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Working Paper

Fathers' parental leave-taking, childcare involvement and mothers' labor market participation

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Marcus Tamm

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Fathers' parental leave-taking, childcare involvement and mothers' labor market participation

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Abstract. This study analyzes the effect of fathers' parental leave-taking on the time fathers spend with their children and on mothers' and fathers' labor supply. Fathers' leave-taking is highly selective and the identification of causal effects relies on within-father differences in leave-taking for first and higher order children that were triggered by a policy reform promoting more gender equality in leave-taking. Results show that even short periods of fathers' parental leave may have long-lasting effects on fathers' involvement in childcare and housework. Effects on maternal labor supply are also significantly positive but do not persist over time.

JEL classification: H31, J13, J22

Keywords: parental leave, childcare, female labor supply, gender differences, policy evaluation

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1. Introduction

There is extensive evidence that women have lower rates of employment than men and lower wages if employed (OECD 2017). These differences are much larger for mothers than for childless women and it has been argued that it is the birth of children and specifically the birth of the first child which is one of the main triggers for the divergence of labor market outcomes of men and women (e.g. Waldfogel 1998a, 1998b, Bertrand et al. 2010, Angelov et al. 2016). At the same time it is well known that within families it is mainly mothers who leave the labor market for the first couple of months after childbirth and who take care of the child. Even several years after childbirth mothers continue to dedicate more time to childcare and housework than fathers (Bianchi 2000, Bianchi et al. 2000). Several studies document that time out of the labor market for childcare has long lasting effects on employment, earnings and wages of women (Shapiro and Mott 1994, Lundberg and Rose 2000).

In order to achieve a more equal division of childcare, housework and employment between mothers and fathers, several countries introduced father quotas for parental leave, e.g. Norway, Sweden, Iceland, Germany and France. These quotas or daddy months are intended to incentivize fathers to take leave and to engage more in childcare and housework. The literature discusses several mechanisms of how fathers' leave-taking might affect the involvement in childcare and the sharing of household duties afterwards. Based on Becker (1991), parents acquire caring skills while on leave. These result in comparative advantages in caring for the child later on and respective relative disadvantages in labor market skills due to reduced labor market experience resulting from leave. Other mechanisms may be based on changes in resource-bargaining within couples (Lundberg and Pollak 1996) that are due to reduced labor market experience while on leave or on changes of identity (for a survey on mechanisms discussed in different disciplines see Schober and Zoch 2015).

The literature on paternal leave shows that fathers taking leave are more involved in childcare and housework and have female partners who are more engaged in the labor market (e.g. Nepomnyaschy and Waldfogel 2007, Tanaka and Waldfogel 2007, Haas and Hwang 2008, Kluve and Tamm 2013). However, whether this is due to selection of specific fathers into leave or due to a causal effect is less clear. The literature estimating causal effects of fathers' leave-taking is rather small and inconclusive. For example Ekberg et al. (2013) analyze a reform in Sweden that reserved one month of parental leave for fathers. They do not find that fathers' parental leave affects childcare involvement, which they measure using leave taken for care of sick children, or fathers' and mothers' long-term employment and wages. Cools et al. (2015) analyze reforms in Norway and find that mothers' labor market outcomes do not significantly improve due to a father quota. However, fathers' take-up of parental leave improves children's school performance at the end of lower secondary education. According to Cools et al. (2015) men's earnings are not affected by leave-taking which is in contrast to findings by Rege and Solli (2013) who analyze the same Norwegian reform and show that parental leave reduces fathers' earnings significantly. With regard to the division of household tasks Kotsadam and Finseraas (2011) show that fathers are more involved in the task of washing clothes but not in other tasks such as cooking or cleaning if they took leave and that this effect persists almost 15 years after childbirth. Analyzing a reform in Quebec Patnaik (2016) shows that fathers' involvement in childcare and domestic work increases as well as maternal employment, while

fathers' employment is not significantly affected by the introduction of daddy months. Similarly, Farré and González (2018) show that the introduction of two weeks of paternity leave in Spain increases maternal employment rates, while leaving fathers' labor market attachment unchanged.

Analyses estimating causal effects of paternal leave generally rely on natural experiments coming from policy reforms for identification. Typically they compare families with children born shortly before the policy reform and families with children born shortly after the reform in a kind of regression discontinuity setting to obtain estimates of the intention to treat effect. This identification strategy is not unproblematic because most reforms implementing or extending father quotas also change other aspects of leave-taking. In this case the intention to treat effects that are presented in the papers generally measure a combined effect of fathers' increased leave-taking and other elements of the reform. Recognizing this Cools et al. (2015) provide evidence demonstrating that the effects estimated in their paper are most likely to be due to fathers' increased leave-taking and not due to the other elements of the reforms they focus on. Most studies, however, miss out on this aspect.

This paper contributes to the literature on paternal leave and to the more general literature on gender differences in labor market participation and home production by asking whether parental leave of fathers influences (i) fathers' involvement in childcare and housework, (ii) maternal employment as well as (iii) fathers' employment. The analysis focusses on short and long-term effects, measured up to six years after childbirth. In contrast to previous studies, the analysis does not rely on a regression discontinuity approach estimating intention to treat effects. Rather, identification of causal effects relies on within-father differences in leave-taking for first and higher order children that were triggered by a policy reform promoting more gender equality in leave-taking. This strategy combines the advantages of fixed effects models to remove any differences in observed and unobserved factors that are stable over time between fathers who are taking leave and those who are not taking leave (e.g. motivation, beliefs or preferences) and the advantages of natural experiments to provide an exogenous source of variation in fathers' leave-taking. In the year 2007 the system of paid parental leave experienced a major reform in Germany that also included the introduction of a father quota comprising two daddy months. The reform increased fathers' leave-taking considerably and enables us to compare fathers with a first child born before the reform and a higher order birth after the reform who display differences in leave-taking over time. Results indicate that fathers' leave-taking significantly boosts the time fathers dedicate to childcare and housework and that this is also the case after fathers' return from leave. Mothers' working hours are significantly increased and fathers' working hours are significantly reduced by fathers' leave-taking, but these labor market effects seem to be rather short-lived.

The paper is structured as follows. A description of the 2007 reform of parental leave in Germany and the identification strategy are provided in the second section. Section 3 presents the data. Results are shown in Section 4. Section 5 presents tests supporting the assumptions of the identification strategy and discusses the generalizability of the results. A conclusion is provided in Section 6.

