea that parents manage to compensate for those children who may be more vulnerable to a family breakup.

Heterogeneity according to parental time investment before the separation

Another interesting question is whether children who previously spent substantial amounts of time with their parents are more vulnerable to a breakup. The reduction could have a greater impact on children previously used to spending a lot of time with their parents because they have more to lose, or because it might be more difficult for their parents to continue spending so much time with them. On the other hand, such parents could be more willing to try to compensate for the negative effect of the separation.

To answer this question, I create a dummy equal to one if parental time (whatever the activity) was above the median before the separation, and zero otherwise¹⁹. The interaction term captures the heterogeneity of the effect of being in a single-mother family depending on whether the parents' time investment was greater than the median prebreakup. I focus

¹⁹This dummy variable is imputed across waves, hence I get a variable that does not vary over time, and is defined as a fixed parental characteristic. The median is computed by age group, for both accessible and engaged time.

TABLE 8

Effect of parental separation on child and parental time investments: heterogeneity according to age at parental separation

	(House) work	Personal needs	Education	Active leisure	Passive leisure	All
Panel A: Time with at least one parent: accessible time						
Single mother	-0.20† (0.11)	-0.13 (0.09)	-0.38** (0.14)	0.01 (0.13)	-0.23† (0.13)	-0.27* (0.11)
Single mother = 1 × < 6 at separation	0.04 (0.24)	-0.14 (0.16)	0.42* (0.18)	-0.01 (0.19)	0.03 (0.18)	0.07 (0.17)
Single mother (SP)	-0.23 (0.27)	-0.21 (0.18)	-0.58* (0.25)	-0.42* (0.17)	-0.17 (0.26)	-0.53* (0.26)
Single mother (SP) = 1 × < 6 at separation	0.07 (0.37)	0.04 (0.28)	0.57† (0.30)	0.15 (0.25)	-0.45 (0.32)	-0.01 (0.32)
Observations	3,395	3,395	3,395	3,395	3,395	3,395
Number of clusters	1,453	1,453	1,453	1,453	1,453	1,453
Panel B: Time with at least one parent: engaged time						
Single mother	-0.19† (0.12)	-0.06 (0.10)	-0.13 (0.11)	0.19 (0.12)	-0.26* (0.12)	-0.14 (0.11)
Single mother = 1 × < 6 at separation	0.08 (0.24)	-0.00 (0.17)	0.40* (0.17)	-0.16 (0.17)	0.33* (0.16)	0.20 (0.17)
Single mother (SP)	-0.40† (0.24)	-0.20 (0.19)	-0.74** (0.27)	-0.16 (0.17)	-0.02 (0.22)	-0.45† (0.23)
Single mother (SP) = 1 × < 6 at separation	0.38 (0.32)	0.19 (0.25)	1.18*** (0.33)	0.24 (0.27)	-0.32 (0.28)	0.44 (0.30)
Observations	3,395	3,395	3,395	3,395	3,395	3,395
Number of clusters	1,453	1,453	1,453	1,453	1,453	1,453
Panel C: Total time (whoever was present)						
Single mother	0.06 (0.13)	0.24* (0.11)	-0.20† (0.12)	0.15 (0.12)	-0.18† (0.10)	
Single mother = 1 × < 6 at separation	-0.03 (0.23)	-0.33† (0.18)	0.05 (0.19)	-0.08 (0.19)	0.25 (0.17)	
Single mother (SP)	-0.17 (0.25)	-0.12 (0.20)	0.15 (0.19)	-0.24† (0.14)	0.31 (0.22)	
Single mother (SP) = 1 × < 6 at separation	0.23 (0.34)	-0.04 (0.28)	-0.07 (0.26)	0.38 (0.24)	-0.61* (0.27)	
Observations	3,395	3,395	3,395	3,395	3,395	
Number of clusters	1,453	1,453	1,453	1,453	1,453	

Notes: Individual Fixed-Effect Model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver's working status and earnings are included, along with a dummy indicating a deceased parent. Clustered standard errors in parentheses.

† $P < 0.1$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

on children observed at least once with both parents and exclude children transitioning to a two-parent family from a single-parent family (parents re-united)²⁰. Due to lack of observations, I focus on children in single-mother families, without a step-parent. I choose to separate the two categories because of the heterogeneity found in the previous results.

