Labour Economics 36 (2015) 84–98

Contents lists available at ScienceDirect

Labour Economics

journal homepage: www.elsevier.com/locate/labeco

The effects of family policy on maternal labor supply: Combining evidence from a structural model and a quasi-experimental approach

Johannes Geyer [a], Peter Haan [b,*], Katharina Wrohlich [a]

[a] DIW-Berlin, Mohrenstr. 58, 10117 Berlin, Germany
[b] FU Berlin, Garystr. 21, 14195 Berlin, Germany

HIGHLIGHTS

- We analyze the effects of family policy instruments on maternal labor supply
- The evaluation is based on a structural model and on quasi-experimental methods
- Both methods show that parental leave benefits affect employment of mothers
- Combining parental leave and subsidized child care increases maternal labor supply

ARTICLE INFO

Article history:
Received 13 December 2014
Received in revised form 3 July 2015
Accepted 5 July 2015
Available online 11 July 2015

JEL classification:
J22
H31
C52

Keywords:
Labor supply
Parental leave benefits
Childcare costs
Structural model
Natural experiment
Quasi-experimental approach

ABSTRACT

Parental leave and subsidized child care are prominent examples of family policies supporting the reconciliation of family life and labor market careers for mothers. In this paper, we combine different empirical strategies to evaluate the employment effects of these policies for mothers with young children. In particular we estimate a structural labor supply model and exploit quasi-experimental variation from a parental leave reform in Germany. Our findings suggest that a combination of parental leave benefits and subsidized child care leads to sizable employment effects of mothers.

1. Introduction

Facing a shrinking working-age population, increasing female labor force participation is high on the political agenda in many countries. One central reason for the lower participation rates of women is child-related employment interruptions of mothers. In response, policy makers aim to improve the reconciliation of family life and labor market participation for mothers with young children by reforming family policy and introducing new instruments. In this context, parental leave programs as well as the provision of affordable and high-quality child care are of particular importance.

The aim of this paper is to provide empirical evidence on how these family policy programs affect the employment of mothers with young children. We analyze two important policies for young mothers: the provision of paid parental leave and childcare. In more detail, we look at the effect of a major reform of the parental leave legislation in Germany that resulted in an increase in the parental leave benefit, while simultaneously reducing the entitlement period for the benefit. In addition, we analyze how an expansion of subsidized child care in combination with the parental leave reform affects the employment of mothers.

In this paper we use two complementary methods for the empirical analysis. Specifically, for the evaluation of the parental leave reform we exploit quasi-experimental variation in a reduced form estimation and

* Corresponding author at: DIW-Berlin, Mohrenstr. 58, 10117 Berlin, Germany.
E-mail addresses: jgeyer@diw.de (J. Geyer), phaan@diw.de (P. Haan), kwrohlich@diw.de (K. Wrohlich).

http://dx.doi.org/10.1016/j.labeco.2015.07.001
0927-5371/

apply a structural model of labor supply behavior. For the analysis of the combined effect of universal child care and the parental leave reform we only use the structural model.[1]

For the quasi-experimental approach we exploit the timing of a parental leave benefit reform in Germany: mothers with children born before 1.1.2007 are subject to the old parental leave regime and mothers with children born on or after 1.1.2007 are subject to the new regime. The financial effects and work incentives for mothers during the first two years follwing birth differ markedly between the two regimes. Before the reform, families received a means-tested transfer amounting to 300 euro per month, which was paid to the parent on leave for a maximum period of 24 months. After the reform the transfer is paid only for a maximum period of 12 or 14 months (there exists a 2 months "partner quota"), with the amount transferred depending upon the earnings of the parent on leave prior to birth. We provide evidence that a causal effect can be identified by comparing mothers who gave birth shortly before and shortly after the implementation of the reform.

The evaluation design for the structural analysis is fundamentally different from the quasi-experimental approach. We develop and estimate a structural labor supply model of maternal employment using data from the German Socio-Economic Panel Study (SOEP) from 2001 through 2006, i.e. prior to the parental leave reform. Based on the estimated structural parameters we simulate the employment effects induced by the incentives of the parental leave benefit reform.

We show that the results obtained using the two different methods are comparable and follow the same pattern across socio-economic subgroups. In particular, the results from the structural model and those from the quasi-experimental approach lead to the same conclusions: In the first year following birth, labor supply declines for mothers of all socio-economic groups, and in the second year we find positive employment effects. Moreover both methods show the same pattern across low and high income households and between households in East and West Germany.