2. Identification strategy and policy reform

In 2007 Germany introduced a new system of paid parental leave. This reform applied to all parents of children born on 1st of January 2007 or later and introduced a father quota. Overall, families were eligible to 14 months of paid parental leave out of which two months were reserved for the father and two months for the mother. The family would lose the two daddy months if the father did not use them. Paid leave had to be taken during the first 14 months after childbirth and parents might take leave consecutively or in parallel. Each parent taking paid leave would have to take at least two months, i.e. it was not allowed that fathers took one month only. This implies that the choice set of fathers was to take either (i) no leave, (ii) exactly two months of leave or (iii) more than two months of leave, up to 12 months at most. The latter required mothers to take less than 12 months of paid leave. While on parental leave parents receive benefits replacing 67% of pre-childbirth net labor earning.

Administrative data reveal that the reform considerably increased the share of fathers taking parental leave. Before the reform the share of fathers on leave was estimated to be no more than 3%. For fathers with children born in 2007, i.e. the first cohort after the reform, the share was 15% and steadily increased to 34% for fathers with children born in 2014 (Huebener et al. 2016). Most fathers taking leave decide to take exactly two months of paid leave and few families share paid leave equally between both parents. RWI (2008) and Reich (2011) show that fathers' take-up of leave is highly selective. The probability of fathers' leave-taking is higher for highly educated fathers, for older fathers, in households where the mother was working before childbirth and in particular if mothers' hours of work were higher than fathers' hours of work. This selectivity in leave-taking makes cross-sectional comparisons of fathers with and without leave unlikely to reveal causal effects. A comparison of fathers with children born shortly before or after the reform in a regression discontinuity setting, however, is also unlikely to generate causal estimates of fathers' leave-taking, as the reform in 2007 included other changes as well. For example, before 2007 parental leave was means-tested, comprised a fixed benefit that was unrelated to pre-childbirth labor earnings and was paid for up to 24 months for either mother or father. In 2007 means-testing was abolished, benefits replaced 67% of pre-childbirth labor earnings and the maximum duration was 14 months for both parents combined. Any comparison of parents giving birth before and after the reform will also reflect behavioral changes due to these elements of the 2007 reform. As a consequence, all analyses relying on such a regression discontinuity setting that analyze the 2007 reform correctly interpret their findings to reflect the effects of the entire reform and not of a single element such as the father quota (e.g. Bergemann and Riphahn 2011, Kluve and Tamm 2013, Schober 2014, Geyer et al. 2015, Cygan-Rehm 2016, Kluve and Schmitz 2018).

If we are interested in separately identifying the effects of fathers' leave-taking we will, therefore, have to look at the actual take-up but will at the same time have to account for the selectivity of take-up. The analysis does so by estimating fixed effects models that identify the effects of differences in leave-taking between first and higher order children. In general, such differences in leave-taking within fathers might be selective as well. For example, if a father took leave for the first child but not for the second this might be due to a more demanding job position at the time of second childbirth which might itself have an impact on fathers' involvement in childcare and housework. Or it might be that a father took no leave when the

first child was born but since the mother was not satisfied with the division of housework he decides to adjust his contribution to housework and when the second child is born also takes parental leave. To circumvent the problem of selectivity in within-father-differences in leave-taking the analysis resorts to the 2007 reform of parental leave and applies the fixed effects model to a sample of fathers who had a first child before the reform and a higher order child after the reform. The analysis argues that the increase in the take-up of parental leave for the higher order child is mainly due to the reform. Given the low share of fathers' taking leave before the reform this is plausible.

The regression equation is modelled as follows:

$$y_{it} = \alpha_i + \text{Paternal leave}_{it}'\beta + X_{it}'\delta + \varepsilon_{it} \quad (1)$$

where y is the outcome of father i (or of the mother) measured at time t . Paternal leave is a dummy variable indicating whether the father took parental leave for the child which is his youngest at time t . X controls for factors that change over time, specifically the number of children of the father and the age of the youngest child. To account for overall changes in fathers' or mothers' behavior over time the analysis also controls for time trends using a cubic specification. All differences between fathers with and without leave that are constant over time are captured in α_i . If, for example, it is mostly fathers taking leave after the reform who would have been highly involved in childcare and housework even in the absence of leave-taking this will be captured in α_i . The model is able to identify these fixed effects because before the reform hardly any father took leave. It assumes that fathers who would have been highly involved in childcare and housework even in the absence of leave-taking already display such high involvement after the birth of their first child when they were not on leave. β measures the causal effect of treatment on the treated, i.e. the impact on families where fathers actually take parental leave. Any influence of the 2007 reform on behavior of families in general that might, e.g., stem from the fact that the government introduced a father quota and promoted fathers' involvement in childcare and that also affected families where fathers did not take leave are not covered by the estimate.

The identification assumptions of this model are that (i) without the 2007 reform and the increased attractiveness to take paid parental leave time trends in behavior of involved and uninvolved fathers (i.e. those eventually taking parental leave and those not taking leave) would have changed in parallel and that (ii) differences in behavior by number of children of involved and uninvolved fathers are similar. The identification strategy would be violated if, irrespective of the reform, involved fathers displayed an increase in childcare time when higher order children are born, while uninvolved fathers decreased childcare time, e.g. as a response to higher specialization of parents. Another violation would be if the other elements of the 2007 reform had differential effects for involved and uninvolved fathers. Section 5 provides evidence that such violations of the identification strategy are unlikely to challenge the results.

Note that the analysis does not consider fathers who had no child before the reform because gender differences in household and market production are much lower before entry into parenthood. Thus, for fathers taking leave who had no child before 2007 it is unlikely that behavior before first childbirth is a good proxy for behavior in the absence of the father quota.

This is most evident when looking at men's time dedicated to childcare which is basically always zero for childless men. A closely related study is Bünning (2015) that also applies father fixed effects models. In her analysis she includes first-time fathers who are observed between childbirth and take-up of parental leave. For first-time fathers she assumes that behavior during the first few months after childbirth and before leave-taking provides a good comparison for behavior later on when the child is older. In doing so, Bünning (2015) only considers a selective group of first-time fathers, namely those taking leave at the end of the 14 months leave period. Other important differences between Bünning (2015) and our paper are that we use a larger set of outcome variables including maternal employment and that we look at more long-term effects, not only at effects within the first or second year after leave-taking.