²⁰Few differences appear when I use this sample rather than the main sample. Results are available upon request.

TABLE 9
*Effect of parental separation on child and parental time investments: heterogeneity according to
 prepartion parental time*

	<i>(House) Work</i>	<i>Personal needs</i>	<i>Education</i>	<i>Active leisure</i>	<i>Passive leisure</i>	<i>All</i>
Panel A: Time with at least one parent: accessible time						
Single mother	0.35** (0.13)	0.04 (0.11)	-0.07 (0.11)	0.23* (0.12)	0.13 (0.12)	0.30** (0.11)
Single mother = 1 × Above the median	-0.88*** (0.22)	-0.32* (0.16)	-0.27 (0.21)	-0.49* (0.21)	-0.84*** (0.20)	-1.10*** (0.17)
Observations	3,132	3,132	3,132	3,132	3,132	3,132
Number of clusters	1,294	1,294	1,294	1,294	1,294	1,294
Panel B: Time with at least one parent: engaged time						
Single mother	0.39** (0.13)	0.22* (0.11)	0.24* (0.11)	0.36*** (0.11)	0.07 (0.11)	0.48*** (0.11)
Single mother = 1 × Above the median	-1.13*** (0.26)	-0.69*** (0.17)	-0.61** (0.19)	-0.46* (0.19)	-0.73*** (0.20)	-1.32*** (0.17)
Observations	3,132	3,132	3,132	3,132	3,132	3,132
Number of clusters	1,294	1,294	1,294	1,294	1,294	1,294
Panel C: total time (whoever was present), interacted with accessible time						
Single mother	0.47*** (0.12)	0.21† (0.12)	-0.63*** (0.12)	0.14 (0.13)	0.07 (0.12)	
Single mother = 1 × Above the median	-0.71** (0.22)	-0.15 (0.18)	0.96*** (0.18)	-0.26 (0.20)	-0.30 (0.18)	
Observations	3,132	3,132	3,132	3,132	3,132	
Number of clusters	1,294	1,294	1,294	1,294	1,294	
Panel D: total time (whoever was present), interacted with engaged time						
Single mother	0.47*** (0.12)	0.21† (0.12)	-0.63*** (0.12)	0.14 (0.13)	0.07 (0.12)	
Single mother = 1 × Above the median	-0.71** (0.22)	-0.15 (0.18)	0.96*** (0.18)	-0.26 (0.20)	-0.30 (0.18)	
Observations	3,132	3,132	3,132	3,132	3,132	
Number of clusters	1,294	1,294	1,294	1,294	1,294	

Notes: Individual Fixed-Effect Model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver's working status and earnings are included, along with a dummy indicating a deceased parent. Above the median is a dummy variable equal to one if the child used to spend more than the median time with the parent prepartion (for accessible or engaged time). Clustered standard errors in parentheses.

† $P < 0.1$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

Table 9 reports the results. Although there are few changes in each cell, these results shed some light on how the level of parental time investment conditions the effect of a family breakup. For accessible time (Panel A), whatever the activity, time with at least one parent decreases more when the total accessible time spent with at least one parent was substantial prepartion. The same holds for engaged time (Panel B). Panel C shows the results for the child's allocation of time (whoever is present or involved) accounting for heterogeneity in total accessible time before the separation. Children who, prior to the separation, spent substantial amounts of time with their parents reduce the time they spend

on work and housework more than children who had less pre-separation time with at least one parent. This is also true for leisure and personal needs, but the coefficients are not statistically significant. However, the former group of children tends to spend more time on educational activities. Panel D shows similar results, now accounting for heterogeneity in total engaged time before the separation. Estimations support these trends, except for leisure, where no differences between the two groups appear.

To sum up, children who spent a lot of time with their parents before the separation are more affected by family breakup in terms of parental time, both accessible and engaged. This is consistent with the hypothesis that they have more to lose. Looking at total time (whoever is present), they also tend to replace time spent on work and housework with the educational activities that more involved parents are likely to protect and promote.