In a second step, we use the structural model to simulate the employment effects related to subsidized child care. Germany is an interesting example in this respect since subsidized child care slots are relatively scarce in the period under study (2001–2006)—with enrolment rates well below 15% (West Germany below 5%). Since 2005, several laws aimed at increasing subsidized childcare slots, in particular for children between one and three years, have been passed. Since August 2013 parents have a legal right to subsidized child care for all children aged one or older regardless of the employment status or income of the parents. First, we use the structural model to simulate the employment effects of introducing universal child care independent of parental leave and then we evaluate the combined employment effect of the parental leave reform together with the provision of universal child care.

Our results indicate that both the parental leave reform and the introduction of universal child care increase the employment of mothers with children aged one year or older. In particular, we find that the parental leave benefit reform has a modest positive effect on the labor supply of mothers in the second year after their child was born. Much larger effects, however, can be attributed to the childcare reform that increases labor supply by almost 5 percentage points. Thus, we conclude that the combination of both reforms has large effects on maternal labor supply. Moreover, while the reform of the parental leave benefit mostly affects mothers with low wages, the child care reform increases the employment of all mothers independent of their socio-economic background.

Our analysis adds to the literature on the labor market effects of family policies and, therefore, contributes to the discussion about the consequences of different family policy reforms on maternal employment. There is a large literature from many different countries focusing on the effects of family policy on the behavior of mothers. As far as parental leave is concerned, a comprehensive study by Lalive et al. (2013) shows that parental leave benefits as well as job protected leave duration influence maternal employment behavior. Datta Gupta et al. (2008) show that the 'Nordic' model of parental leave leads to higher female employment (although lower wages). The employment effects of the German parental leave reform that we look at are studied by (Bergemann and Riphahn (2011), Kluve and Tamm (2013), and Kluve and Schmitz (2014)). All studies exploit the fact that the introduction can be interpreted as a quasi-experiment. In contrast to our analysis, these studies do not analyze employment behavior but the subjective desire of mothers to return to the labor market in the future. Thus our study is the first analysis of realized short run employment effects of the parental leave reform. Kluve and Schmitz (2014) exploit more recent data of the microcensus and extend the short-run analysis to focus on the medium run effects of the reform.

A large body of literature analyzes the effects of childcare policies on maternal labor supply. Many earlier studies are based on structural models where identification relies on the heterogeneity of wages and childcare costs in the cross-section and over time (see, among many others, Ribar (1995), Blau and Robins (1988), Michalopoulos et al. (1992) and Powell (2002) for the US, Kornstad and Thoresen (2007) for Norway, Lokshin (2004) for Russia, Apps et al. (2012) for the Netherlands and Haan and Wrohlich (2011) for Germany). Other studies use quasi-experimental approaches and identify the effect of childcare policy on regional variation in the availability or expansion of child care (see, among others, Havnes and Mogstad (2011) for Norway, Simonsen (2010) for Denmark, Berlinski and Galiani (2007) for Argentina, Cascio (2009) for the U.S., Baker et al. (2008) for Canada, Schlosser (2005) for Israel, Nollenberger and Rodrguez-Planas (2015) for Spain and Bauernschuster and Schlotter (2015) for Germany).

The paper proceeds as follows. In the next section, we provide information about family policy in Germany and the parental leave and childcare reforms enacted on 1.1.2007. In Section 3 we discuss the two evaluation methods, while Section 4 introduces the data sources. The empirical results and the policy simulations are discussed in Section 5. Finally, Section 6 concludes.

2. Institutional background

Germany, like many other countries, has reformed major parts of its family policy instruments, hoping—among other reasons—to encourage more mothers with young children to take up employment. In particular a major parental leave reform, taking effect in 2007, as well as several child care reforms implemented since 2005, aim in this direction. Since these reforms are crucial for our evaluation strategy, we provide an overview of the most important institutional details within this policy field.

2.1. Parental leave legislation

In contrast to the United States but similar to other European countries, parental leave legislation in Germany is very generous with respect to both job protection and monetary benefits during leave. [2] In Germany, both parents are entitled to take parental leave ("Elternzeit") for a maximum period of three years after childbirth. During the leave parents are protected against dismissal and have the right to return to

[1] A reduced form evaluation of the combined effect of universal child care together with the parental leave reform would require exogenous variation in child care provision and parental leave along the same dimension, e.g. at the same time. In our context this is not the case; therefore for the estimation of the joint effect we focus on the structural model.

