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Public child care and mothers' career trajectories*

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ABSTRACT

This paper studies the effect of public child care on mothers' career trajectories. To this end, we combine county-level data on child care coverage with detailed individual-level information from the German social security records and exploit a set of German reforms leading to a substantial temporal and spatial variation in child care coverage for children under the age of three. We conduct an event study approach that investigates the labor market outcomes of mothers in the years around the birth of their first child. We thereby explore career trajectories, both in terms of quantity and quality of employment. We find that public child care improves maternal labor supply in the years immediately following childbirth. However, the results on quality-related outcomes suggest that the effect of child care provision does not reach far beyond pure employment effects. These results do not change for mothers with different 'career costs of children'.

Keywords: child care, maternal employment, career costs of children, women's careers
JEL Codes: J08, J13, J22

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1 Introduction

In recent decades, there has been a growing awareness of the importance to improve gender equality in all areas of society, including the labor market. However, despite significant convergence, gender gaps in career outcomes persist: compared to men, women still earn significantly lower wages (e.g., Blau & Kahn, 2017; Olivetti & Petrongolo, 2016), are less likely to be employed in managerial positions (Bertrand & Hallock, 2001; Wolfers, 2006), and have slower career progressions (e.g., Goldin, 2014). Recent literature suggests that much of the remaining differences can be explained by the unequal impact of parenthood on men and women, a phenomenon also referred to as the 'child penalty' or 'career cost of children' (e.g., Adda et al., 2017; Angelov et al., 2016; Kleven, Landais, Posch, et al., 2019; Kleven, Landais, & Sogaard, 2019).

Many countries have increased spending on family benefits, including the provision of subsidized universal public child care, to help women reconcile work and family life. While a large literature studies the effects of public child care on women's employment in the first three years after birth, little is known about how public child care affects mothers' labor supply in the long run. In addition, evidence on the effect of public child care beyond its impact on general aspects of female employment (i.e., participation rates, working hours, earnings) and beyond its average effects is scarce.

To fill this gap, we study the long-run effects of public child care on female career trajectories including novel insights on effect heterogeneities by the career costs of children. Therefore, we combine county-level information on child care coverage and county-level background variables with the BIBB/BAuA Employment Survey 2018 and the social security data from the Institute of Employment Research in Nuremberg (SIAB 7519), which contain detailed and highly reliable individual-level information on daily wages, employment histories, occupation status, education level, and many other variables. We then concentrate on first-time mothers and investigate the long-run effects of public child care on maternal employment using an event study design similar to Kleven, Landais, & Sogaard (2019) and Kleven et al. (2021). Specifically, we compare the long-term trajectories of labor market outcomes of mothers who—prior to childbirth—lived in counties with a high level of public child care expansion and mothers who lived in counties with a rather low level of expansion in the years surrounding the birth of their first child. Thereby, we introduce exogeneity in our group definition by exploiting the large temporal and spatial variation in child care coverage in West German counties after several policy initiatives starting in 2005. To fully understand the impact of child care on maternal employment, we not only examine labor supply and yearly earnings, but also more particular aspects of women's careers such as labor market mobility, the time spent in jobs with abstract tasks, or the time spent in manager positions.

Our results suggest that public child care improves maternal labor supply immediately

following childbirth. To be precise, we find that two years after the birth of the first child, mothers in high expansion counties are 5.5 percent more likely to work than mothers in low expansion counties. We also confirm the finding of previous studies (see, e.g., Müller & Wrohlich, 2020) that this effect seems to be driven by an increase in part-time employment. The effects on job-quality related outcomes are, however, small to insignificant suggesting that the effect of child care provision does not reach far beyond pure employment effects. To better understand the (lack of) average effects, we further explore effect heterogeneities depending on the expected career costs of children a woman faces. Yet, we do not find significant differences at the individual, occupational, or firm level. Finally, we consider the pitfalls of standard two-way fixed effects models and confirm our results using the interaction weighted estimator of Sun & Abraham (2021). Our results are also robust to a bunch of additional validity checks investigating unobserved heterogeneity between mothers in high and low expansion counties, fertility effects, selective migration, and the impact of other family policies.

Our paper contributes primarily to two strands of literature. First, we contribute to the broad literature on gender inequality in the labor market (see, e.g., Bertrand, 2011; Olivetti & Petrongolo, 2017, for a review) and in particular to recent work on the employment effects of parenthood. Applying an event study approach to Danish data, Kleven, Landais, & Sogaard (2019), for example, find that the birth of the first child leads to a long-term gender gap in earnings of around 20%, which results from changes in female labor force participation, reductions in working hours, and changes in wage rates. Other studies, also using an event study design, find similar results in different contexts (see, e.g., Angelov et al., 2016, for Sweden, Kuziemko et al., 2018, for the US, and Kleven, Landais, Posch, et al., 2019, for a comparison of child penalties in six different countries). Moreover, another line of work highlights that these 'child penalties' depend on women's wage rates as well as on their occupations, due to different penalties on amenities related to workplace flexibility (Adda et al., 2017; Becker, 1965; Goldin, 2014; Mincer, 1963).

Second, we contribute to the literature on the effect of child care on maternal employment. The more recent work in this strand of the literature relies on quasi-experimental changes induced by policy reforms and finds mostly evidence in favor of child care provision helping women to reconcile work and family life (e.g., Baker et al., 2008; Bauernschuster & Schlotter, 2015; Berlinski & Galiani, 2007; Cascio, 2009; Lefebvre & Merrigan, 2008).[1] However, not all studies find significant positive effects of subsidized child care on maternal employment. Fitzpatrick (2010), for example, finds very small, yet statistically insignificant effects of publicly subsidized Pre-Kindergarten programs in the US. Similarly, Havnes & Mogstad (2011), who analyse the effect of the introduction of subsidized child care in Norway, find little effect. The literature explains these mixed results

[1] Although, some of these studies suggest that some women benefit more, such as single or less educated mothers (Gelbach, 2002; Müller & Wrohlich, 2020).

by differences in women's employment levels or differences in the availability of informal care.

As most of these studies focus on relatively short time horizons, our paper is most closely related to two ongoing projects by Krapf et al. (2020) and Kleven et al. (2021) who investigate the effect of child care on child penalties in earnings.[2] While Krapf et al. (2020) focus on Switzerland and find that the availability of child care reduces the child penalty by increasing mothers' earnings and reducing the compensating increase in fathers' earnings, Kleven et al. (2021) conclude that the expansion of public child care (as well as the expansion of parental leave) has had no effect on gender convergence in Austria. Again, the institutional context seems to play an important role in explaining the differences in the results (Krapf et al., 2020). We contribute to this literature by providing evidence on the impact of child care not only on earnings, but also on labor market outcomes that focus on more specific aspects of women's career trajectories. Moreover, to the best of our knowledge, our paper is the first to investigate previously unexplored heterogeneities by the career costs of children.

The remainder of the paper is organized as follows. Section 2 lays out the institutional setting and the data. Section 3 describes the set-up and results of our event study approach and provides robustness checks. Section 4 discusses the results and concludes.

2 Institutional background and data

2.1 Institutional background

Germany has traditionally been characterized as a breadwinner model with low fertility rates and female labor force participation. The latter holds in particular for mothers with young children: in 2005, only 46.7% of mothers with children under six were employed, a figure almost ten percentage points below the European average of 55.8% (Eurostat, 2018). Looking in more detail at mothers with children in this age group, Kreyenfeld & Geisler (2006) find that in 2002 only 19.2% of mothers with children between three and six were full-time employed. Moreover, they find that this rate varied substantially between East (50.5%) and West Germany (14.5%). Among mothers of children under the age of three, only 11.8% had a full-time job. The percentages for East and West Germany amounted to 31% and 8.9% respectively.

One reason often cited as an important cause of low female labor force participation rates in Germany is the low availability of formal child care. While the provision of public care for children between one and six years was quite high in East Germany as the

[2] A recent working paper by Chhaochharia et al. (2022) investigates the effect of public child care on the child penalty and on career decisions. They include both East and West Germany in their analysis and consider only the first five years after childbirth.

result of the German Democratic Republic (GDR), West Germany lacked significantly behind. A first step toward expanding child care was taken in 1996. At that time, the German government passed a law granting three- to six-year-old children a place in a public kindergarten, which led to the availability of half-day care for this age group throughout Germany (Bauernschuster & Schlotter, 2015). However, for children under the age of three, the supply of formal care was still limited: in 2002, public child care for under-three-year-olds was available for only 2% of the children in West Germany, whereas 35% of the children had a child care slot in East Germany (Geyer et al., 2015). At the same time, there was virtually no private market for child care (Bauernschuster et al., 2016; Felfe & Lalive, 2012).

In response to the large excess demand for child care provision for children under the age of three, the German government consecutively enacted three major child care reforms. The first of these reforms, the *Tagesbetreuungsausbaugesetz*, was passed in 2005. This law encompassed the commitment to create 230,000 new child care slots for children aged younger than three by 2010. Moreover, the law made quality requirements more concrete to stress that early child care should also contribute to early childhood education (BMFSFJ, 2004). The second expansion stage took place in 2007. At the so called *Krippengipfel*, the government decided to reach a child care coverage rate for under-three-year-olds of 35% by 2013, which was equivalent to tripling the existing slots (Tiedemann, 2014). Finally, in 2008, the *Kinderförderungsgesetz* introduced a legal claim to child care for children aged one and above by August 2013. This last reform was also accompanied by a paradigm shift concerning the financing of additional child care slots. Until 2008, local authorities had to bear all the costs of expanding public child care themselves. After 2008, the costs were shared between the three federal levels, resulting in low-cost child care for children under the age of three throughout Germany (Tiedemann, 2014).[3]

The state did not impose penalties on local authorities that did not reach the target coverage rate of 35% by 1 August 2013. Nevertheless, municipalities had an incentive to expand child care as parents could claim the additional costs for private child care or the remuneration for forgone earnings if they did not get a slot for eligible children (see, e.g., the decision of the Federal Administrative Court in September 2013 (BVerwG 5 C 35.12)). Thus, especially West German municipalities, where child care for under-three-year-olds was technically not-existent, created additional child care slots even before the entitlement to a slot was enshrined in law (Tiedemann, 2014). Figure 1 demonstrates that East German counties had already reached the 35% coverage rate before the introduction of the new law.

[3]The parental fees depend on family size and income and range from 0 to 600 EUR per month (Bauernschuster et al., 2016).