Testing Potential Mechanisms

As stated in section II, three potential mechanisms could explain a decrease in the parents' accessible time: a decrease in resources leading to a lower investment in the child's human capital, a decrease in consumption and production complementarities, and complementarities between the two parents' allocation of time (if one increases/decreases the time spent with the child, the other may increase/decrease it too). On the other hand, there could be compensatory mechanisms: an increase in the bargaining power of the most altruistic parent, and compensation by the custodial parent in the form of decreased private leisure time or labour supply. In this section, I provide empirical evidence to distinguish among mechanisms. First, I look at the primary care-giver's²¹ time-use: her labour supply, her time spent on household chores, and whether time spent with the child is re-allocated over different hours of the day, divided into week and weekend days. Second, I examine whether this re-allocation of time reduces economic resources.

Primary care-giver's time use

We saw in section IV that mothers partially compensate for the decrease in time spent with the non-custodial parent and maintain their own amount of time investment. Here, I investigate how these changes interact with other changes in their time-use. First, I look at two major uses of mother's time: household chores and labour supply. Second, I check whether they re-allocate time spent with the child over different hours of the day, by week and weekend day.

As mentioned in section II, separation means parents lose all the consumption and production complementarities they had as a couple (Couprie, 2007; Couprie and Ferrant, 2015). I estimate the effect of a family breakup on the primary care-giver's participation in household chores, available in hours per week in the family survey waves for years 1997, 2003 and 2007. There may be some measurement error for 2003, since the mother may have re-partnered the year after 2002. Results are listed in the first column in Table 10. I find that single mothers without a partner increase the time they spend on household chores by around 5 hours a week, consistent with a loss in production

²¹In this section, the primary care-giver is defined as the primary care-giver in the last wave to avoid switching from father to mother if surveyed before and after the parental separation.

TABLE 10
Effect of parental separation on primary care-giver's allocation of time and earnings

	<i>PCG's household chores (hours/week)</i>	<i>PCG's labour supply (hours/week)</i>	<i>Taxable income (in log)</i>	<i>Total Family Income (in log)</i>
Single mother	4.81*** (0.86)	-6.35*** (1.34)	-0.54*** (0.08)	-0.38*** (0.06)
Single mother (step-parent)	-1.00 (1.18)	-0.52 (1.82)	-0.35*** (0.09)	-0.22** (0.07)
Observations	3,624	3,637	3,506	3,587
Number of clusters	1,522	1,522	1,502	1,518

Notes: Individual Fixed-Effects Model. PCG's household chores are surveyed in 1997, 2003 and 2007. PCG's working hours are available for 1996, 2002 and 2006, surveyed in 1997, 2003 and 2007, respectively. Income are available for 1998, 2002 and 2008, and surveyed in 1999, 2003 and 2009, respectively. Family income includes transfer income and the taxable and transfer income of other family unit members. Clustered standard errors in parentheses.

† $P < 0.1$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Source: Estimation sample drawn from the PSID-CDS, see section III.

complementarities. Mothers who are re-partnered are unaffected. This may explain why mothers are unable to fully compensate for the decrease in time spent with the father.

As stated in section II, to compensate for the decrease in time spent with the non-custodial parent, the mother may decrease her labour supply. While observations of the parent's yearly working hours are available for 1996, 2002 and 2006,²² it is unfortunately impossible to determine whether the separation occurred before or after working hours were measured (for 1996 and 2006). For ease of interpretation, these variables are converted into hours per week. Results, listed in column 2 in Table 10, suggest that the primary care-giver works 6 hours less per week. This is consistent with the idea that the primary care-giver aims to compensate for the decrease in paternal time, which means decreasing her labour supply to maintain the time she spends with her child.

Taken together, these results show that single mothers face greater time constraints (when they do not re-partner). To compensate for decreased production complementarities, they spend more time on household chores. To compensate for the decrease in the father's time investment, they tend to reduce their labour supply so as to maintain time devoted to their children. Greater time constraints may translate into a re-allocation of time spent with the child over different hours of the day, which I check for, by week and weekend day. Since the main analysis did not reveal much effect for engaged time, I focus on accessible time. Results are available in Table 11.

For time spent with at least one parent, while there is no statistically significant effect, an increase is observed between 23:00 and 6:00 on a weekday, and a decrease is observed on the weekend. As previously shown, time spent with the mother alone increases when the child is in a single-mother family, but this increase is largest between 23:00 and 6:00, and between 19:00 and 23:00, on a weekday. During the weekend, however, the increase is largest between 6:00 and 19:00. Hence, in addition to spending less time with at least

²² Again, these variables are based on the PSID family surveys, whose survey years do not perfectly match those for the CDS. Working hours in 1996, 2002 and 2006 are surveyed in 1997, 2003 and 2007, respectively. We also observe weekly hours, which yields similar results.