[2] For an overview of the development of parental leave legislation in Germany, including developments since 2007, see Kluve and Tamm (2013), Schönberg and Ludsteck (2014) or Spiess and Wrohlich (2008).

the same or similar job as before their leave. This implies previously employed mothers are not restricted by labor market frictions related to involuntary unemployment during this period. The 2007 parental leave reform did not change the total length of the leave but replaced the means-tested benefits by an earnings related system. This is important for our evaluation design. As discussed in Lalive et al. (2013), if both the period of job protection and the benefits change, it is difficult to identify the relative importance of cash benefits versus job protection.

During the leave, parents can claim parental leave benefits for a limited period of time. Through 2006, there was a child-rearing benefit ("Erziehungsgeld") amounting to 300 euro per month, which was paid to the parent on leave for a maximum period of 24 months. This transfer was means-tested with income thresholds below the median income of a one-earner family. Thus, less than half of all families with newborn children were entitled to this transfer. [3] The transfer was only paid to families in which at least one parent worked less than 30 h per week.

In 2007, the child-rearing benefit was replaced by the "parents' benefit" ("*Elterngeld*"). In contrast to the old scheme, this transfer is paid only for a period of 12 or 14 months. Mothers and fathers can either share their entitlement, in which case the leave is extended to 14 months, or, if only one parent takes the leave, it amounts to 12 months. [4] In contrast to the old scheme, the parents' benefit is not means-tested on household income and the amount of the benefit depends on earnings prior to birth. It replaces 67% of previous net earnings, but does not exceed 1800 euro per month. There is a minimum of 300 euro per month that is paid to parents whose parents' benefit would otherwise be less than 300 euro, including parents without prior earnings. If the parent who is receiving the benefit is working part-time, the benefit is reduced. It then replaces 67% of the difference in net earnings before and after birth. Families with two children under three years of age or those families with three or more children under six years of age receive an extra bonus of 10%. For parents with prior-to-birth earnings of less than 1000 euro per month, the replacement rate increases gradually until it reaches 100% for parents with a pre-birth income of 340 Euro per month. As in the old scheme, the parent receiving the parents' benefit is not allowed to work more than 30 h per week.

2.2. Childcare institutions

Traditionally, the supply of public or publicly subsidized formal child care for children under the age of three has been very low, at least in West Germany. While in East Germany child care was available for a larger fraction of children, even in the youngest age group, the prevalent care arrangement in West Germany was to look after children under the age of three in private settings, i.e. mostly by their mothers. Private institutionalized child care was (and still is) almost non-existent, while public or publicly subsidized child care for children under the age of three years was only available for 2% of the children in West Germany, and 35% in East Germany (see Table 1). Families who are rationed with respect to subsidized child care can arrange privately financed alternatives, i.e. nannies, which however come at considerably higher cost.

Since 2005, several laws increasing subsidized childcare slots, in particular for children between the ages of one and three years, have passed. The August 2013 reform in the field of childcare policy was the introduction of a legal claim for subsidized child care for all children after their first birthday, unconditional on employment status or income of the parents.

[3] The income thresholds during the first 6 months after childbirth were higher and about 77% of all parents claimed the child-rearing benefit. Starting from the 6th month, only about 50% were entitled to full benefits.

[4] Note, in this paper we do not analyze the behavior of the father nor the effect of this "partner quota", the focus is only on the employment effects of mothers.

Table 1
Childcare enrolment rates for children under three between 2002 and 2013 by region.

Year	Germany (overall mean)	West Germany	East Germany
2002	0.12	0.02	0.35
2006	0.16	0.07	0.41
2007	0.18	0.09	0.42
2008	0.21	0.12	0.43
2009	0.21	0.14	0.47
2010	0.24	0.17	0.49
2011	0.26	0.20	0.50
2012	0.28	0.22	0.52
2013	0.29	0.24	0.52

Note: Data for the year 2002 refer to the availability of child care slots, i.e. the supply of child care slots per 100 children in the relevant age group. The numbers from 2006 on refer to actual enrolment, i.e. children enrolled in child care facilities per 100 children in the relevant age group. Given the large amount of excess demand to child care, we consider availability and enrolment to be comparable in this case. Data for the years 2003–2005 are not available.
Source: Federal Statistical Office.