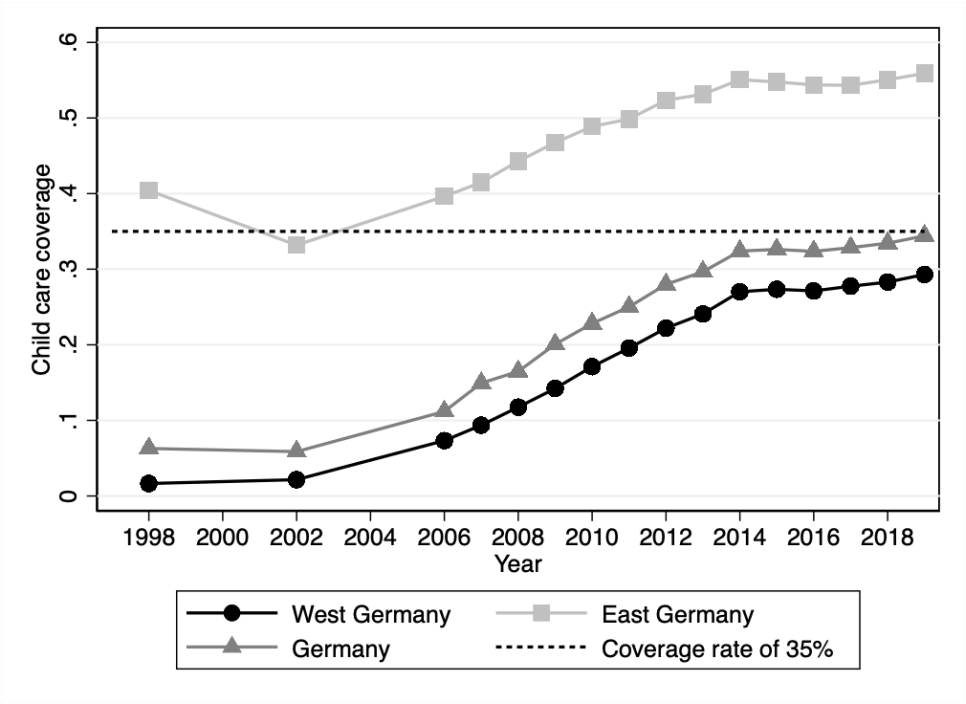


Figure 1. Child care coverage over time in East Germany, West Germany, and Germany as a whole. The dotted line indicates a coverage rate of 35%. Local child care coverage is calculated by the number of child care slots relative to the number of children aged 0 to 3 years.

Looking at the child care expansion in more detail, Table A1 in the Appendix shows that the average child care coverage in West German counties increased from 1.7% to 14.2% between 1998 and 2009, to 24.2% in 2013 and to 29.3% in 2019. However, the differences in child care coverage between counties after the reforms are even more striking: in 2009, it ranges from 3.7% to 35.9% and demonstrates huge differences in the speed and intensity of the expansion of child care slots between West German counties. These differences across counties can be explained by both demand and supply side factors. On the one hand, local authorities had to make projections concerning the future demand for child care slots depending on demographic and economic factors. On the other hand, the state was responsible for approving the construction of new child care centers and this approval was necessary for receiving the state subsidies (Bauernschuster et al., 2016; Felfe & Lalive, 2012). The division of responsibilities between the three federal levels made the underlying administrative process complex and lengthy and, according to Hüsken (2011), also dependent on county-specific factors that local authorities could not influence (e.g., different expansion strategies, different funding rules, etc.). Thus, the regional variation is not only due to differences in demand, which are likely to be endogenous to expected changes in maternal employment. Figure A1, which depicts yearly averages in child care coverage for high and low expansion counties (panel (a)) as well as emerging differences in child care coverage between the two groups, proves that this indeed is the case: after controlling for demand-side factors (panel (c)), there still exists substantial regional variation that primarily results from supply-side shocks and thus is exogenous

to our outcomes of interest.[4] Possible reasons for such supply-side shocks named in the previous literature are shortages in construction ground, a lack of qualified staff, delays in approval, rejections due to non-compliance with specific regulations, or differences in the routines and rules concerning the funding system (see, e.g., Bauernschuster et al., 2016; Felfe & Lalive, 2012, 2014).

2.2 Data

Labor market outcomes Our study relies on administrative data from the Sample of Integrated Labor Market Biographies (SIAB) (Frodermann et al., 2021). This dataset includes a two percent sub-sample of all individuals who were registered at least once between 1975 and 2019 due to employment, unemployment, or receipt of other public transfers (i.e., welfare benefits) through the social security system. The data contain rich information on individuals' earnings, labor supply, occupation status, education level, and many other variables. Moreover, we use the information on benefit receipts for maternity protection and parental leave to identify (first-time) mothers in our data set (Müller & Strauch, 2017).

We prepare the data set by splitting overlapping spells, creating biographical variables, cleaning of occupational and educational information, and deflating wages. As earnings recorded in the SIAB are top-coded for about 5% of the spells for workers, we also impute top-coded wages following the procedure suggested by Dauth & Eppelsheimer (2020). We then collapse our data to one observation per individual per year and create out-of-labor force spells if an individual is not observed in a given year.[5] Finally, we restrict our data to females living in West Germany as well as to the years 1998-2019. We thus have a balanced panel of women whom we observe over a time span of 22 years.[6]

To get more detailed information on individuals' occupations, we furthermore combine our data with the BiBB/BAuA Employment Survey 2018 (Rohrbach-Schmidt & Hall, 2020). This survey is representative of 20,000 employees in Germany and contains detailed information on the kind of job the employee performs, on tasks, qualifications needed, and the work environment.

[4]Note that this argument is only valid for West German counties which all started from a pre-reform child care coverage level close to zero. East German counties already varied substantially in terms of child care coverage before the reforms and on average had already reached the 35% mark (see Figure 1). Consequently, we focus our analysis on West German counties.

[5]We limit the data to one observation per year per individual using June 30 as the cutoff date because additional firm-level data from the Establishment History Panel (BHP) are measured at the last day of June (Schmucker et al., 2016).

[6]Note that we start with a panel that is balanced in years. However, putting further restrictions on, e.g., the range of event times (see Section 3) will lead to an unbalanced panel for the analysis. We cannot use years prior to 1998 because the county of residence indicator is not filled in our data for earlier years.

Child care provision Our analysis also relies on information on child care provision at the county level. To this end, we use administrative data from the Federal Statistical Office of Germany, which contain the number of public child care places per county for the years 1998, 2002 and each year after 2005.[7] We combine this data with information on the counties' age structures and define public child care coverage as public child care slots divided by the population of children less than three years old.

Additional county-level data from the Federal Statistical Office of Germany and the Federal Institute for Building, Urban Affairs and Spatial Research complement our final data set. These data include the population density, GDP per capita, the male employment rate, the share of highly educated women, and the interpolated vote shares of political parties.

3 The effects of public child care on mothers' careers

3.1 Identification strategy

To identify the effects of public child care on maternal career trajectories, we restrict our sample to first-time mothers who were in regular employment in the year before the birth.[8] In addition, we focus on births after 2004 in order to include only mothers whose children could potentially be affected by the child care reforms between the ages of one and three. Table A2 in the Appendix provides descriptive statistics for our final sample. We then adopt the event study specification proposed by Kleven, Landais, & Sogaard (2019). Specifically, we run the following regression separately for mothers in high and low expansion counties:

$$Y_{ist}^{g} = \alpha_{t}^{g} D_{ist}^{Event} + \beta^{g} D_{ist}^{Age} + \gamma^{g} D_{ist}^{Year} + v_{ist}^{g} \tag{1}$$

where Y_{ist}^{g} is the outcome for individual i of group g in year s and at event time t (measured relative to birth). D_{ist}^{Event} is a vector of event time dummies with respect to the birth of the first child. D_{ist}^{Age} is a vector of age dummies controlling for life-cycle trends and D_{ist}^{Year} is a vector of year dummies controlling for any time-varying shock. Following Bauernschuster et al. (2016), we define a county as 'high expansion' county if it had an above-median increase in public child care coverage from 2002 to 2009. Counties with an increase in public child care provision below the median over the same period of time

[7] To be precise, the data for the year 1998 and 2002 report the actual number of slots, the data following the year 2005, report the number of children attending child care. This, however, should not be a problem, since in general child care provision is so small that one can assume that the number of children attending child care resembles the amount of the available slots (Bauernschuster et al., 2016).

[8] Regular employment refers to full-time and part-time jobs that are subject to social security contributions and income tax. It does not include marginal employment, which is exempt from these, otherwise mandatory, contributions.

are considered as 'low expansion' counties.[9] We omit the event time dummy at $t = -1$, implying that the event time coefficients (α_t^g) measure the impact of children relative to the year prior to the birth of the first child. To keep the zeros in the data, we specify our outcome variables in levels rather than logs. The identification relies on the assumption that maternal employment outcomes would develop smoothly in the absence of children (Kleven, Landais, & Sogaard, 2019).

To emphasize the differences in labor market outcomes between mothers in high and low expansion counties t years after birth, we additionally run an alternative model specification:

$$Y_{ist} = \alpha_t D_{ist}^{Event} + \alpha_t^{CC} D_{ist}^{Event} \times CC_i + \delta CC_i + \beta D_{ist}^{Age} + \gamma D_{ist}^{Year} + v_{ist}^g \tag{2}$$

where CC_i is the group indicator for woman i, which is unity for women living in high expansion counties prior to birth and zero otherwise. As before, we define a county as 'high expansion' county if it has an above-median increase in public child care coverage from 2002 to 2009. We cluster standards errors at the county level. The results remain virtually unchanged if we cluster standard errors at the individual level instead. This specification allows us to identify the effect of child care on maternal employment under the assumption that, in the absence of the child care reforms, the evolution of maternal employment outcomes t years after birth would have been the same in high and low expansion counties (Kleven et al., 2021). We validate our findings in Section 3.3.

3.2 Main results

We present our results in three steps. In a first step, we focus on the impact of public child care on maternal employment rates and earnings. In a second step, we turn to the effect on more specific labor market outcomes that do not only capture the quantity but also the quality of maternal employment. Finally, we study the heterogeneity of the effect depending on individual-, firm-, and occupational-level characteristics and thus whether the effects of public child care on mothers' career trajectories depend on the 'career costs of children' a woman faces.