TABLE 11
Effect of parental separation on parental time investments over the day (accessible time)

	23:00–6:00 hours	6:00–15:00 hours	15:00–19:00 hours	19:00–23:00 hours
Panel A: Time spent with at least one parent				
<i>For a week day</i>				
Single mother	1.26 (0.76)	0.33 (0.41)	−0.02 (0.86)	0.75 (0.88)
Single mother (step-parent)	−0.32 (0.63)	−0.24 (0.33)	0.39 (0.71)	0.17 (0.72)
Observations	3,661	3,661	3,661	3,661
<i>For a weekend day</i>				
Single mother	−1.52 (1.36)	−0.10 (0.96)	−0.26 (1.15)	−1.91† (1.02)
Single mother (step-parent)	−0.34 (1.26)	−0.24 (0.89)	−0.44 (1.07)	−0.40 (0.95)
Observations	3,652	3,652	3,652	3,652
Panel B: time spent with the mother (alone)				
<i>For a week day</i>				
Single mother	2.63*** (0.55)	0.09 (0.49)	−0.00 (0.82)	1.66* (0.66)
Single mother (step-parent)	−0.11 (0.45)	−0.22 (0.40)	0.27 (0.67)	0.60 (0.55)
Observations	3,661	3,661	3,661	3,661
<i>For a weekend day</i>				
Single mother	0.03 (0.74)	1.37 (0.86)	2.19* (0.86)	0.81 (0.58)
Single mother (step-parent)	−0.70 (0.68)	−1.84* (0.80)	−0.87 (0.80)	−1.20* (0.54)
Observations	3,652	3,652	3,652	3,652

Notes: Individual Fixed-Effect Model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver's working status and earnings are included, along with a dummy indicating a deceased parent. Clustered standard errors in parentheses.

† $P < 0.1$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Source: Estimation sample drawn from the PSID-CDS, waves 1997, 2002 and 2007, see section III.

one parent, children in single-mother families may face a decrease in the quality of time spent with the parent if time spent in early morning and late evening is time of lower quality. This may impact their allocation of time over the day (e.g. they may go to bed later).

Economic resources

The decrease in the primary care-giver's labour supply may reduce their income and thus economic resources. As mentioned in section II, this may explain a decrease in time spent on costly activities (e.g. sports, extracurricular activities, cinema). Although the effect is not statistically significant, a decrease in time spent on educational activities (including extra-curricular educational activities) is observed in single-mother families. While it is impossible to directly test for the effect of expenditures on a child's development, parents'

income can serve as a proxy for resources available to be invested in a child's human capital, although it does not take the non-custodial care-giver's income into account. I also look at total family income, which includes transfer income and the taxable and transfer income of other family unit members.

While information on economic resources is available in the main family survey of the PSID, the survey waves do not exactly match the year of interview of the CDS. Hence, I use the income data provided in the following year as a proxy when current income is not available. Income information for 1998 is available in the 1999 survey, information for 2002 in 2003, and information in 2008 in 2009. Since information for 1997 and 2007 is not available, it is impossible to determine whether another change in the family structure had occurred at the time when labour market outcomes were measured. Hence, the results in columns 3 and 4 of Table 10 should be interpreted with caution. Being in a single-mother family leads to a decrease of around 54% in income. The effect is 35% when there is a step-parent. Where family income is considered, both effects are smaller, but still negative and statistically significant. Thus, the effect found on children's time allocation may be related to a shock on the primary care-giver's resources.