As a consequence of these reforms a substantial increase of the availability of child care slots can be observed (see Table 1). In West Germany, the availability of child care for children under the age of three has increased: from 2% in 2002 to 22% in 2012. In East Germany, child care slots increased from 35 to 52% over the same period.

It is shown (Wrohlich, 2008) that the limited availability of subsidized child care has led to excess demand and rationing of child care: In 2002, parents of 25% of all children below three years in West Germany were rationed with respect to subsidized child care. As availability increased, this number dropped to 16% in the year 2010 (Müller and Wrohlich, 2014). Table 1 shows the development of the availability of subsidized child care in Germany in the period from 2002 to 2013.

2.3. Changes in work incentives due to family policy reforms

We now describe in more detail how net household income and incentives to work are affected by the parental leave reform. Moreover, we show how the introduction of universal child care and thereby the reduction of childcare costs change disposable income and working incentives.

In order to illustrate the incentives, we derive hypothetical budget lines, i.e. monthly disposable household income as a function of the mother's working hours, for i) a couple where both spouses earn median wages and ii) a couple where both spouses earn low wages. We show monthly disposable household income as a function of the mother's working hours for the first (Fig. 1) and second (Fig. 2) year after a child is born. The working hours of the father are assumed to be constant at 40 h per week.

We define disposable income as net household income (gross income less taxes and social security contributions plus social transfers) less childcare costs. In particular, starting from gross earnings, we derive net household income applying a tax-transfer simulation model (see Section 4.2). This model accounts for income taxation, social security contributions and all social transfers. To derive disposable household income, we then subtract child care costs in case that both spouses are working. We follow previous work (Wrohlich, 2011) and use the concept of "expected costs of child care" (*ec*) to calculate childcare costs. This measure takes rationing explicitly into account, which as mentioned above is crucial in the German context, given the considerable excess demand for childcare between 2001 and 2006. In more detail, families who do not have access to subsidized child care must rely on the private market of nannies and babysitters, which comes at considerably higher costs than subsidized child care.

More formally, since we do not know in the data whether a family is restricted in the access to subsidized child care or not, *ec* consist of a

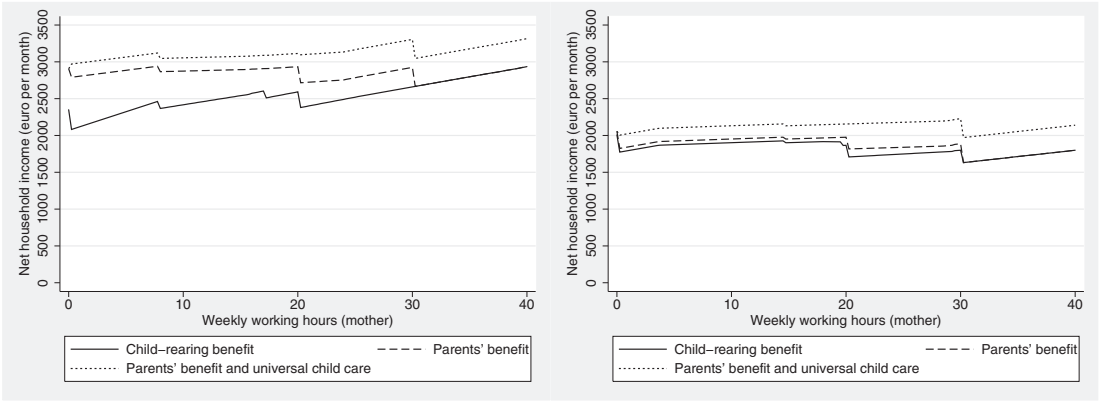

Fig. 1. Disposable household income with respect to mothers' working hours, first year after first childbirth.

weighted average of parents' fees to subsidized child care and costs of private child care, i.e.

$$ec_i = c_i^s \cdot p_i + c_i^{ns} \cdot (1-p_i) \quad (1)$$

where ec_i are the expected childcare costs for child i, c_i^s are the fees for a childcare slot in a subsidized facility, p_i is the probability that a child has access to a slot in a subsidized childcare facility and c_i^{ns} are the costs for privately organized child care. The calculation of the components of Eq. (1) is explained in more detail in Appendix A.