[9] Note that Bauernschuster et al. (2016) include a set of regional covariates in their Diff-in-Diff model to control for the endogenous demand-side factors mentioned in Section 2. As we are not interested in identifying the causal effect of being in a high expansion county on female labor supply, but rather in analyzing how the birth of the first child affects the labor market outcomes of women in high expansion counties differently from women in low expansion counties, this is less of an issue in our setting. It is, however, reassuring that we are able to replicate the findings of Bauernschuster et al. (2016) and of Müller & Wrohlich (2020) in the classical Diff-in-Diff setting with our data. The results of this replication exercise are available upon request. Moreover, the plot of the difference in child care coverage rates between high and low expansion counties after controlling for the demand-side factors supports the assumption that our definition of high and low expansion counties is primarily based on supply-side differences and thus exogenous to our employment outcomes (see Figure A1 in the Appendix).

3.2.1 Average effects

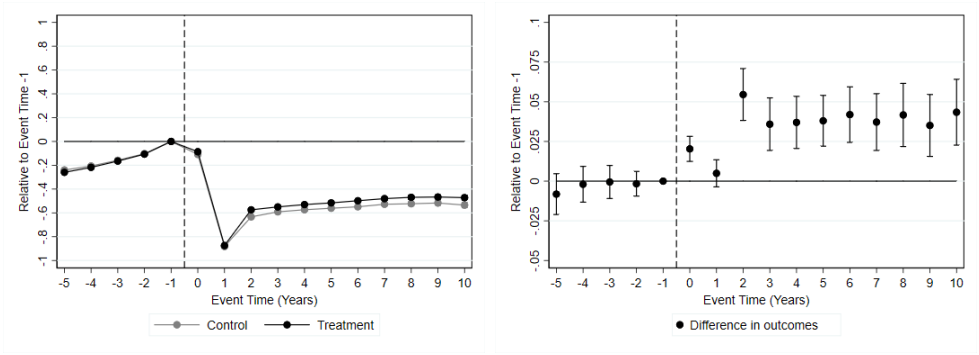
Impacts on general employment outcomes In Figure 2, we present our results on the general employment outcomes. The graphs in the left column plot the event time coefficients, α_t^g, from equation (1). Thus, they show the impact of children on labor market outcomes separately for mothers in high and low expansion counties across event times. The graphs in the right column plot the coefficients on the interactions of the event time dummies and the group indicator, α_t^{CC}, from equation (2) and therefore highlight the differences in the labor market outcomes between the two groups.

Focusing on panel (a), we find that, once we control for age and year dummies, the employment rates of mothers in high and low expansion counties follow the same trend until the onset of parenthood. We also observe a steep drop in employment after giving birth for mothers in both groups. However, following event time two (i.e., the year in which the entitlement to a child care slot becomes relevant), the trajectories of mothers living in high and low expansion counties diverge. In terms of magnitude, the estimates suggest that two years after the birth of the first child, mothers in high expansion counties are 5.5 percent more likely to work than mothers in low expansion counties. Measuring employment as the number of days a mother is regularly employed, we find a similar effect (panel (b)). Consistent with the expectations that early child care helps mothers to return to work sooner, these findings suggest that the effect of public child care on maternal labor supply happens at the extensive margin as opposed to the intensive margin (Lemieux & Milligan, 2008).

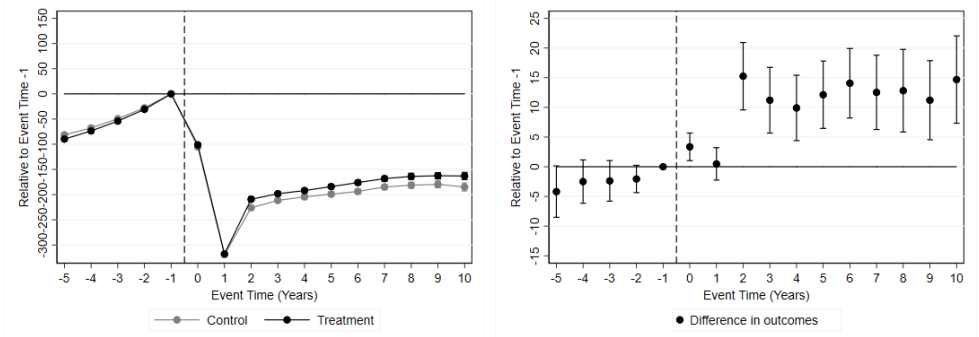
In the remaining panels of Figure 2, we explore the effect of public child care on different types of maternal employment and annual earnings. In line with the findings by Müller & Wrohlich (2020), we find that the effects of child care on maternal employment are mainly driven by differences in part-time employment (panel (d)). Full-time employment, however, does not differ between mothers in high and low expansion counties after giving birth (panel (c)). Regarding the impact of children on (normalized) annual earnings (panel (e)), we find that mothers in both groups experience substantial earnings losses after the birth of their first child, which persist for at least 10 years after the birth.[10] Consistent with the employment results, however, we also find that child care reduces these earnings losses for mothers in high expansion counties following their child's first birthday.

[10] We express annual incomes in multiples of the individual's earnings in the year prior birth to account for ex-ante earnings differences across mothers in high and low expansion counties (Dauth et al., 2021).

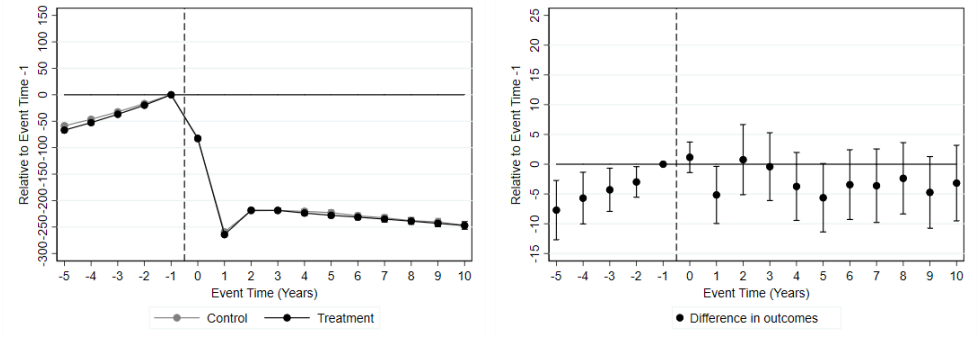
(a) Employment (0/1)



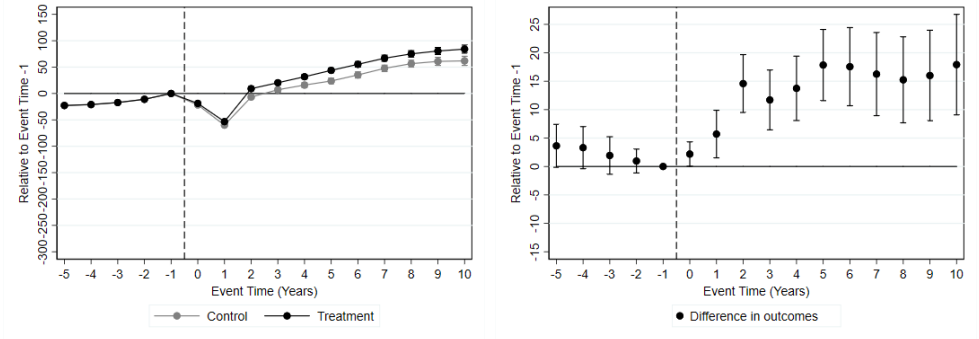
(b) Days employed



(c) Days employed - Full-time



(d) Days employed - Part-time



(e) Annual earnings (normalized)

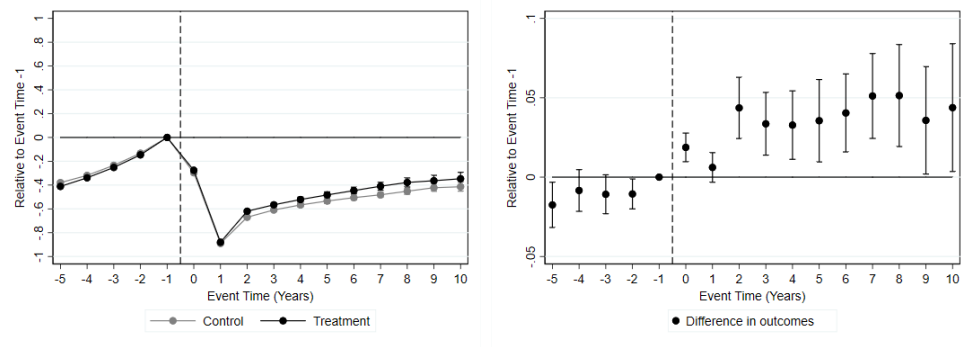


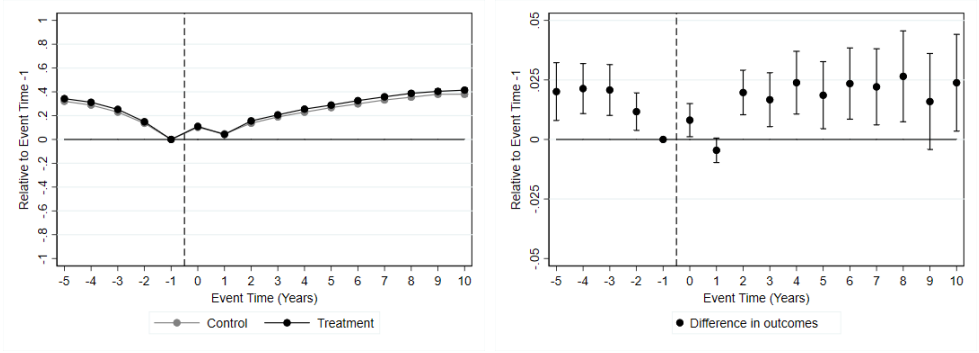
Figure 2. Child care and general maternal employment outcomes: Event study estimates. The figures on the left show the event time coefficients estimated from equation (1). The figures on the right show the coefficients on the interaction term in equation (2). All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019 and were regularly employed in the year prior to birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

Impacts on specific employment outcomes As previous literature suggests that women switch to more family-friendly jobs, face a decrease in occupational rank, and are less likely to become a manager after having their first child (Felfe, 2012; Kleven, Landais, & Sogaard, 2019), we now take a closer look at whether public child care not only affects maternal labor supply quantitatively but also qualitatively. The results are plotted in Figure 3, which is based on the same specification as above.