Time with other adults

So far, only parental time has been considered. I now explore whether time spent with other adults, such as a grandparent or a step-parent, mitigates the effect of a family breakup on parental time.²³

Figure 5 shows the effects of a parental separation on time spent with at least one adult. Accessible time decreases when the child lives in a single-parent family; however, not statistically significantly (Figure 5a). The effect on engaged time spent is close to zero. Next, I investigate which adult acts as a recovery channel. I first test the sensitivity of my definition of parental time. So far, my definition of parental time has excluded time spent with a parent if someone else is also present/engaged (denoted exclusive definition). This is because of uncertainties over the effect on a child's well-being of time spent with a parent and other adults (e.g. a step-parent), relative to time spent with a parent alone. A parent might be less accessible when there is another adult around. I now broaden my definition to include time spent with at least one parent and another adult (inclusive definition). This last category is broken down into time spent with at least one parent (the

²³I also look at time spent with siblings. Unfortunately, lacking information on the age of siblings involved in the activities. I cannot distinguish between time spent with a younger sibling (when children may be giving child-care) from time spent with an older sibling (when children may be receiving child-care). Nor can I isolate the effect of receiving child-care by limiting the sample to the last born, since the sample contains only 337 children (769 observations) with at least one older sibling and no younger sibling, observed at least twice, and only 87 observations in a single-parent family. This does not allow sufficient statistical power for an effect to be detected. To capture receiving child-care, I define time spent with a sibling as time spent with a sibling or a step-sibling with no adult involved or around, rather than family time or time siblings spend playing together. Results are reported in Table S8. Accessible time spent with a sibling increases by 34% of a standard deviation in single-parent families, and by 80% of a standard deviation in single-mother families with a step-parent. The latter estimate is statistically significant at a 1% level, while the former is not. Engaged time spent with a sibling increases by 29% of a standard deviation in single-parent families, and by 76% of a standard deviation in single-mother families with a step-parent. The latter estimate is statistically significant at a 1% level, while the former is not. While these results suggest that siblings may also compensate for the decrease in paternal accessible time, they do not permit strong conclusions to be drawn.