We assume no costs of child care if the mother is not working; if the mother is working less than 20 h per week, parents have to pay for part-time care; if the mother is working 20 or more hours per week, parents have to pay for full-time care.

Each graph shows disposable household income for three scenarios: The solid line "child-rearing benefit" represents disposable income under the old parental leave benefit scheme (year 2006) and under the childcare regime of the year 2006. The dashed line "Parents' benefit" refers to the legislation of the year 2007 (new parental leave benefit scheme), holding childcare costs constant. The dotted line "Parents' benefit and universal child care" refers to the hypothetical scenario of the new parental leave benefit scheme and childcare costs that would occur if subsidized child care was available to all families. For this simulation scenario, we set the probability of being rationed in Eq. (A.1) to zero.

The change in working incentives due to the parental leave benefit reform (the difference between the solid and the dashed line) depends on several characteristics, such as household income, mothers prior-to-birth earnings and number of children, and in particular on the time since childbirth. In the first year after giving birth, work incentives have generally decreased, while incentives to work have increased in the second year, in particular for low-income mothers.

In Fig. 1 we show how incentives to work have changed in the first year following childbirth. First we focus on the comparison of the different parental leave benefits schemes, holding childcare costs constant. Panel (a) shows disposable household income for a couple household with median income. For mothers with median wages (whose partner earns also median wage and works full-time), work incentives during the first year after birth are lower with the parents' benefits than with child-rearing benefits. In the post 2006 regime, the household has a higher out-of-work income, and the transfer is withdrawn at a high rate, such that the budget line is relatively flat. Panel (b) shows disposable household income for couples with low wages. As this panel shows, in contrast to the couple with median income, the parental leave benefit reform hardly affected incentives to work for this group in the first year after childbirth.

If we additionally simulate the reduction in childcare costs that results from an increase in subsidized childcare (dotted line) work incentives increase for both types of households. Subsidized child care is no longer rationed under this scenario and, thus, childcare costs simply

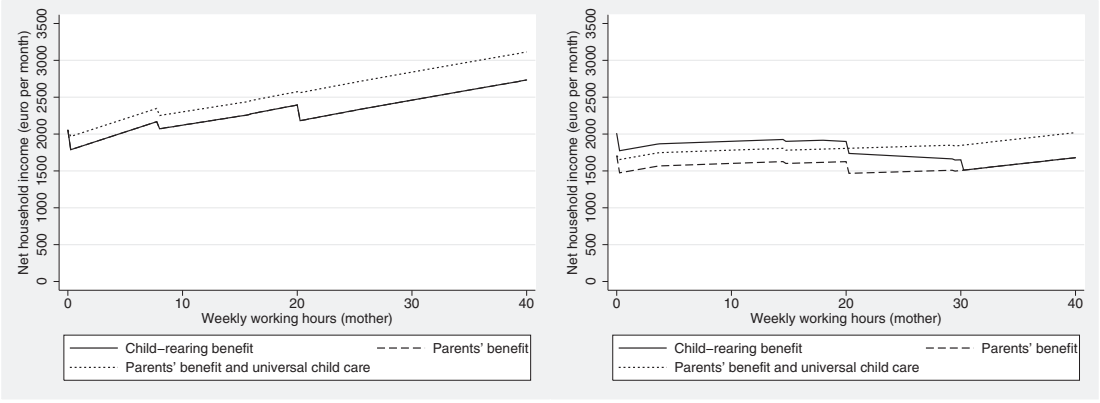

Fig. 2. Disposable household income with respect to mothers' working hours, second year after first childbirth.

amount to the relatively inexpensive parental fees paid to childcare centers. Therefore, the opportunity costs of work are considerably reduced.

In Fig. 2 we turn to disposable household income for families in the second year after a child is born. In this time period, couple households with median income (such as shown in Panel (a) of Fig. 2) and above do not face any changes in work incentives, since they were not entitled to benefits in the second year under the old scheme. For this household type, we do not expect the 2007 parental leave reform to affect labor supply behavior in the second year. Incentives to work for mothers in these households, however, increase substantially under the childcare reform, as the dotted line shows.

For lower-income households the graph indicates that work incentives have increased not only due to the reduction in childcare costs, but also due to the parental leave benefit reform. The budget line for the relevant households in panel b in Fig. 2 implies strong disincentives to work under the old parental leave benefit scheme, in particular to work more than 20 h per week. Between 20 and 30 h, the slope of the budget line is even negative, i.e. marginal tax rates exceed 100%. If the mother works full-time, net household income is about the same as when she was not working. These strong disincentive effects are reduced with the parents' benefit. Still, the budget line of these household types are very flat, because at low earnings the family can draw means-tested social transfers. However, the slope of the budget line is positive over the whole range of working hours. Thus, we would expect an increase in labor supply in the second year after childbirth.