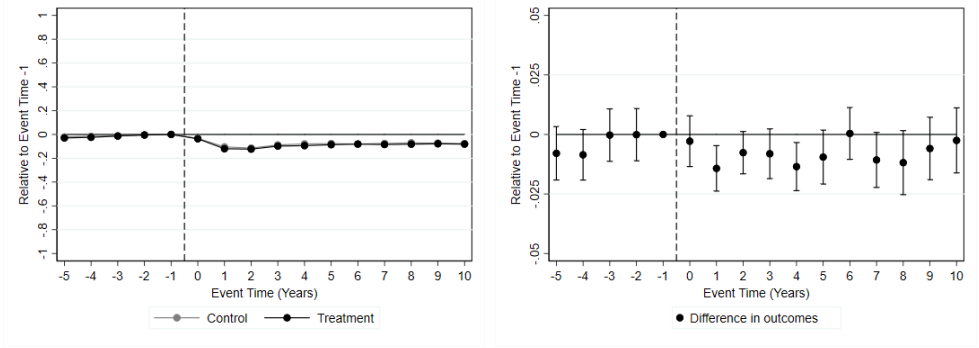
First, we examine maternal labor market mobility by exploring the effect of child care on the annual likelihood of switching from the pre-birth employer to a new firm (panel (a)) and the annual likelihood of switching employers in general (panel (b)). Looking at the results, we, however, find no significant differences between mothers in high and low expansion counties. This suggests that public child care neither affects the likelihood of a mother staying with her pre-birth employer, nor her employment mobility in general. Next, we explore maternal labor market experience in jobs with abstract and thus more complex tasks as well as the experience in manager positions.[11] Yet, as becomes evident in panel (c) and (d), we again do not find any significant differences in the labor market experience between mothers living in high and low expansion counties.

[11]To identify jobs wit abstract tasks, we use the dataset provided by Dengler et al. (2014) who apply the task-based approach developed by Autor et al. (2003) to occupations in the German labor market. Using expert knowledge about competencies and skills needed for the respective job, Dengler et al. (2014) compute the main task type and the composition of tasks of every 2-digit occupation.

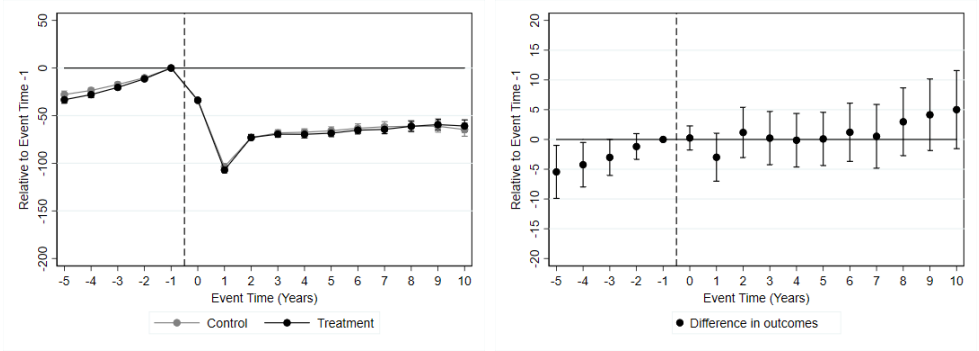
(a) Employment stability



(b) Employment mobility



(c) Days employed - Abstract task



(d) Days employed - Manager position

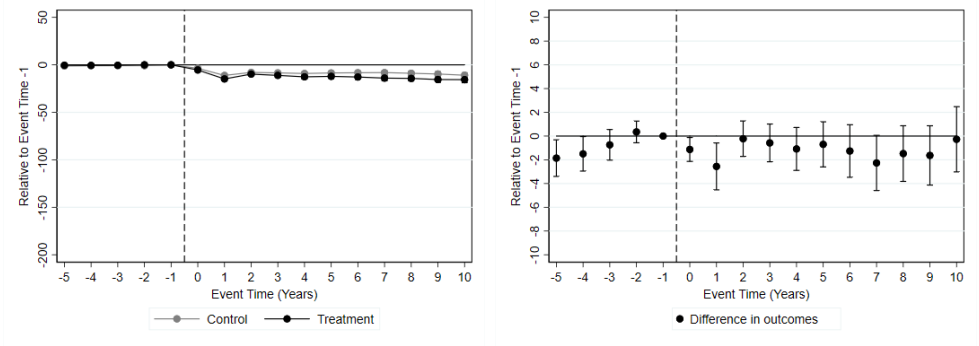


Figure 3. Child care and specific maternal employment outcomes: Event study estimates. The figures on the left show the event time coefficients estimated from equation (1). The figures on the right show the coefficients on the interaction term in equation (2). All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019 and were regularly employed in the year prior to birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

3.2.2 Effect heterogeneity

In a next step, we analyze heterogeneities in the effects of public child care to see whether some groups of mothers benefit more than others in terms of the general employment outcomes. Moreover, this might reveal potentially significant effects on the more specific labor quality outcomes that are hidden in the average effects. We examine effect heterogeneities depending on the expected career costs of children a woman faces at the individual level, the occupation level and the firm level.

First, we show heterogeneous effects by individual educational attainment. This is based on the idea that the career costs of children vary according to differences in the cost of one's own time and in household production functions (Becker, 1991). Both Becker (1965) and Mincer (1963) point out that the price of having children is relatively higher for families with higher income and when the wife has a higher potential wage rate. We therefore define two education groups: Highly educated mothers are those who have a university or college degree. Medium-skilled (and low-skilled) mothers are those who do not have a university degree (or any vocational training).

Second, we analyze whether the effects differ for mothers whose pre-birth occupation is characterized by a low degree of substitutability compared to mothers whose pre-birth occupation is characterized by a high degree of substitutability. Several papers highlight that the career costs of children depend on women's occupation, due to different penalties for amenities related to workplace flexibility, due to heterogeneous pay structures and due to differences in the degree to which a worker can be substituted by a co-worker (Adda et al., 2017; Goldin, 2014; Goldin & Katz, 2016; Hotz et al., 2018). We use the BIBB/BAuA Employment Survey of the Working Population on Qualification and Working Conditions in Germany 2018 and determine for each mother whether she worked in a pre-birth occupation characterized by a high or low degree of substitutability.[12]

Finally, we examine heterogeneities that might occur between women who were employed in different types of firms before the birth of their first child. Differences could arise if certain firm characteristics directly affect the career costs of having children (e.g., family friendly arrangements).[13] To depict firm-level differences, we rely on the so called 'AKM' pay premium (Abowd et al., 1999; Card et al., 2013) which is interpreted as a result of rent-sharing, efficiency wage, or strategic wage posting behavior and which is paid to all employees. Moreover, firms with a high 'AKM' wage premium are usually also characterized by collective bargaining agreements (Card et al., 2013), better non-

[12]Specifically, we consider information on time flexibility, the degree of regular contact with clients, decision making processes, and transferability of skills for each two-digit occupation and construct a standardized index of the overall degree of substitutability. Occupations in the bottom third of the distribution are classified as having a low degree of substitutability.

[13]Firms might also respond differently to family policies in terms of hiring new or temporary workers to replace workers on leave or adjusting the working hours of stayers. For a detailed discussion see Ginja et al. (2023).

monetary amenities, a higher level of job satisfaction among employees (Sorkin, 2022) and thus overall higher firm 'quality'. For our version of the SIAB, we use the firm-level information on the establishment wage premia computed by Bellmann et al. (2020) and merge this data to each mother's pre-birth employer. We then determine whether our mothers worked for a firm that paid a premium in the top third of the distribution before birth.

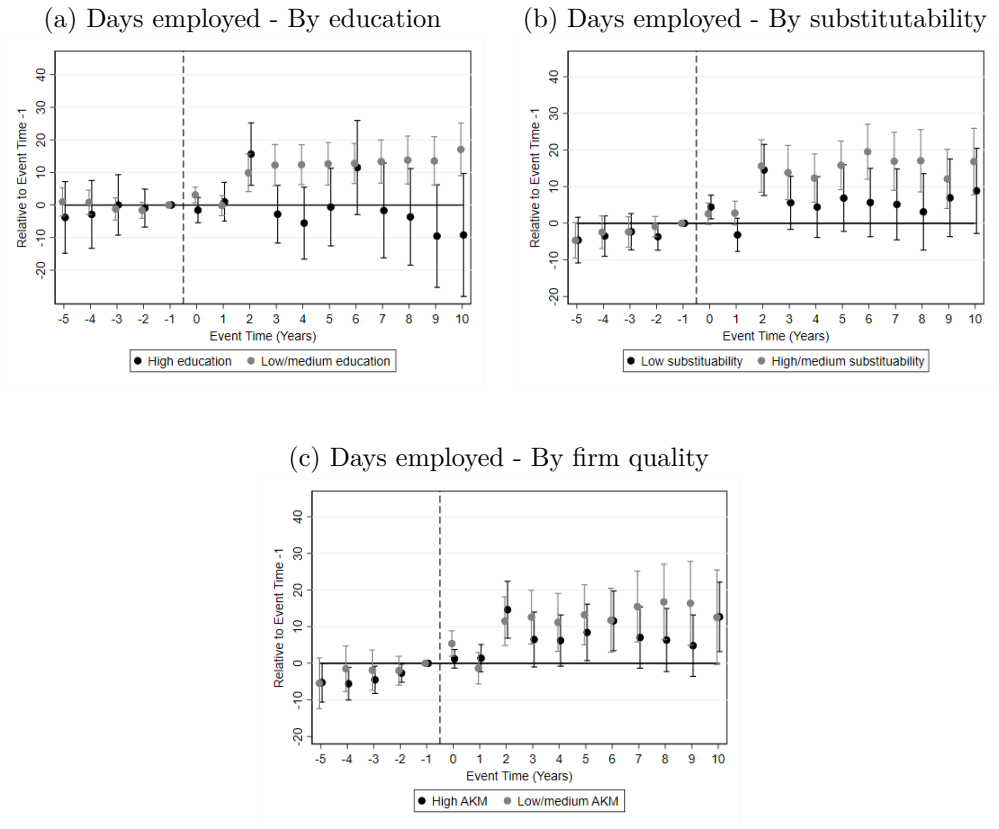
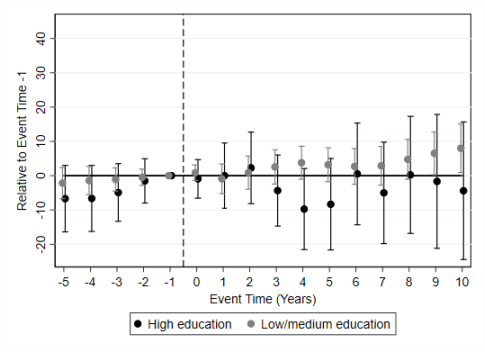