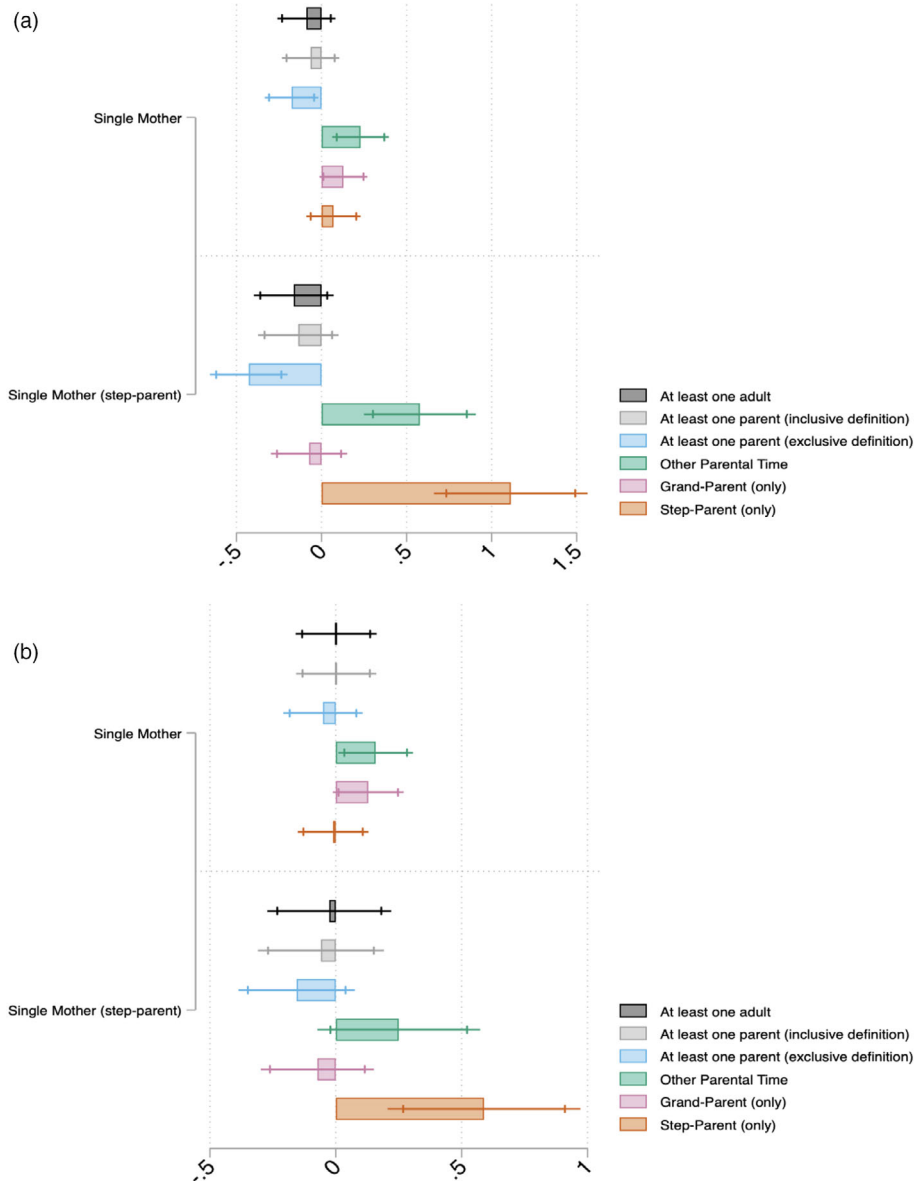


Figure 5. Effect of a parental separation on time with at least one adult.

Notes: Results from a child fixed-effect model. Time variables are standardized by age group (across waves) to a mean of zero and a standard deviation of one. Controls for age, number of siblings, primary care-giver's working status and earnings are included, along with a dummy indicating a deceased parent. The inclusive definition of parental time includes time spent with at least one parent and another adult. This last category is broken down into time spent with at least one parent (exclusive definition) and other parental time, that is time spent with at least one parent and someone else (a step-parent or a grandparent)

previous exclusive definition) and other parental time, that is time spent with at least one parent and someone else (a step-parent or a grandparent).

Comparing the inclusive and the exclusive definitions of parental time, it is clear from Figure 5a that the effect of the family breakup is greater under the exclusive definition. This difference is more pronounced for single-mother families with a step-parent, those likely to be the most affected by under-estimation of parental time under the exclusive definition. Nevertheless, the results remain similar. For engaged time (Figure 5b), there is no statistically significant effect on time spent with at least one parent, regardless of the definition used.

In a period where the nuclear family seems to be the norm, inter-generational links might come into play, absorbing some of the shock of parental separation (Deleire and Kalil, 2002)²⁴. I now consider time spent with a grand-parent (alone). Several cross-sectional studies have attempted to address this question (Deleire and Kalil, 2002; Pilkauskas, 2012; Dunifon, Near, and Ziol-Guest, 2018). In comparison to married mothers, single mothers were found to be 4.7 times more likely to have lived in a three-generation family household (Pilkauskas, 2012). Dunifon, Near and Ziol-Guest (2018) found that children in single-parent families spend more accessible time with their grand-parents but that engaged time with a grand-parent is the same in two-parent and single-parent families. Consistent with these findings, I find that the time spent with a grand-parent (alone), both accessible and engaged, increases in single-mother families without a step-parent (Figure 5). This suggests that the differences found between single-parent and two-parent families in cross-sectional studies are not due to unobserved characteristics.

However, time spent with a grand-parent is not affected in single-parent families with a step-parent. Step-parents may act as a stronger recovery channel. Several studies found that step-parents can have a negative effect on outcomes for their step-children as compared to their biological children, but these effects are not always statistically significant (Evenhouse and Reilly, 2004; Ginther and Pollak, 2004; Gennetian, 2005). According to Hofferth and Anderson (2003), once selectivity on observable variables is eliminated, differences in paternal investments between step-fathers and biological fathers are small and not statistically significant. The difference between using the inclusive and the exclusive definition is much more pronounced for single-mother families with a step-parent, regardless of whether living with the child, meaning that other parental time (i.e. time spent with the parent and other adults, possibly the step-parent) increases in such families (Figure 5). Time spent with a step-parent (alone) also increases in these families (Figure 5), acting as a recovery channel. On the important question of whether having a step-parent leads to an accumulation of parental time, the results do not indicate this. While none of the effects is statistically significant, children in single-mother families with a step-parent are allocated less time than those without a step-parent, when considering time spent with at least one adult or at least one parent (inclusive definition).