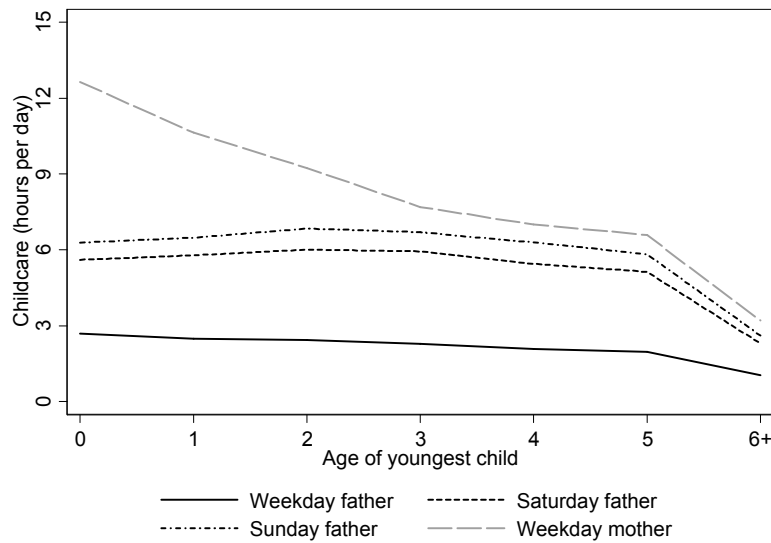
By design of the comparison and the restriction to a sample of families who already had a first child, the treatment effect is estimated only for families with more than one child and for fathers' leave-taking with higher order children. Section 5 presents a discussion on the external validity of the findings and on whether these findings can be generalized to all families with fathers taking leave.

3. Data

The analysis uses data from the Socio-Economic Panel (SOEP v31.1). SOEP is a representative longitudinal study of households in Germany running since 1984. On an annual basis individuals provide, among others, information on demographic events, lifestyle and labor market participation of all household members. More than 11 000 households with more than 30 000 individuals participate in SOEP each year. The analysis focuses on information from the years 2000 to 2015.

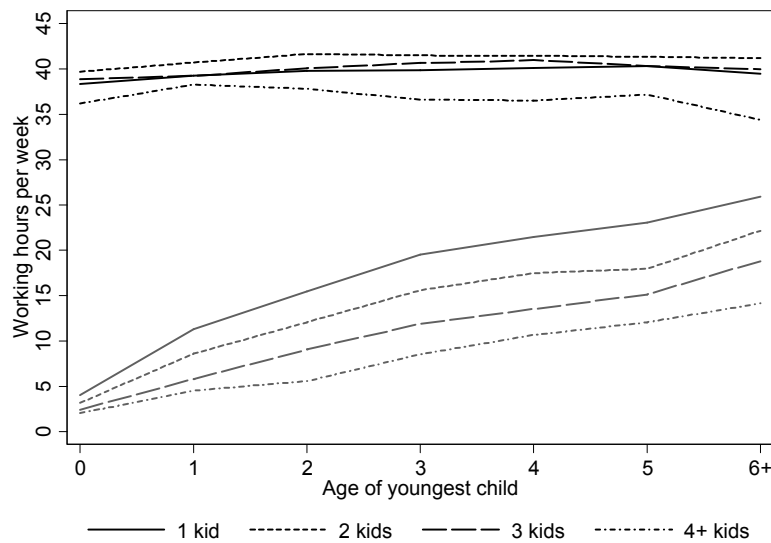
The main variables of interest are fathers' time dedicated to childcare and housework and the labor market participation of fathers and mothers. Information on time dedicated to childcare and housework are collected annually. In the interview individuals are shown a list of activities and are asked how many hours per day they spend on these activities on a typical weekday. The list of activities includes job, education and training, errands, housework, childcare, care for other persons in need of care, repairs on the house/car and garden work as well as hobbies and other free time activities. Every second year similar questions are asked for activities on Saturdays and on Sundays. Figure 1 shows how fathers' time for childcare differs by day of the week and by age of the (youngest) child. On Saturdays and Sundays fathers spend much more time with their children than on weekdays. It hovers around 6 hours per day on weekends and is generally below 2.5 hours on weekdays. Compared with mothers' childcare time, fathers' involvement is small. While mothers steadily decrease time for childcare while children grow older, fathers' time for childcare shows only small declines until children are aged five. Note that there are few differences in fathers' childcare time on weekdays by number of children (cf. Figure A1 in the Appendix). Similar patterns are found for housework and errands.

Figure 1 – Average time spent on childcare by day of the week and gender



Note: Calculated from SOEP v31.1, years 2000 to 2015 for all parents with children below age 18.

Figure 2 – Mothers' and fathers' average working hours after childbirth



Note: Calculated from SOEP v31.1, years 2000 to 2015 for all parents with children below age 18. Working hours of fathers indicated in black, those of mothers in grey.

With respect to labor market participation the analysis focuses on actual weekly hours of work. Note that individuals not working on the labor market are accounted for by having zero hours of work. Figure 2 shows how fathers' and mothers' average working hours evolve by age of the (youngest) child and number of children. Fathers' working hours are relatively stable during the first couple of years after childbirth and hardly differ by number of children, except for large families with more than 3 kids. Mothers' working hours increase continuously after childbirth. Figure 2 documents that maternal labor market engagement decreases with each additional child. Furthermore, we find that mothers' average hours of work increase considerably over time. For example, mothers giving birth to their first child between 2000 and

2006 worked an average of 12 hours in the labor market when their child was two years old while the average number of weekly hours was 16 for mothers giving birth to their first child after 2007. This illustrates the necessity to control for general time trends in the regression models as well as for the age of the youngest child and the number of children.

In the interview, information on parental leave is collected retrospectively on a monthly basis for the entire preceding year. We define that fathers took (paid) parental leave for a specific child if they were on leave in any of the 14 months following the birth of the child. According to the SOEP data, around 3% of all men becoming father in the years 2000 to 2006 took parental leave, while for all men becoming father after 2006 the rate is 27% for first children, 22% for second children and 17% for third children. These rates are quite similar to official statistics based on administrative data (cf. Section 2) and document a tremendous change in fathers' behavior.