Figure 4. Child care and maternal days employed: Event study estimates. The gray dots show the coefficients of the interaction terms of event time dummies and the group dummy for the low/medium education, the high/medium substitutability and the low/medium firm quality. The black dots depict the sum of the coefficients of the interaction between event time dummies and the group indicator and the the triple interaction with the subgroup indicator. All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019 and who were regularly employed in the year prior to birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

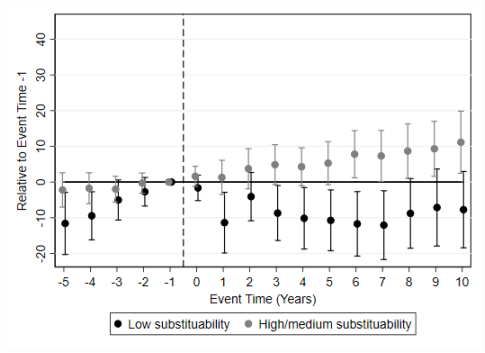
Figures 4 and 5 show the results of our heterogeneity analysis for one measure of employment quantity (days employed) and for one measure of employment quality (days employed in a job with abstract tasks). Overall, we do not find striking differences between the different groups of mothers; for most estimates, the confidence intervals of the two groups overlap and the effects are therefore not significantly different. Nevertheless, Figure 4 shows an interesting pattern: while both groups follow the same time trends before the birth of the child, the magnitude of the coefficients suggests that mothers with less education, mothers in jobs with a higher degree of substitutability, and mothers

in lower quality firms tend to benefit slightly more from child care than the respective comparison group following the third year after childbirth. A similar picture emerges for job quality in Figure 5, especially for less educated mothers and for mothers in jobs in which co-workers can more easily substitute their tasks.

(a) Days in abstract tasks - By education



(b) Days in abstract tasks - By substitutability



(c) Days in abstract tasks - By firm quality

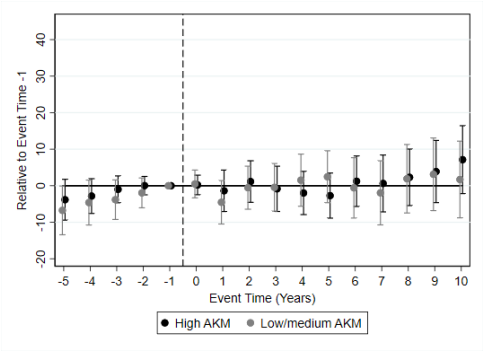


Figure 5. Child care and maternal days employed in abstract tasks: Event study estimates. The gray dots show the coefficients of the interaction terms of event time dummies and the group dummy for the low/medium education, the high/medium substitutability and the low/medium firm quality. The black dots depict the sum of the coefficients of the interaction between event time dummies and the group indicator and the the triple interaction with the subgroup indicator. All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019 and who were regularly employed in the year prior to birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

Thus, the results do not suggest that mothers with higher career costs of children benefit more from child care than mothers with lower career costs of children. If anything, we observe the opposite. This could indicate that career-oriented mothers with a high level of education or mothers in occupations with a low degree of substitutability work regardless of the availability of public child care and substitute private child care for public child care when it is sufficiently available. The more positive effects on women in low AKM firms can be explained by the literature showing that firms with a lower wage premium on average have less favorable working conditions for minority groups such as migrants or women due to the lack of collective bargaining (Card et al., 2013; Corradini

et al., 2022). Moreover, these firms tend to offer fewer non-monetary amenities related to work-life balance (e.g., Sorkin, 2022). This explains why employees in low quality firms have to rely more on public child care and benefit more from it.

3.3 Validity checks

3.3.1 Staggered treatment design

Our event study analysis relies on variation in timing of treatment (i.e., variation in the timing of the first birth) and thus amounts to a 'staggered treatment design'. If the treatment effects are heterogeneous across the different birth cohorts or over time, the standard two-way fixed effects model leads to biased estimates. Specifically, the coefficient on a given lead or lag is a weighted combination of its own period effects and other period effects (de Chaisemartin & D'Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun & Abraham, 2021). To evaluate the extent of the problem in our setting, we follow Sun & Abraham (2021) and estimate the lead and lag specific weights. Figure A2 in the Appendix plots the results. As we can see, the problem seems to be sizeable. Nevertheless, the relative period coefficients may still be contaminated by the effects from other periods included in the specification and from other relative periods excluded from the specification. To avoid any pitfalls, we thus estimate an event study applying Sun and Abraham (2021)'s interaction weighted estimator. The results for our four general employment outcomes are presented in the Appendix and yield qualitative similar results (see Figure A3).

3.3.2 Placebo-test

To address the concern that our results rather capture the effect of some unobserved heterogeneity between mothers in high and low expansion counties than the effect of public child care on maternal labor supply, we furthermore perform a placebo test.[14] To this end we use a sample of mothers who gave birth between 1999 and 2004 (i.e., before the child care reforms) and whom we follow two years before and five years after the birth of their first child.We then apply equation (2) to measure the differential effects of child care in this sample. As no child care had been introduced by this time, we should not observe any significant effects.

Figure 6 presents the results for our four general employment outcomes: although most of the coefficients on the interactions of the event time dummies and the group indicator are statistically insignificant, we observe a positive trend for all our outcomes. However, a comparison of these results with those in the previous section reveals clear differences in the magnitude of the effect. Thus, even if our results capture some unob-

[14]Table A2, for example, shows that mothers in high expansion counties are more educated.

served heterogeneity and are therefore somewhat overestimated, we still find evidence of an effect of child care on maternal labor supply. This is particularly true for the periods when we would expect child care to benefit mothers most (i.e., in the second and third year after birth). As far as the effects of the later years are concerned, we have to be careful because our placebo test does not represent the full ten years after birth.

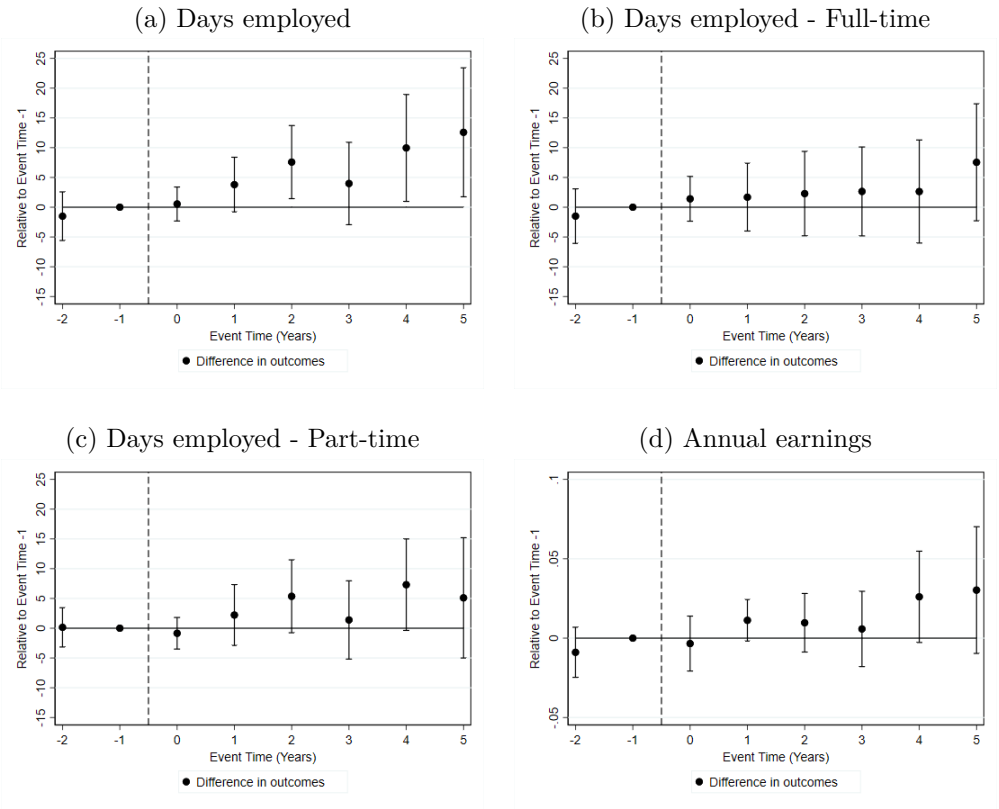


Figure 6. Placebo effect of child care. The figures show the coefficients on the interaction term in equation (2). All of these statistics are estimated on a sample of mothers who have their first child between 1999–2004, i.e., before the child care reforms and who were regularly employed in the year prior to birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

3.3.3 Fertility effects

Next, we have a closer look at the effect of public child care on fertility. In general, there are two ways in which the availability of public child care can affect fertility: First, it can affect the fundamental decision to have children (including the timing) and thus affect fertility at the extensive margin. If so, the estimates of the impact of child care on maternal employment documented in the previous section may be biased. To check whether such selective fertility is an issue in our setting, we restrict our sample to women in fertile age (i.e., women aged 15 to 44) and estimate an event study similar to equation (2) using the start year of the child care reforms (2005) as the event and a dummy indicating whether a woman gave birth to her first child in a given event time as the

dependent variable. The results are plotted in Figure A4 in the Appendix and provide no evidence for changes of fertility at the extensive margin in the post-reform period.

Second, the increase in child care may affect the number of children a mother has. While our data cover primarily first-order births, making it impossible to analyze the effect on fertility at the intensive margin, Bauernschuster et al. (2016) provide evidence that the German child care expansion indeed increased the number of second and third births.[15] Thus, we should interpret our results against the backdrop that child care may have led women in high expansion counties to have more children.

3.3.4 Selective migration

Another potential problem for our identification strategy arises if women who are more attached to the labor market move from low to high expansion counties around the birth of their first child. In this case we would be overestimating the impact of child care on maternal labor market outcomes, as this could then also be due to changes in population characteristics.