Ceteris paribus, for families with more children, work incentives induced by the parental leave benefit reform should be higher, since the income threshold of the old benefit scheme increased with each additional child. For example, a family with three children would have received the old benefit even at incomes above the median. Additionally, the reduction in childcare costs should have even stronger positive effects on work incentives for families with more than one child.

If we combine the described working incentives with a standard theoretical model of labor supply behavior with positive preferences for income (consumption) and leisure, we can derive hypotheses about the potential labor supply effects of the reforms. In general, it is expected that mothers reduce labor supply in the first year after childbirth. We expect this effect to be particularly large for mothers with high prior-to-birth earnings. In the second year, incentives to work have changed only for mothers who have a partner with below-median earnings (or for mothers with more than two children and partners with earnings in the first three quarters of the wage distribution) and for single mothers. For all other families, work incentives in the second year after childbirth have not changed due to the reform. Thus, we expect to find the labor supply of mothers in low-income families to increase. An increase in subsidized child care, on the other hand, should increase employment of mothers in all types of families since working incentives increased for all groups.

3. Estimation strategy

In the following, we discuss the two different methodologies that we use for the empirical analysis. First, we directly exploit the variation induced by the parental leave reform in a reduced form regression. This reform can be interpreted as a quasi-experiment and our strategy is to compare the employment behavior of mothers who gave birth just before and after January 1, 2007, the date the reform came into effect.

Second, we present a structural model of maternal labor supply which is derived from economic theory. In contrast to the quasi-experiment approach, this model relies on several structural assumptions that are imposed on the model. Based on this structural model we can estimate preferences of households which allows us to simulate the employment behavior of mothers and responses to specific family policy reforms. For example, in order to evaluate the employment effects of the parental leave reform, we use the estimated structural model and simulate the employment behavior under the pre-reform child-rearing benefit scheme of 2006. Then, in a second step, we simulate behavior under the newly introduced "parents' benefit". All other rules of the tax and transfer system in both scenarios are identical (law as of 2006). This procedure allows a *ceteris paribus* analysis of the change in the labor supply incentives introduced by the parental leave reform, in particular the difference in labor supply behavior can be interpreted as the reform effect. The employment effects of an expansion of subsidized child care is evaluated using the same methodological design.

3.1. Evidence from quasi-random variation

We present first the empirical evidence on the employment effects of the parental leave benefit reform exploiting the quasi-experimental setting that was created due to the timing of the reform. We argue that this timing created random variation in financial incentives for two reasons: First, the reform was introduced for all newborns at one point in time. If the child was born on or before December 31, 2006, parents were entitled to the old scheme, while if the child was born on or after January 1, 2007, parents were entitled to the new scheme. Second, as is documented in great detail in Kluve and Tamm (2013), mothers who gave birth in the first three months of 2007 did not know that there would be a new benefit scheme at the time of conception (see also Kluve and Schmitz (2014)).

Thus, the introduction of the new benefit scheme can be evaluated by a comparison of the employment behavior of a treatment and a control group: the treatment group consists of mothers who gave birth in the first quarter of 2007, and the control group consists of mothers who gave birth in the fourth quarter of 2006. [5]

More formally, we estimate the labor supply (ls) of mothers with a child in the first and second year after birth separately. ls denotes the employment status of mothers with children aged 3–12 months or 13–24 months at the time of the interview. [6] The treatment dummy D_i depends on whether the child was born in the last three months of 2006 ($D_i = 0$) or in the first three months of 2007 ($D_i = 1$):

$$ls_i = \beta D_i + \varepsilon_i. \tag{2}$$

Interviews in the microcensus are distributed across the whole year. Therefore, seasonal employment effects that could differ between treatment and control groups are not a problem in our case since we analyze the average employment outcome of all mothers with children aged 3–12 months and children 13–24 months, respectively. However, in order to control for potential differences of mothers with children born from October to December and mothers with children born from January to March, following e.g. Schönberg and Ludsteck (2014) we estimate a differences-in-differences model as a sensitivity test which is shown in the 9.