As mentioned in section II, the presence of a step-parent can have two opposite effects. The mother may increase time spent with the child under complementarity and if she

²⁴Deleire and Kalil (2002) find that children who live in single-parent families with a grand-parent fare as well as children in two-parent families.

prefers to spend time with the child when another adult is involved. This would mean more time spent with the child (jointly with the step-parent). On the other hand, since the custodial parent now has to bargain with the step-parent, her bargaining power regarding the allocation of the household resources will decrease. If this partner is less altruistic about her child, the resources available for investment in the child's human capital may be taxed by this new partner (Ginther and Pollak, 2004). Comparing maternal time in single-mother families with and without a step-parent reveals the dominant effect. When time spent with the mother (whoever else is present) is considered, children with a step-parent spend less time with their mother than children whose mother has not re-partnered. The difference for engaged time is large, about 0.20 points of a standard deviation and statistically significant.²⁵ Hence, my results do not suggest any complementarity effect of a step-parent: the mother does not appear to increase her time with the child through a desire to share this time with her partner. The 'taxation' of maternal time by the partner seems to dominate the complementarity effect. However, as mentioned above, time spent with the step-parent alone increases. Whether time spent with the step-parent alone is a good substitute for parental time is an open question. The possibility that mothers reduce the time they spend with their child because they rely on their partner to take over cannot be ruled out.

V. Concluding discussion

This paper examines whether a parental separation impacts child and parental time investments. Five new findings emerge. First, time with at least one parent accessible decreases. This finding supports the *resource theories*, pointing to both a decreasing amount of resources available to children and a loss of consumption and production complementarities. However, estimations do not indicate a strong effect on engaged time; this is consistent with the existence of compensation effects. Second, the decrease in accessible time does not translate into a change in children's allocation of their time, whoever is present.

Third, the breakdown of accessible and engaged parental time is highly affected. Both time spent with both parents together and time alone with the non-custodial parent decrease in most activities²⁶. The custodial parent compensates partially for the decrease in time spent with the non-custodial parent, and seeks to maintain the amount of quality time. This suggests a certain degree of complementarity between paternal and maternal time in these families. However, since substitution is high regarding parental involvement, the custodial parent's time constraint may be a better explanation for this partial substitution. There is an increase in single parents' participation in household chores, consistent with the loss of production complementarities (Couprie, 2007; Couprie and Ferrant, 2015).

Fourth, children who were younger when the separation occurred seem to be less affected by the decrease in time spent with at least one parent. This is in line with compensation theories: with younger children requiring more parental time, the custodial

²⁵Results are reported in Table S9.

²⁶This might be less the case for younger cohorts. The share of fathers who have no contact with their children after a separation has decreased; and involved fathers spend more time with their children after a separation in younger cohorts (Westphal, Poortman and van der Lippe, 2014).

parent may substitute parental time for their own leisure time. Results are less clear-cut for the gender differential in the effect of family breakup. Boys in a single-mother family experience larger reductions in parental engaged time, but the effect is reversed where accessible time is concerned. Moreover, participation in household chores increases more for girls than for boys, though the difference is not statistically significant. Note that children accustomed to spending substantial amounts of time with their parents prior to breakup are more affected by the separation.

Fifth, time spent with at least one adult present also decreases, but the effect is not statistically significant. Time spent with grand-parents partially acts as a recovery channel, as does time spent with the step-parent alone. The presence of a step-parent does not, however, lead to an accumulation of time spent with an adult. Single mothers spend on average less time with their child when they have a new partner. Thus, the loss of mother's bargaining power due to the presence of a step-parent overcomes the complementarity effect of the child spending time with a step-parent. However, it is impossible to rule out the hypothesis that single mothers with a partner decrease the time they spend with their child, relying on their partner's time as a substitute.

Several studies highlight the importance of time spent with parents in early childhood for skill acquisition (Fiorini and Keane, 2014; Del Bono *et al.*, 2016; Del Boca, Monfardini and Nicoletti, 2017). Hence, the average decrease in accessible time could hamper the child's skill development. Based on the findings of Fiorini and Keane (2014), I estimate that the negative effects of parental separation on parental time could translate into a decrease of 0.036 and 0.024 points of a standard deviation for verbal abilities and logical abilities, respectively. Children living in a single-mother family with a step-parent are even more affected: the negative effect on parental time could translate into a decrease of 0.06 and 0.04 standard deviation points for verbal abilities and logical abilities, respectively.

Moreover, the change in the breakdown of parental time might also have a negative impact on the child's development, an area of inquiry that has attracted little attention. Future research needs to look at whether time spent with the mother and the father are substitutes rather than complements in a child's skill development (Le Forner, 2021).

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Supporting information