To ensure that our effects are not due to selective migration, we follow Krapf et al. (2020) and re-estimate our event study using a sample of women who lived in the same county in both the two years before the birth and the two years after the birth. As we can see in Figure A5 in the Appendix, the estimates are qualitatively and quantitatively similar to our results in the previous section. These findings suggest that selective migration does not bias our results.

3.3.5 Other reforms

Parental leave reform in 2007 One might also be concerned about the existence of another policy affecting maternal labor supply and that took place during the same observation period. A major parental leave reform passed by the German government in 2007 is an example of such a policy. Among other things, this reform replaced a means-tested parental leave benefit, targeted at lower-income families and paid for a maximum of two years, with an earnings-dependent system, which favors higher-income women by paying a certain share of the mother's pre-birth income for up to one year (e.g., Kluve & Tamm, 2013). As this reform affected all German counties equally, year fixed effects should absorb the effects of the reform on maternal labor market outcomes. However, if for some reason the impact of the reform varies systematically across counties, our results may be biased.

To explore this issue further, we follow Bauernschuster et al. (2016) and include an interaction term of a post-2007 dummy and educational attainment to allow for changes

[15] Our data only covers individuals who have a record in the administrative data sources. Thus, we cannot identify a second birth, if a mother does not return to an employment subject to social security between two successive births (Müller & Strauch, 2017).

in the relationship between women's education and employment after the parental leave reform. In line with previous literature and consistent with the expectation that it is mainly highly educated mothers who benefit from the new parental leave regulation and adapt their labor supply accordingly (see, e.g., Huber, 2019; Kleven et al., 2021; Kluve & Tamm, 2013), Table A3 in the Appendix shows that the interaction coefficient is negative and significant for our general employment outcomes. What is more important, however, is that our results on the effect of public child care on the labor supply of mothers still show the same pattern as before (see Figure A6 in the Appendix).

Legal claim to child care in 2013 Finally, there may be some concern that the intensity of the (exogenous) child care expansion has decreased in the years since 2013, when the legal entitlement to a child care slot was introduced for all children aged one and above (see Section 2.1). We therefore restrict our sample to mothers who gave birth between 2005 and 2011 and therefore did not benefit from the legal entitlement. As we can see from Figure A7 in the Appendix, the results look remarkably similar to those presented in the previous section. If anything, they show a slightly stronger effect of the introduction of child care on maternal employment.

4 Discussion & conclusion

In this paper, we study the long-run effect of public child care on female labor market outcomes, both in terms of quantity and quality of employment. We investigate this question by using an event study approach that compares the career trajectories of mothers living in high and low child care expansion counties between five years before and ten years after having a child. Our empirical analysis draws on a combination of county-level information on child care coverage with the BIBB/BAuA Employment Survey 2018 and with the administrative data from the Sample of Integrated Labor Market Biographies (SIAB) and exploits a set of German reforms leading to a substantial temporal and spatial variation in child care coverage for children under the age of three.

We find that public child care provision can reduce the child penalty by helping mothers to return to the labor market more quickly after the birth of their first child. However, we also find that the increase in employment is mainly due to an increase in part-time employment and is not associated with a change in the quality of work. Moreover, these effects do not differ for mothers with different career costs of children. All in all, our results therefore suggest that the impact of child care on mothers' career trajectories, and thus on the child penalty, is limited. In the following, we offer some suggestive explanations that could be worth further consideration.

First, public child care in Germany is not organized in a way that facilitates full-time work or demanding jobs. Figures published by DESTATIS (2022) suggest that only

about 55% of children under the age of three attended child care for more than seven hours a day. Working in a full-time job of 40h+ thus requires additional (in)formal care arrangements, which may not always be available.[16]

Second, although formal child care helps mothers to spend more time at work, it also has negative side effects that have received little attention in the literature. For example, child care centers are prone to the transmission of infectious diseases because many children from different places interact and exchange viruses and bacteria (Brady, 2005). Consequently, children who spend more time in child care centers are more likely to be ill, which may require at least one parent—typically the mother—to take child-related sick leave. This may be another barrier to combining early parenthood with less flexible and more responsible jobs.

Third, as mentioned in Section 3.3.3, our data have the disadvantage that we can primarily identify first-order births. However, the results of Bauernschuster et al. (2016) suggest that public child care has significant positive effects on fertility at the intensive margin. As a result, mothers may postpone their careers and continue to rely on part-time work (between subsequent births) despite better access to public child care facilities.

Finally, the limited effect of public child care on maternal career trajectories may also reflect mothers' preferences or persistent gender norms. Kleven et al. (2021), for example, find that a large expansion of child care provision in Austria does not seem to have altered the strong preferences for maternal care, which seems to be an important reason why child care has had virtually no effect on female labor market outcomes. Thus, regardless of the availability of child care, mothers may still not work or only work limited hours because they simply prefer to care for their child themselves. At the same time Boelmann et al. (2021) show that both early childhood exposure and exposure to a work environment with more egalitarian gender norms not only leads mothers to return to work faster, but also to work more hours. This suggests that factors other than government interventions play an important role in gender convergence and should therefore be subject of future research.

[16] Lafférs & Schmidpeter (2022) show for Austria that informal care by, for example, the partner matters much more for maternal job mobility than formal child care.

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A Appendix

A.1 Figures

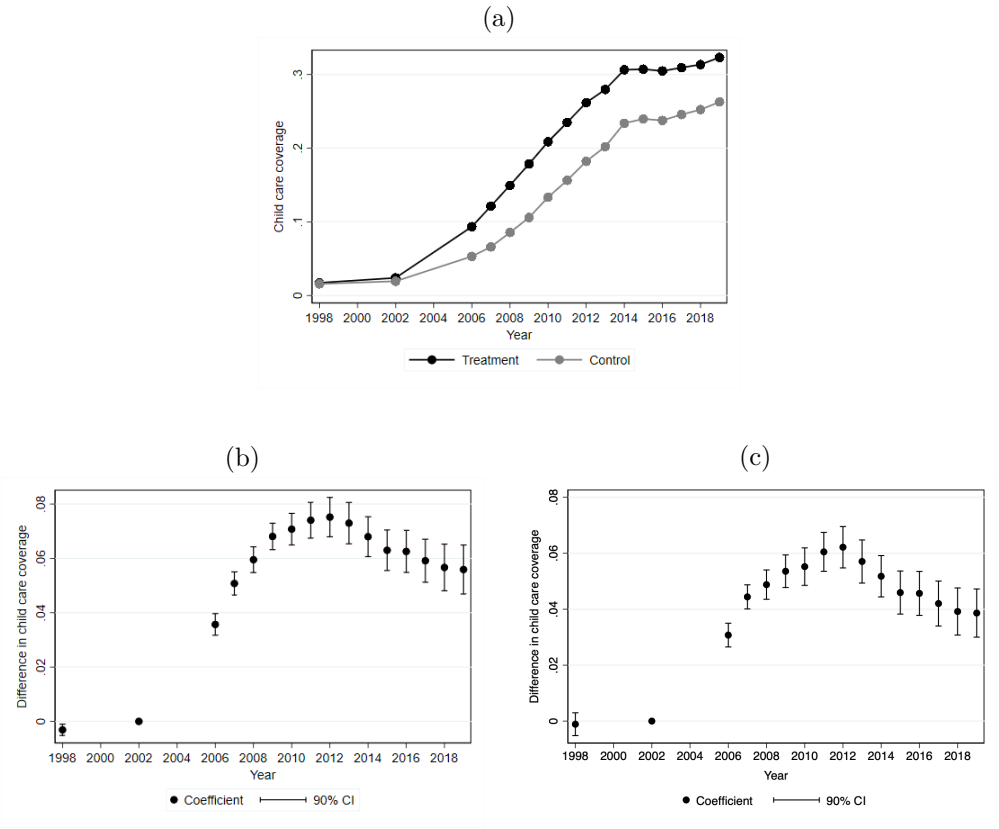


Figure A1. Child care coverage over time. Panel (a) shows the averages in child care coverage, separately for high expansion ($CC_i = 1$) and low expansion counties ($CC_i = 0$). High expansion counties consists of women living in counties with an above-median increase in child care coverage rates from 2002 until 2009, whereas the low expansion counties consists of women living in counties with below-median increase in child care coverage rates from 2002 until 2009. Panel (b) depicts emerging differences in child care coverage between high and low expansion counties with the difference normalized to zero in 2002, the last year with data on child care coverage before the 2005 reform. Panel (c) depicts emerging differences in child care coverage between high and low expansion counties net of differences in child care coverage rates due to demand side factors (population density, GDP per capita, male employment rate, interpolated conservative vote share, share of highly-educated females, and age structure controls).