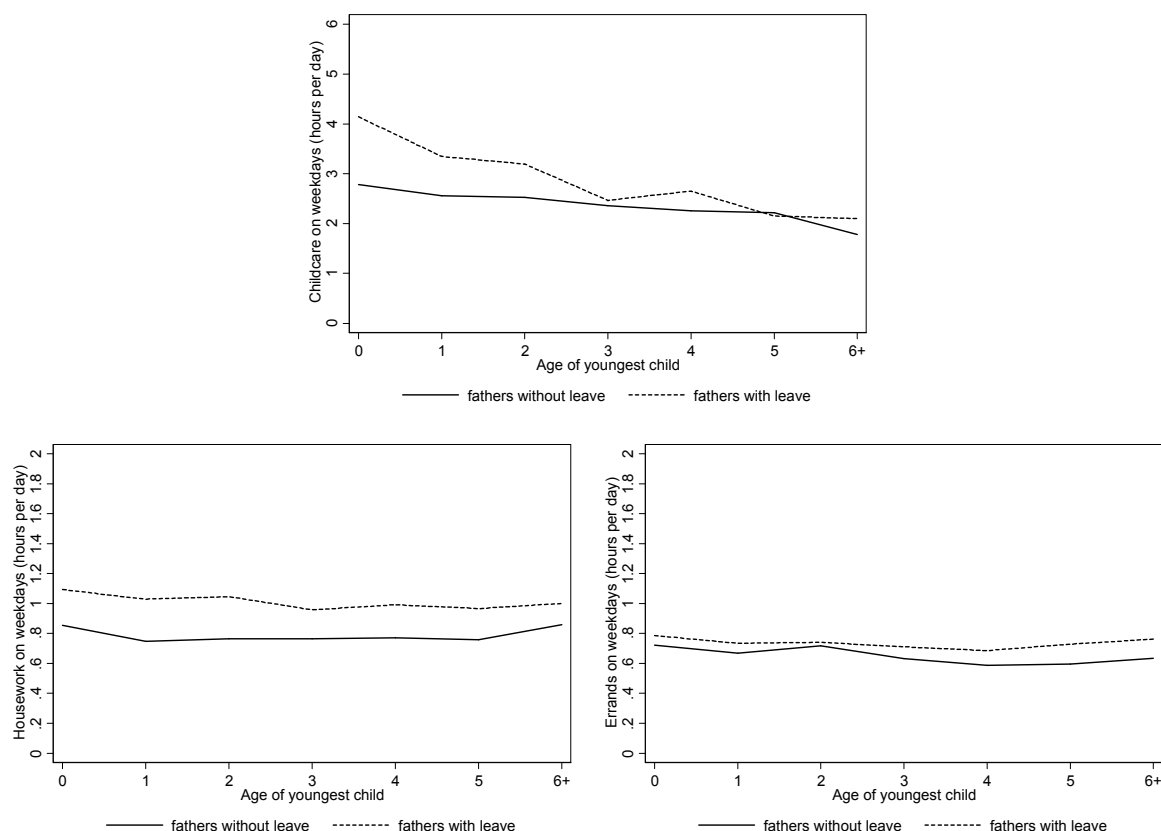
As has been described in Section 2, the sample for the main analysis using father fixed effects comprises fathers who had a first childbirth before the 2007 reform and a higher order birth after the reform and who participate in SOEP both before and after 2007. Overall there are 304 fathers in the SOEP data who meet these restrictions. Around 9% of these fathers are low educated (ISCED 2 or lower) and 35% are highly educated (ISCED 5 or higher). 29% of these fathers have a migration background. On average they were aged 29 at the birth of their first child. At the time of the last interview covered in the data, these fathers have 2.5 children on average. Less than 2% of the fathers who are used for the fixed effects estimation took parental leave for their first child (i.e. born before the reform). In contrast, when looking at the first child born after the reform, 13% of the fathers took parental leave for this child.¹

4. Results

We start this section by presenting descriptive differences between fathers with and without parental leave. To do so, we restrict the sample of analysis to childbirths in the years 2007 onwards, i.e. after the new parental leave policy was implemented. Figure 3 documents differences in fathers' time for childcare, housework and errands by leave status. Fathers with parental leave are much more engaged in housework and childcare than fathers without leave. With respect to childcare, however, the difference decreases when children grow older. Similarly, Figure 4 shows average weekly working hours of fathers and mothers. Note that for mothers we focus on leave-taking of the partner, not on leave-taking of the women themselves. Figure 4 shows that mothers whose partner has been taking leave have considerably higher working hours, right from the first year after childbirth onwards. For example, when the youngest child is aged two the average number of working hours is 21 for mothers with a leave-taking partner and 13 for mothers with a partner not taking leave. It appears that the difference in mothers' employment by partners leave status is less pronounced in the first year of the life

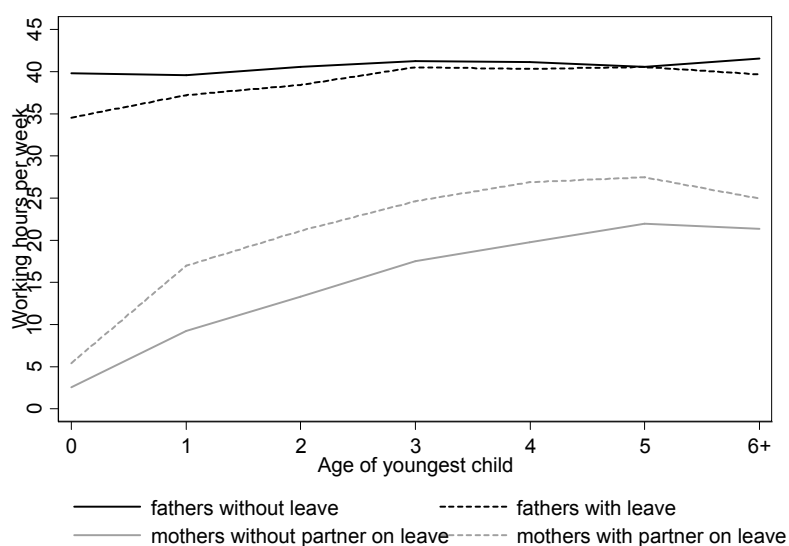
¹ The respective descriptive statistics for all fathers who had a child born after the 2007 reform, i.e. including those whose first child was born after the reform, are: 16% low educated, 34% highly educated, 38% with a migration background, on average aged 30 at first childbirth, 2.1 children on average at the time of the last interview, 22% with parental leave for the first child born after the reform.