[5] Theoretically, there is a chance that some mothers tried to delay births that would otherwise have taken place in December 2006 to January 2007 because of the reform. If this were the case, it would imply self-selection into the treatment group, which would bias our estimates. There are two studies claiming that the parental leave reform in fact led to a significant delay of births. Neugart and Ohlsson (2013) estimate that the probability to give birth the first seven days of 2007 rather than the last seven days of 2006 increased by 5 percentage points for employed mothers. Another study by Tamm (2013) quantifies the number of delayed births due to the reform at around 1000. However, we think that this problem is negligible for the following reason. Even if it was true that these births have been delayed due to the reform, this fraction of births is very small. Since our treatment and control group include mothers who gave births three months before and three months after the reform, respectively, the "delayed" births have a very small weight. To be more precise, according to the Federal Statistical Office, there were 57,578 births in January 2007 in Germany. Thus, the proportion of delayed births is less than 2%. If we take the number of births of our treatment group, i.e. births from January to March 2007, this fraction is less than 0.01%.

[6] To analyze employment effects of the reform for mothers in the first year after giving birth, we only look at employment outcomes of mothers whose child is at least 3 months old since in the first 8 weeks after birth, mothers are not allowed to work due to maternity leave legislation ("Mutterschutz").

In our main specification, we do not control for observable characteristics. Instead, we estimate the equation separately for different subgroups, namely for mothers living in east versus west Germany as well as for mothers in households above versus below the median income.[7]

The identifying assumption for the causal effect estimated by β is that no other factors that potentially influence labor supply are correlated with D_i, in other words, individual unobservable factors measured by ε_i are not correlated with the treatment. This assumption cannot be tested. However, it is plausible in this setting because there are no selection effects (since the reform was not known at the time of the conception) and there is no time trend since the time period in which we compare treatment and control group is very small (six months). In particular the continuous increase in subsidized child care (see Table 1) is not problematic in our setting since we compare mothers within a very short time window. On average, we observe mothers in the treatment group only three months later than mothers in the control group. Within these three months, the increase in the availability of child care is—if at all—very small.[8]

3.2. Structural model

In a second step, we propose a structural model of maternal labor supply which follows the discrete choice labor supply framework used in many empirical studies, see e.g. Aaberge et al. (1995), van Soest (1995) or Blundell et al. (2000). The central idea of this approach is that agents, in our application mothers with newborns, make a labor supply decision to maximize a utility function that depends on the preferences for income and leisure time. Based on revealed preferences, i.e. the observed employment behavior, it is then possible to estimate the structural preferences of the model. When analyzing the employment behavior of mothers with newborns it is important to extend the standard static framework. In particular it is crucial to account for persistence or state dependence effects that might affect the behavior of mothers over time. Moreover the pecuniary and non-pecuniary transaction costs of working, such as social norms regarding child care settings for infants, need to be reflected. The persistence and transaction costs can be sizable and might vary significantly by the elapsed time after giving birth, i.e. by the age of the newborn. In the empirical specification we capture these time varying effects by conditioning the employment behavior of the mothers in a flexible non-parametric way on the age of the newborn.

More formally, the structural model is based on the assumption that mothers maximize a household utility function, which is a function of the net household income and her leisure time in a discrete labor market status. According to the empirical specification, we define four discrete labor market statuses, namely inactivity, marginal employment [$0 < weeklyworkinghours(h) < 13$], part time employment [$13 \le h < 30$], and full time employment [$h \ge 30$]. The distribution of working hours categories of mothers is shown in Table 4. In this set up we assume that the labor supply of male partners is exogenously given, i.e. a mother maximizes the household utility conditional on the behavior of her partner. [9] In line with e.g. van Soest (1995) or Blundell et al. (2000), we propose a utility function with the following functional form

$$U_{ijt} = \beta_l l_j + \beta_y y_{ijt} + \beta_{ll} l_j^2 + \beta_{yy} y_{ijt}^2 + \beta_{ly} l_j y_{ijt} + \epsilon_{ijt}, \tag{3}$$

where l_j is the leisure time of the mother in labor market status j, y_{ijt} the disposable net income of household i at time t, and state j and ϵ_{ijt} is an error term. Note that in this model the leisure term includes all activities except market work. In particular, it includes childcare by the mother. Since we do not model childcare choices explicitly, child care is always linked to the mother's leisure time.[10]