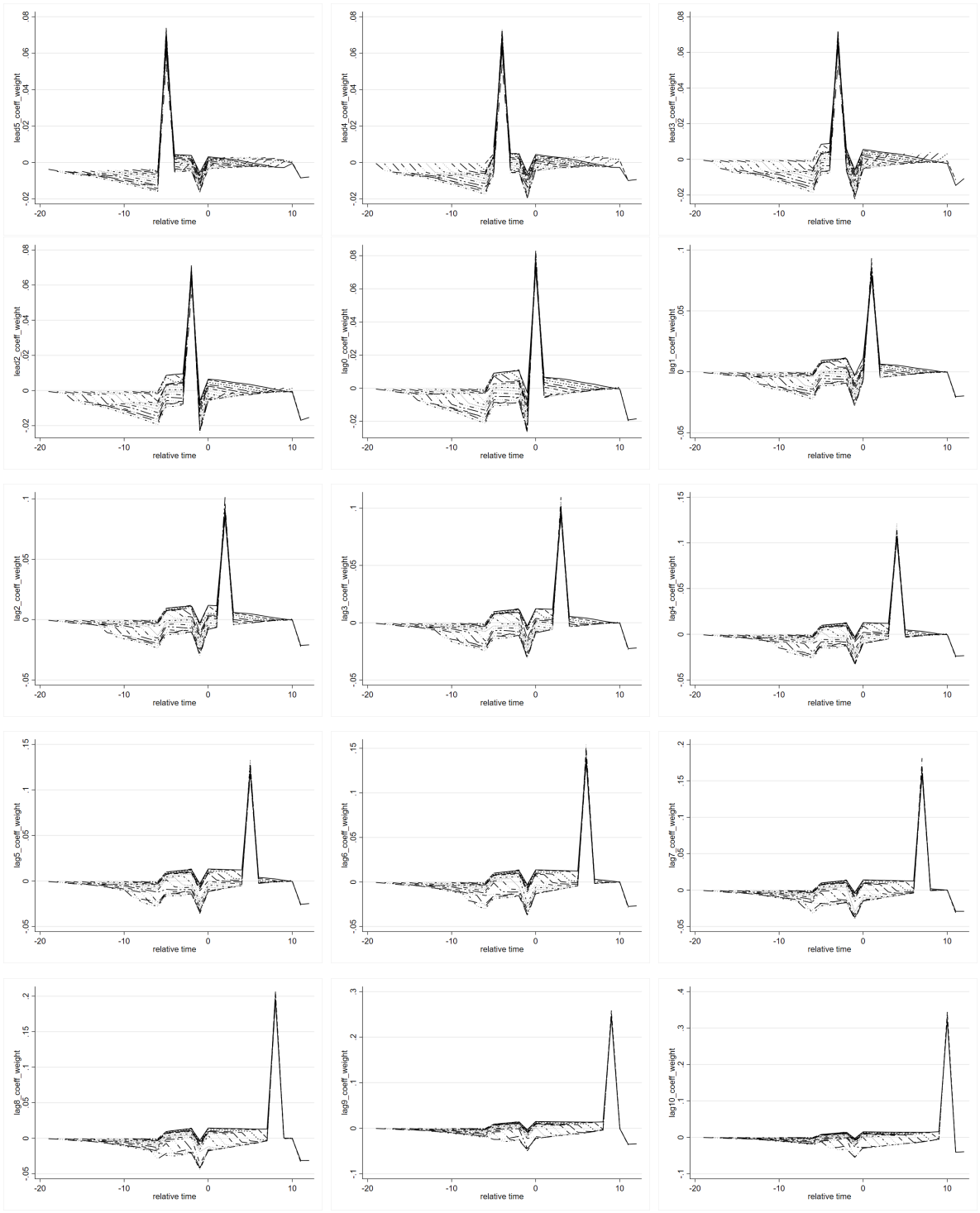
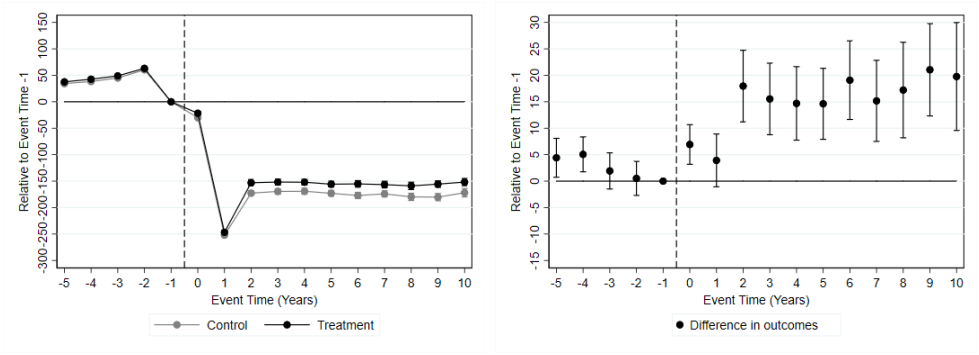
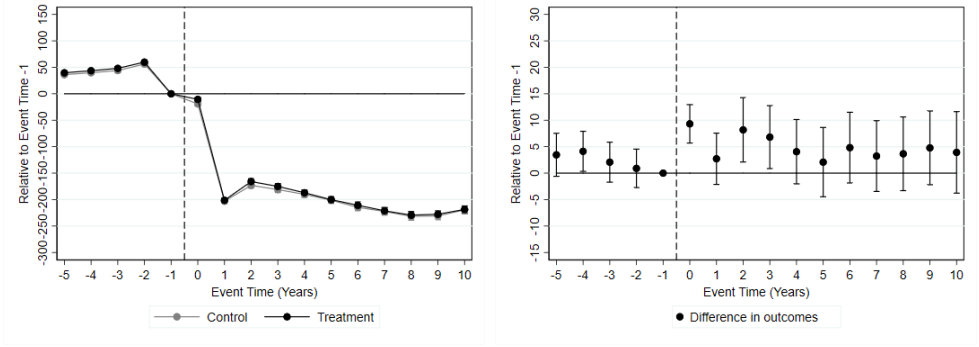


Figure A2. Lead and lag specific weights. The figure shows that in a dynamic two-way fixed effects specification, the estimated event study coefficients are combinations of their own and other period effects. We employ Sun and Abraham's publicly available Stata package *eventstudyweights* to estimate the weights.

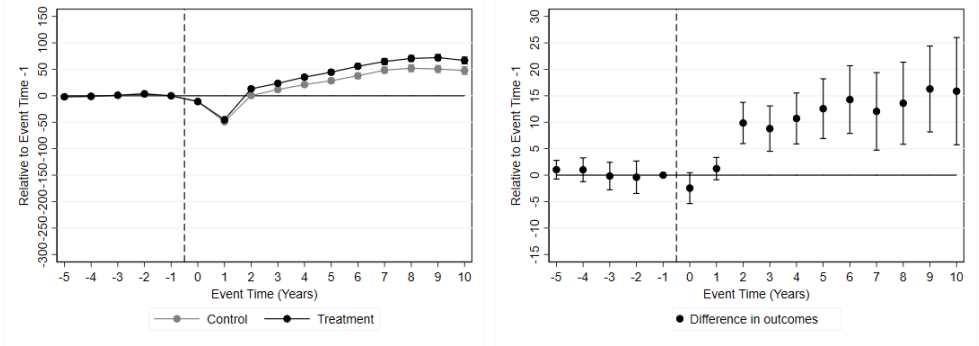
(a) Days employed



(b) Days employed - Full-time



(c) Days employed - Part-time



(d) Annual earnings (normalized)

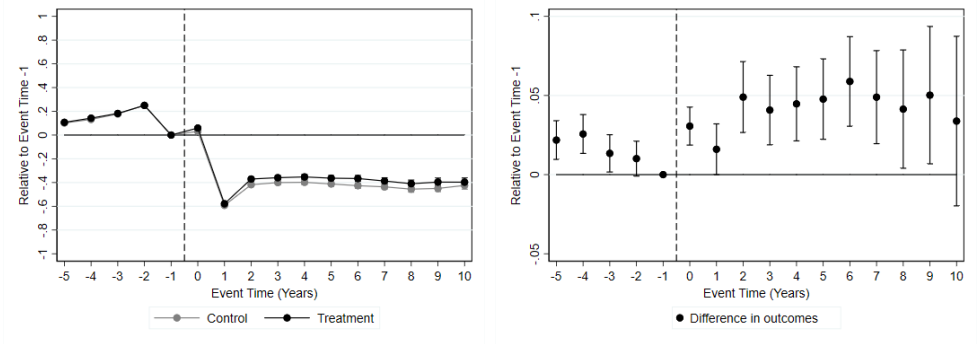


Figure A3. Child care and maternal employment: Event study estimates applying Sun & Abraham (2021)'s interaction weighted estimator. All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019 and were regularly employed before birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

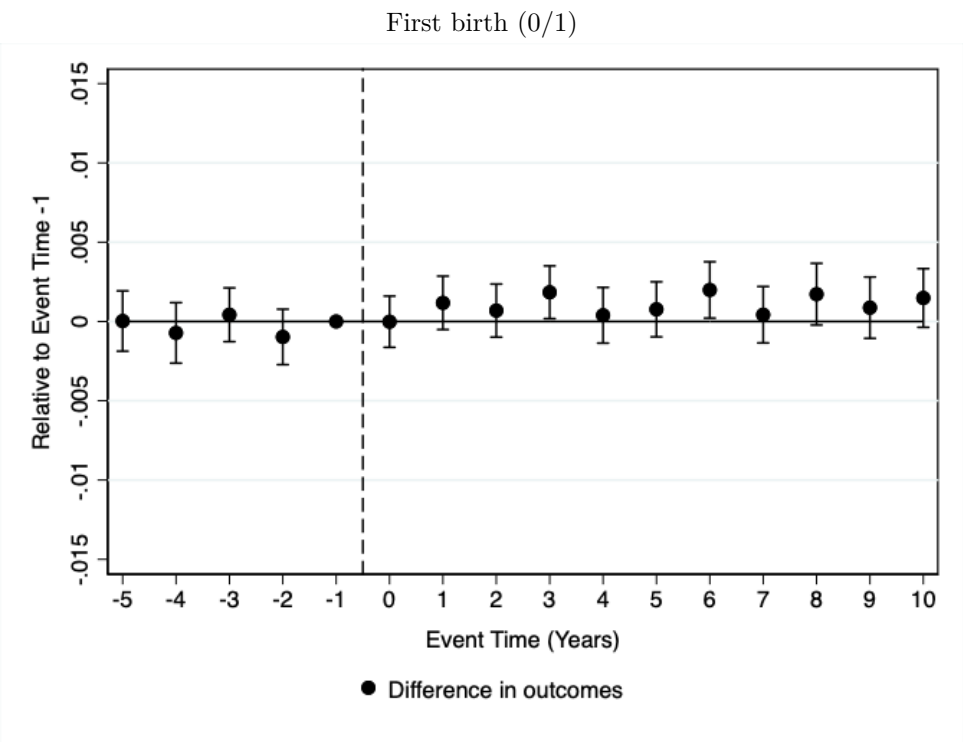


Figure A4. Child care and fertility: Event study estimates. The figures show the coefficients of the interaction term of an equation similar to equation (2). Event times are defined relative to the start of the child care reforms in 2005, year dummies are omitted due to perfect multicollinearity with the event time dummies. The outcome is a dummy variable for having a (first) child. All of these statistics are estimated on a sample of women aged between 15 and 44. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