Figure 3 – Fathers' time spent on childcare, housework and errands by fathers' leave-taking



Note: Calculated from SOEP v31.1, years 2007 to 2015 for all parents with childbirth in 2007 or later.

Figure 4 – Working hours after childbirth by fathers' leave-taking



Note: Calculated from SOEP v31.1, years 2007 to 2015 for all parents with childbirth in 2007 or later.

of the child and after children turn age six. As is documented in Figure 4, fathers taking leave have somewhat lower working hours during the first two or three years after childbirth than fathers not taking leave. After that, however, working hours appear to be similar. Given that RWI (2008) and Reich (2011) have shown that there is considerable selectivity in leave-taking of fathers with respect to observable characteristics (and quite likely also with respect to unobservable characteristics), it is unlikely that these raw differences represent causal effects. Selectivity might either lead to raw differences being larger than the true causal effect or hide any effects, depending on the specific correlation between leave-taking, the confounding factors and the outcome of interest. Therefore, we next present results using father fixed effects models. These control for the impact of any observable and unobservable factors that are constant within families over time.

Table 1 shows results for fathers' time use during early childhood. Specifically, time use is measured during the first six years after childbirth. The fixed effects estimates indicate that fathers' time for childcare increases if fathers' took parental leave. On weekdays the increase is almost two thirds of an hour, which is insignificant, and on Saturdays and Sundays the increase in time for childcare is 1.4 and 1.6 hours respectively, both of which are significant. Parallel to this, fathers' parental leave-taking increases time for other duties that are generally performed by women. The increase in housework (washing, cooking, cleaning) is by 0.5 hours per weekday and slightly higher on Saturdays and Sundays. For errands (shopping, trips to government agencies, etc.) there is also a significant increase on weekdays (by 0.1 hours) but not on weekends. Compared with average fathers' involvement in these activities the estimated effects are considerable. These findings suggest that fathers' parental leave-taking not only influences fathers' childcare involvement but also contributes to more gender equality in other household duties. Other activities such as education and training, repairs on the house/car and garden work as well as hobbies and other free time activities are not significantly affected by fathers' leave-taking (results available upon request).

In principle it would be interesting to split down the impact estimates by age of the child. However, the number of observations for such a detailed analysis is small and accordingly only few of the estimates turn significant. Yet, the pattern of the point estimates is interesting. We present selected results in Table 2 but caution to put too much emphasis on the single estimates (for reasons of comparison column 1 of Table 2 always repeats the less detailed estimates from Table 1). For fathers' childcare involvement the positive effect appears to be quite stable over early childhood. Most importantly, the increase in childcare of fathers does not appear to be restricted to the first or second year after childbirth when fathers are on leave but also persists afterwards. Similarly, the increase of fathers' involvement in housework and errands is present after fathers' return from leave.²

² When estimating a model that only includes observations between month 15 after childbirth and age six, the point estimate is 0.33 for childcare on weekdays, 0.88 for childcare on Saturdays, 1.57 for childcare on Sundays, 0.57 for housework on weekdays and 0.19 for errands on weekdays. The point estimates for childcare on Sundays, housework on weekdays and errands on weekdays are significant.

Table 1 – Effects on fathers' childcare and housework

	Childcare (weekday)	Childcare (Saturday)	Childcare (Sunday)	Housework (weekday)	Housework (Saturday)	Housework (Sunday)	Errands (weekday)	Errands (Saturday)	Errands (Sunday)
Paternal leave	0.6399 [0.5034]	1.3629*** [0.5072]	1.5544*** [0.5620]	0.4501*** [0.1627]	0.5730** [0.2531]	0.4732** [0.2026]	0.1409* [0.0799]	0.2188 [0.1775]	-0.0229 [0.0210]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2385	1164	1165	2331	1148	1136	2326	1145	1101

*Note: Results using father fixed effects models for a sample of fathers with first childbirth before 2007 and higher order childbirth after the 2007 reform. Control variables include dummies for the age of the youngest child in years, for the number of children as well as a time trend using a cubic specification. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table 2 – Effects on fathers' childcare and housework by age of the child

Outcome	Child age 0 to 6	Child age 0	Child age 1	Child age 2	Child age 3	Child age 4
Childcare (weekday)	0.6399 [0.5034]	0.7088 [0.9809]	0.8093 [0.5323]	1.1273* [0.6435]	-0.3068 [0.5718]	1.0904* [0.6229]
Obs.	2385	584	566	454	346	251
Childcare (Saturday)	1.3629*** [0.5072]	1.3191* [0.7646]	1.1817 [1.1633]	1.3226 [1.4573]	-0.7177 [2.9103]	3.3810** [1.3996]
Obs.	1164	270	301	204	183	111
Childcare (Sunday)	1.5544*** [0.5620]	0.7207 [0.6600]	0.0414 [1.3206]	3.2298*** [0.9744]	2.7831 [3.1267]	4.3810* [2.2389]
Obs.	1165	271	300	205	182	112
Housework (weekday)	0.4501*** [0.1627]	0.0895 [0.2191]	0.4194** [0.1826]	0.6525** [0.3060]	0.9646*** [0.2931]	1.4160 [0.8639]
Obs.	2331	571	552	439	335	248
Errands (weekday)	0.1409* [0.0799]	-0.1318 [0.1581]	0.1795* [0.0932]	0.3550 [0.2717]	0.3746 [0.2873]	0.0400 [0.4641]
Obs.	2326	567	552	436	336	250

*Note: Results using father fixed effects models for a sample of fathers with first childbirth before 2007 and higher order childbirth after the 2007 reform. Control variables include dummies for the number of children as well as time trends using a cubic specification. Column 1 also includes dummies for the age of the youngest child. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table 3 – Effects on mothers’ childcare and housework

	Childcare (weekday)	Housework (weekday)	Errands (weekday)
Paternal leave	-1.2916* [0.7777]	-0.1536 [0.2307]	-0.2085*** [0.0761]
Control variables	yes	yes	yes
Observations	2254	2258	2241

*Note: Results using father fixed effects models for a sample of fathers with first childbirth before 2007 and higher order childbirth after the 2007 reform. Control variables include dummies for the age of the youngest child in years, for the number of children as well as a time trend using a cubic specification. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table 3 shows results for the effect of fathers’ leave-taking on mothers’ time for childcare and housework. Here the analysis once more looks at the first six years after childbirth. Point estimates suggest that while fathers increase their time for childcare and housework mothers’ time decreases. For example, time for childcare on weekdays is significantly lower by around 1.3 hours and time for errands is significantly lower by 0.2 hours. Similarly time for housework is lower by 0.2 hours but the estimate is not significant.

Having shown that fathers’ leave-taking leads to a more equitable distribution of home production, the question arises whether this also increases equity in labor market participation. Results using hours of work as dependent variable are presented in Table 4. The first column shows estimates for the entire six years after childbirth and the following columns show estimates for a more detailed analysis by age of the child. Fathers’ leave-taking significantly increases mothers’ hours of work during early childhood by 5.8 hours per week and decreases fathers’ hours of work by 4.1 hours per week. The difference between the absolute values of the increase of mothers’ and the decrease of fathers’ labor supply is insignificant (p-value: 0.5661), suggesting no impact on the overall supply of labor by the couple. The detailed analyses by age of the child suggest that these changes in labor market participation of mothers and fathers are mainly due to changes in the first year after childbirth, i.e. the period when fathers are on leave for a couple of months, and, at most, persist until the child is aged one or two.³ Afterwards the point estimates change sign and are insignificant. This implies that during the first year after childbirth some women increase their labor market participation who would otherwise not have done so if the father had not taken parental leave.

5. Discussion of the internal and external validity

This section presents the results of tests questioning the identification assumption of the father fixed effects estimates and discusses the generalizability of the results. One of the assumptions of the father fixed effects model is that differences in behavior between involved and uninvolved fathers are constant for first and higher order children. We test this by looking at a sample of fathers whose first and second child were born after the 2007 reform. We compare changes in behavior between first and second childbirth for fathers who took leave after the

³ When estimating a model that only includes observations between month 15 after childbirth and age six, the point estimate is 1.8 for mothers’ hours of work and -0.6 for fathers’ hours of work. Both point estimates are insignificant.

Table 4 – Effects on parents’ labor market participation

Outcome	Child age 0 to 6	Child age 0	Child age 1	Child age 2	Child age 3	Child age 4
Mothers’ hours of work per week	5.7608*** [2.2036]	9.1419** [4.1838]	5.3667 [3.9584]	4.7800 [6.9919]	-6.8944 [5.2550]	-4.1650 [3.1359]
Obs.	2242	562	535	418	328	231
Fathers’ hours of work per week	-4.1084* [2.4038]	-7.4058* [4.4312]	-5.9590 [3.8664]	3.3027 [5.9888]	6.5298 [6.4604]	-1.8731 [7.8215]
Obs.	2384	583	568	450	348	247

*Note: Results using father fixed effects models for a sample of fathers with first childbirth before 2007 and higher order childbirth after the 2007 reform. Control variables include dummies for the number of children as well as time trends using a cubic specification. Column 1 also includes dummies for the age of the youngest child. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

first child was born and for fathers who did not take leave after the first child was born. Results show that the difference in the change in behavior between involved and uninvolved fathers is never significant (see Table A1). This supports the identification strategy.

Another violation of the assumptions of the father fixed effects model would be if the other elements of the 2007 reform had differential effects for involved and uninvolved fathers. We cannot test this directly. However, studies analyzing the entire 2007 reform, not only the father quota, have shown that treatment effects are heterogeneous among groups, mainly between East and West Germany and by mothers' level of education (Kluve and Tamm 2013). To account for such differential effects by subgroup we repeat the main analyses allowing for different time trends for those groups. The main model already includes time trends using a cubic specification and we add interactions with mothers' level of education and with East Germany, respectively. Results are basically not affected by this (see Table A2). Exceptions are that when controlling for differential trends by mothers' level of education, fathers' time for errands on weekdays is no longer significantly positive (but now fathers' time for errands on Saturdays turns significant) and when controlling for differential trends in East and West mothers' time for childcare on weekdays is no longer significantly negative (but the point estimate is almost identical to the main specification). Overall, this is reinforcing the main findings.

The father fixed effects model controls for any factors that are constant over time and assumes that the within father differences in parental leave taking are only due to the exogenous policy reform. If there are changes in family specific observed or unobserved factors that also lead to changes in fathers' parental leave taking and in the outcomes of interest, the estimates will be biased. We are not able to rule out this case. However, Table A3 presents results that try to control for such changes. Specifically, the table shows results of a specification that controls for mothers' and fathers' hours of work in the year before the birth of the child which is the youngest at that time. These pre-birth hours of work of mother and father are thus specific for each child, similar to the information on fathers' leave taking. They are supposed to capture situations where, for example, a father takes no leave when the first child is born but because mother or father are not satisfied with the division of housework they decide to adjust his contribution to housework and also to take leave when the second child is born. If such a family already displays changes in labor market attachment before the second or higher order birth takes place, controlling for mothers' and fathers' pre-birth hours of work should control for such changes in preferences. The results in Table A3 are quite similar to those of the main specification. The only difference is that fathers' housework on Saturdays and Sundays and errands on weekdays are not significant any more. In summary, these findings do not challenge our main message.

Cygan-Rehm (2016) and Raute (2018) have shown that the parental leave reform affected fertility. If after the reform only a selected sample of parents decided to have a second or higher order birth, this might lead to biased estimates. Table A4 presents results that try to avoid using a selected sample. We do so by using information on only those parents with childbirth in 2007, i.e. in the first year after the reform. Parents who had a second or higher order birth later are dropped from the analysis. Because the reform was announced only shortly before coming into effect (Kluve and Tamm 2013), the rationale for looking at treated families

who had a childbirth in 2007 is that for them fertility is unlikely to have changed due of the reform. The results show that the sign of the coefficients is always the same as in Tables 1, 3 and 4. In most cases the same estimates are statistically significant, even though the sample size is now considerably smaller. Only for father' childcare involvement on Sundays, father' errands on weekdays and father' hours of work the estimates are not significant any more. But the point estimate for father' childcare involvement on Sundays is very similar to the one reported in the main analysis and for father' hours of work the point estimate is even larger. Thus, overall, this also reinforces the main findings.