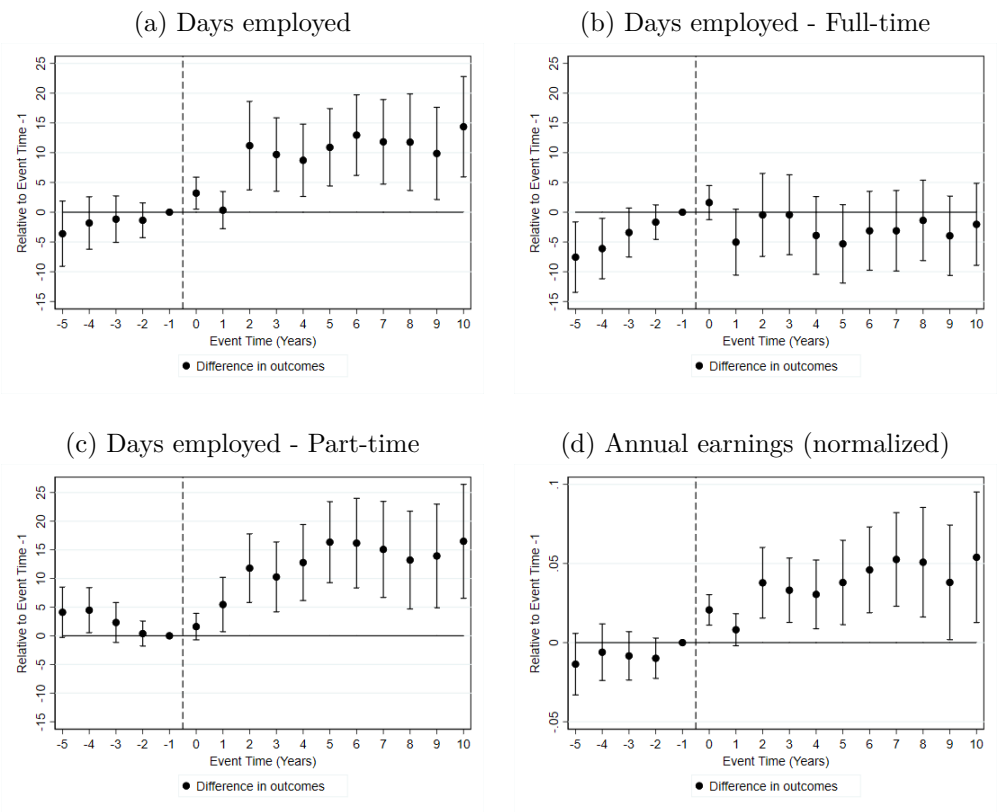


Figure A5. Validity check - Selective mobility: Event study estimates. The figures show the coefficients on the interaction term in equation (2). All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019, were regularly employed before birth and lived in the same county in both the two years before the birth and the two years after the birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

Figure A6. Validity check - Parental leave reform: Event study estimates. The figures show the coefficients on the interaction term in equation (2) that is complemented with an interaction term of a post-2007 dummy and educational attainment. All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019 and were regularly employed before birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

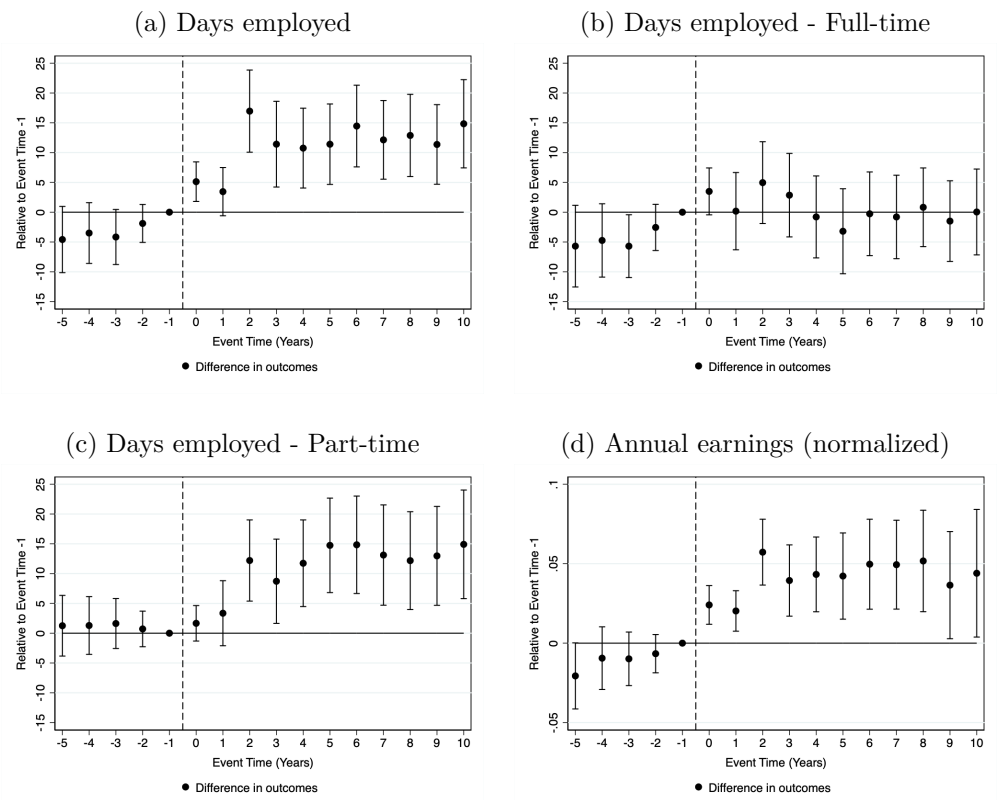


Figure A7. Validity check - Legal claim: Event study estimates. The figures show the coefficients on the interaction term in equation (2) restricted to births up to 2011. All of these statistics are estimated on a sample of mothers who have their first child between 2005–2011 and were regularly employed before birth. All figures include 95 percent confidence intervals around the event time coefficients. These confidence intervals are based on standard errors clustered at the county level.

A.2 Tables

Table A1. Child care coverage rates over time

Year	N	Mean	Median	SD	Min	Max
1998	324	0.017	0.009	0.020	0.000	0.117
2002	324	0.022	0.015	0.023	0.000	0.131
2007	324	0.094	0.085	0.044	0.022	0.289
2008	324	0.118	0.109	0.048	0.033	0.352
2009	324	0.142	0.135	0.050	0.037	0.359
2010	324	0.171	0.163	0.053	0.071	0.365
2011	324	0.196	0.189	0.057	0.092	0.376
2012	324	0.222	0.215	0.059	0.108	0.402
2013	324	0.241	0.236	0.060	0.113	0.442
2014	324	0.270	0.266	0.058	0.140	0.467
2015	324	0.273	0.271	0.058	0.130	0.470
2016	324	0.271	0.270	0.059	0.143	0.479
2017	324	0.277	0.278	0.058	0.137	0.454
2018	324	0.283	0.288	0.060	0.136	0.445
2019	324	0.293	0.295	0.061	0.145	0.466
Total	4,860	0.193	0.202	0.106	0.000	0.479

Notes: The table shows the number of West German counties observed, the mean, the median, the standard deviation, and the minimum/maximum values of public child care coverage for all years in which data are provided. Data source: Regional Statistics, Inkar.

Table A2. Differences between mothers in high and low expansion counties prior to first birth

	Total sample Mean	Treatment Mean	Control Mean	Difference t-stat
Dependent variables				
Employment status	1.00	1.00	1.00	-
Days employed	355.43	355.71	355.12	1.60
Annual earnings	31,223.05	33,107.46	29,174.63	18.96
Days employed - Full-time	288.67	291.52	285.57	3.75
Days employed - Part-time	66.62	64.03	69.43	-3.52
Days employed - Abstract task	114.48	116.14	112.68	1.84
Days employed - Manager position	13.00	14.64	11.22	4.55
Individual level variables				
Age	28.71	28.94	28.45	9.90
German	0.90	0.89	0.91	-6.67
High Education	0.20	0.23	0.16	16.67

Notes: Column 1: mean of all women who have a first birth between 2005-2019. Columns 2-3: means of respective mothers in the high an low expansion counties. Column 4: Difference in means between mothers in the high an low expansion counties. t-stat based on linear regressions of the respective variables on the group indicator.

Table A3. Validity check - Parental leave reform: Event study estimates

	Days employed	Days employed full-time	Days employed part-time	Annual earnings (normalized)
Event -5 x Child care	-4.589	-8.423	3.903	-0.019
	(2.229)	(2.595)	(1.954)	(0.007)
Event -4 x Child care	-3.051	-6.691	3.729	-0.01
	(1.853)	(2.277)	(1.933)	(0.007)
Event -3 x Child care	-3.024	-5.349	2.345	-0.013
	(1.744)	(1.888)	(1.688)	(0.006)
Event -2 x Child care	-2.423	-3.667	1.281	-0.012
	(1.167)	(1.341)	(1.061)	(0.005)
Event 0 x Child care	3.127	0.793	2.321	0.018
	(1.162)	(1.327)	(1.099)	(0.005)
Event +1 x Child care	0.422	-5.611	6.048	0.006
	(1.413)	(2.481)	(2.194)	(0.005)
Event +2 x Child care	14.924	0.351	14.638	0.042
	(2.919)	(3.003)	(2.639)	(0.01)
Event +3 x Child care	10.917	-0.672	11.656	0.032
	(2.908)	(2.959)	(2.743)	(0.01)
Event +4 x Child care	9.705	-3.953	13.729	0.031
	(2.814)	(2.923)	(2.899)	(0.011)
Event +5 x Child care	11.811	-6.004	17.854	0.034
	(2.92)	(2.932)	(3.264)	(0.013)
Event +6 x Child care	13.884	-3.666	17.573	0.039
	(3.028)	(3.015)	(3.562)	(0.013)
Event +7 x Child care	12.336	-3.916	16.334	0.051
	(3.2)	(3.141)	(3.778)	(0.014)
Event +8 x Child care	12.372	-2.954	15.361	0.05
	(3.566)	(3.055)	(3.897)	(0.017)
Event +9 x Child care	11.164	-5.427	16.615	0.033
	(3.408)	(3.086)	(4.065)	(0.018)
Event +10 x Child care	14.492	-3.93	18.446	0.041
	(3.796)	(3.269)	(4.55)	(0.021)
Post07 x Highly educated	-6.969	-4.603	-2.34	-0.012
	(1.363)	(1.375)	(1.203)	(0.005)
Event time dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Age dummies	Yes	Yes	Yes	Yes
N	371,985	371,927	371,927	371,985

Notes: Event study estimates. The table shows the coefficients on the interaction term in equation (2) and the interaction term of a post-2007 dummy and educational attainment. All of these statistics are estimated on a sample of mothers who have their first child between 2005–2019 and who were regularly employed in the year prior to birth. Robust standard errors are clustered at the county level and given in parentheses.