As has been discussed in Section 2 the fixed effects model identifies treatment effects only for families with multiple children. Because we restrict the sample to fathers who had at least one child before 2007, in order to use exogenous variation in take-up of parental leave, and because hardly any father took leave before 2007 the effects only refer to leave-taking for second or higher order children. Generally, these may differ from effects of leave-taking for first children or for one child families. There is no way to formally test the generalizability of the results to other groups, instead we provide descriptive evidence making it more plausible for some outcomes that estimated treatment effects have external validity and less plausible for other outcomes. If we look at fathers' childcare involvement, housework and errands, descriptive statistics do not reveal any major differences by number of children (see Figure A1 in the Appendix). We take this as evidence that estimated treatment effects are more likely to be generalizable to all families with fathers taking leave. Similarly, fathers' employment hardly differs by number of children, except for families with numerous children (cf. Section 3 and Figure 2). This might suggest that effects on fathers' employment are similar when taking leave for first children. With respect to mothers' employment, however, Figure 2 documents that maternal hours of work largely differ by number of children. This makes it unlikely that the treatment effects on maternal employment identified in our paper are generalizable to first time mothers. In addition, findings in Kluve and Tamm (2013) and Kluve and Schmitz (2018) suggest that the effects of the entire reform in 2007 differ between first time mothers and higher order mothers. For example, the positive impact of the entire 2007 reform on employment several years after leave was much higher for first time mothers. This also suggests that with respect to maternal employment the effects of fathers' leave-taking differ between first time mothers and higher order mothers.

6. Conclusion

Investigating a policy reform that introduced two daddy months of parental leave in Germany using a within-father differences estimator, the analysis documents several significant changes in fathers' and mothers' behavior. We find that fathers' parental leave-taking has significant influence on the time fathers dedicate to childcare and leads to a reduction of gender differences in housework. Both effects persist even after fathers return from leave. This documents the importance of the first few months after childbirth for shaping gender roles in childcare and in household production.

With respect to employment the effects of fathers' leave-taking are rather short-lived. While mothers increase hours of work, fathers decrease hours of work. Given the specific

design of parental leave regulations in Germany which allows fathers and mothers to take paid leave at the same time and does not require a working partner while on leave, one might suspect a negative effect on the overall supply of labor by the couple. However, the reduction of fathers' hours of work is not significantly different from mothers' increase in working hours, suggesting no decrease of labor supply of the couple. A policy allowing only consecutive spells of paid leave might have even larger positive effects on the division of housework and might increase the overall supply of labor by couples.⁴ Similar arguments apply to a policy where paid leave of fathers requires that mothers are working during that time.

⁴ Descriptive findings in Bünning (2015) suggest that impact estimates for fathers' involvement in childcare and housework are larger if fathers and mothers take leave consecutively rather than parallel.

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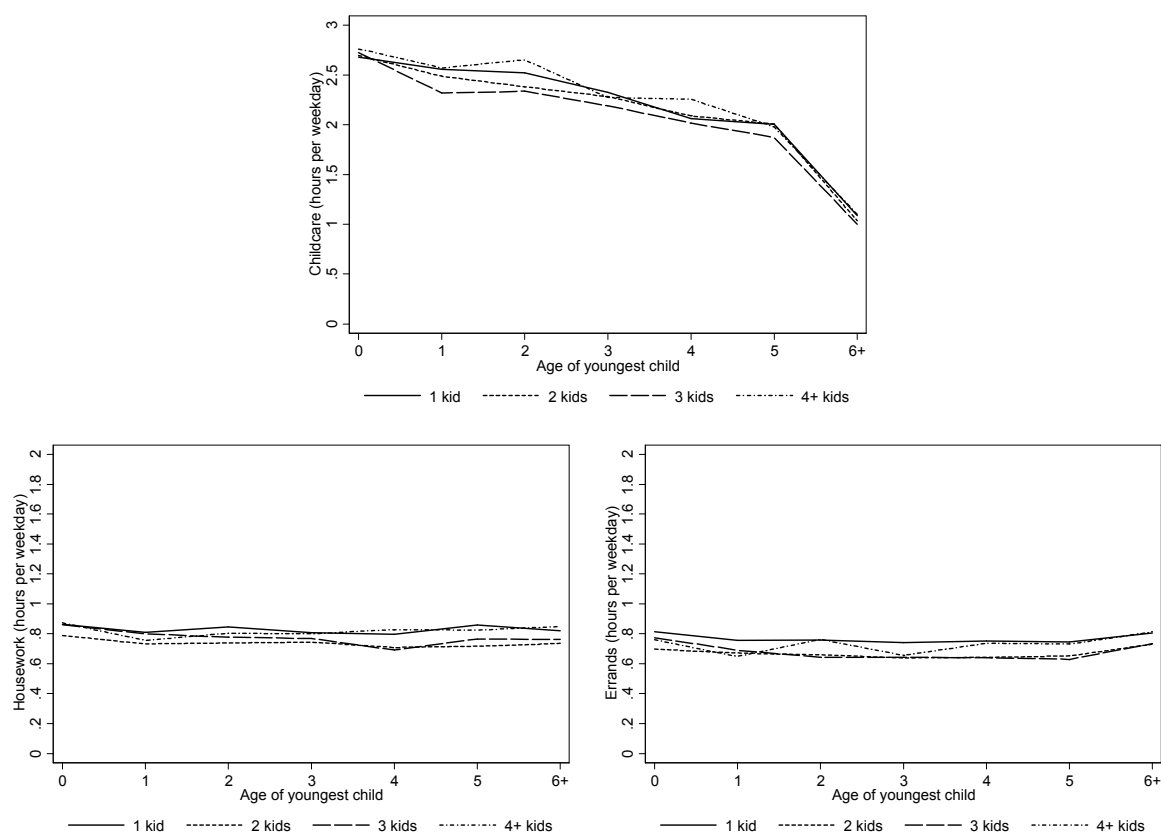
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Appendix

Figure A1 – Fathers' average time spent on childcare, housework and errands on weekdays by number of children



Note: Calculated from SOEP v31.1, years 2000 to 2015 for all parents with children below age 18.

Table A1 – Robustness test: Difference in behavior between first and second childbirth by fathers' involvement

	Childcare father (weekday)	Childcare father (Saturday)	Childcare father (Sunday)	Housework father (weekday)	Housework father (Saturday)	Housework father (Sunday)	Errands father (weekday)	Errands father (Saturday)	Errands father (Sunday)
Involved fathers * second child	-0.6384 [0.4184]	0.2070 [1.0484]	-0.1519 [1.0408]	-0.0955 [0.1004]	-0.1263 [0.1630]	-0.1166 [0.1678]	-0.0736 [0.0766]	0.0771 [0.1655]	-0.0192 [0.0337]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1439	781	779	1428	773	768	1424	779	762
	Childcare mother (weekday)	Housework mother (weekday)	Errands mother (weekday)	Mothers' hours of work per week	Fathers' hours of work per week				
Involved fathers * second child	0.8304 [0.7474]	0.2193 [0.1774]	0.0271 [0.0789]	-1.4518 [1.6727]	1.4481 [1.9157]				
Control variables	yes	yes	yes	yes	yes				
Observations	1352	1352	1348	1346	1430				

*Note: Results using father fixed effects models for a sample of fathers with first and second childbirth after the 2007 reform. Control variables include dummies for the age of the youngest child in years, for the number of children as well as a time trend using a cubic specification. Involved fathers are those taking parental leave for the first child. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A2 – Robustness test: Controlling for separate time trends by mothers' level of education and for East and West Germany

	Childcare father (weekday)	Childcare father (Saturday)	Childcare father (Sunday)	Housework father (weekday)	Housework father (Saturday)	Housework father (Sunday)	Errands father (weekday)	Errands father (Saturday)	Errands father (Sunday)
Differential trends by mothers' level of education									
Paternal leave	0.7383 [0.5599]	1.7033*** [0.5709]	1.8972*** [0.5856]	0.3892** [0.1557]	0.4717** [0.2247]	0.4472* [0.2272]	0.1124 [0.0850]	0.3481* [0.1897]	-0.0313 [0.0197]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2187	1071	1072	2132	1054	1045	2130	1053	1011
Differential trends in East and West									
Paternal leave	0.6414 [0.5028]	1.3809** [0.5330]	1.5730*** [0.5864]	0.4497*** [0.1641]	0.5737** [0.2530]	0.4728** [0.2051]	0.1412* [0.0799]	0.2207 [0.1700]	-0.0216 [0.0208]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2385	1164	1165	2331	1148	1136	2326	1145	1101
	Childcare mother (weekday)	Housework mother (weekday)	Errands mother (weekday)	Mothers' hours of work per week	Fathers' hours of work per week				
Differential trends by mothers' level of education									
Paternal leave	-1.4118* [0.8035]	-0.2102 [0.2363]	-0.1963*** [0.0744]	5.3483** [2.1325]	-5.0803* [2.6511]				
Control variables	yes	yes	yes	yes	yes				
Observations	2207	2211	2194	2195	2186				
Differential trends in East and West									
Paternal leave	-1.2557 [0.7848]	-0.152 [0.2343]	-0.2059*** [0.0786]	5.6457** [2.2547]	-4.0711* [2.3628]				
Control variables	yes	yes	yes	yes	yes				
Observations	2254	2258	2241	2242	2384				

*Note: Results using father fixed effects models for a sample of fathers with first childbirth before 2007 and higher order childbirth after the 2007 reform. Control variables include dummies for the age of the youngest child in years, for the number of children as well as a time trend using a cubic specification. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A3 – Robustness test: Controlling for mothers’ and fathers’ pre-birth hours of work

	Childcare father (weekday)	Childcare father (Saturday)	Childcare father (Sunday)	Housework father (weekday)	Housework father (Saturday)	Housework father (Sunday)	Errands father (weekday)	Errands father (Saturday)	Errands father (Sunday)
Paternal leave	1.0816 [0.7009]	1.3012* [0.6610]	1.3191* [0.6790]	0.3347** [0.1642]	0.2649 [0.2209]	0.3368 [0.2760]	-0.0012 [0.0848]	0.2547 [0.1636]	-0.0099 [0.0275]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1855	907	908	1809	893	886	1807	890	855
	Childcare mother (weekday)	Housework mother (weekday)	Errands mother (weekday)	Mothers’ hours of work per week	Fathers’ hours of work per week				
Paternal leave	-2.1219** [0.9992]	-0.3627 [0.2769]	-0.1791** [0.0705]	6.0895** [2.6460]	-8.0533*** [2.6461]				
Control variables	yes	yes	yes	yes	yes				
Observations	1873	1873	1859	1862	1860				

*Note: Results using father fixed effects models for a sample of fathers with first childbirth before 2007. Control variables include hours of work of the mother and of the father in the year before the birth of the child which is the youngest at that time, dummies for the age of the youngest child in years, for the number of children as well as a time trend using a cubic specification. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A4 – Robustness test: Leaving out families with childbirth after 2007

	Childcare father (weekday)	Childcare father (Saturday)	Childcare father (Sunday)	Housework father (weekday)	Housework father (Saturday)	Housework father (Sunday)	Errands father (weekday)	Errands father (Saturday)	Errands father (Sunday)
Paternal leave	1.8614 [1.2228]	2.0280* [1.1319]	1.4707 [1.3437]	0.8446*** [0.2522]	0.8763* [0.4818]	0.9145*** [0.2607]	0.0858 [0.1397]	0.4227 [0.3393]	0.0059 [0.0158]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1604	793	795	1560	783	773	1561	784	749
	Childcare mother (weekday)	Housework mother (weekday)	Errands mother (weekday)	Mothers' hours of work per week	Fathers' hours of work per week				
Paternal leave	-2.9275** [1.3275]	-0.6379 [0.4538]	-0.3472*** [0.1329]	19.8608*** [4.0503]	-6.5754 [4.4791]				
Control variables	yes	yes	yes	yes	yes				
Observations	1504	1508	1496	1499	1601				

*Note: Results using father fixed effects models for a sample of fathers with first childbirth before 2007 and higher order childbirth in 2007. Control variables include dummies for the age of the youngest child in years, for the number of children as well as a time trend using a cubic specification. Standard errors accounting for clustering at father level in brackets. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*