The disposable household net income, which is a function of gross wages, the tax and transfer system and childcare costs, describes the financial incentives for working. The financial incentives vary between households by demographic characteristics and over time. The time variation adds to the cross-sectional variation and improves the identification of the model. In more detail, the variation over time is related to several changes in the tax and transfer system in the observed period (2001–2006). In particular a reform in the "child-rearing benefit" in 2004, when income thresholds were significantly reduced, is important since similar mothers before and after the reform had different incentives to return to work. [11] Moreover, there is significant variation in childcare costs across regions and over time, which directly affects the disposable net household income (see Table 1, Section 2.3 and Appendix A). In addition policy reforms not directly linked to children also affect maternal work incentives during that period; most importantly the 2000 tax reform. This reform, which significantly reduced the progressivity of income taxation in particular for high income households, was implemented in several steps between 2000 and 2005, thus affecting the working incentives of comparable mothers differently over time.

In the model we introduce preference heterogeneity, as described in Eq. (4), and specify female leisure time as a function of demographic characteristics: X_{it} includes the mother's age, her nationality, region of living, number of siblings of the newborns and the age of the newborn.

$$\beta_l = \alpha_0 + \alpha_l X_{it}. \tag{4}$$

The preference for leisure varies nonparametrically with the age of the newborn. In more detail, we include quarterly dummy variables to measure the age of the youngest child. With this specification we capture the mentioned persistence effects and transaction costs that vary by the elapsed time following birth. The non-parametric specification allows for potential non-linearities in these effects.

Assuming that, conditional on y_{ijt}, l_j, and X_{it}, all observations are independent, the model can be estimated as a conditional logit model with maximum likelihood where the sample likelihood function is the probability of the chosen employment state in period t.

In our model, family policies directly affect disposable income. In particular, parental leave benefits directly increase net household income. An increase in the availability of child care slots also enters disposable household income as expected costs of child care decrease. This is discussed in more detail in Section 5.4.[12]

[7] Adding controls such as marital status, nationality and the mothers' education level does not change the results.

[8] In West Germany, the increase in child care availability from the 2007 to 2008 was three percentage points over the whole year. This implies less than one percentage point increase in a period of three months, assuming linearity. In East Germany, the increase is even smaller, see Table 1.

[9] At first glance this often applied simplification, which Killingsworth (1983) named the male chauvinist model, might seem restrictive. However, based on the same data source, the SOEP, and using a similar structural model, Steiner and Wrohlich (2004) show that cross elasticities between spouses are relatively small. In addition, Bargain et al. (2014) compare cross elasticities across countries. They find significant but very small elasticities for German men, i.e. they do not react strongly to the labor supply behavior of their partners. This provides justification for the imposed assumption which allows abstracting from the complex joint decision of spouses in the household context.

[10] In models where childcare choices are estimated together with the labor supply decision and no fixed link is a priori assumed, labor supply elasticities with respect to child care costs are found to be lower than in models where child care is assumed to be linked to mothers' working hours n. Thus, the elasticities obtained from our model should be interpreted as upper bound.

[11] In 2004, the income threshold for eligibility to the child-rearing benefit for the first six months after birth of a child was reduced from 52,130 euro per year to 30,000 euro for a couple. Note, given that we estimate the structural model based on data covering the period before the parental leave reform we do not use the variation related to this reform for the identification of the model.

[12] Note, in our model the time constraint is not affected by child care policies.

4. Data

The two proposed methods have quite different requirements with respect to data. The empirical evaluation based on the quasi-random variation requires a large data set, such that enough observations are available despite of the narrow definition of the treatment and the control group. For the estimation of the structural model, on the other hand, we need a rich data set that allows us to determine gross wages and net household incomes under several policy scenarios. Therefore we use two different representative data sources for the estimation of the two models. The structural model is estimated based on panel data from the SOEP, the policy evaluation based on the quasi-experimental approach builds on data from the German microcensus.

4.1. Data for the quasi-experimental approach: microcensus

The German microcensus is a 1% random sample of the population living in Germany and includes about 830,000 observations per year living in approximately 390,000 households. [13] We use the 2007 and 2008 waves in order to select mothers who gave birth to children in the fourth quarter of 2006 (control group) and in the first quarter of 2007 (treatment group).

From this subsample, we further select mothers whose youngest child was 3–12 months old (to analyze the effect on labor supply in the first year after birth) or when their children are between 13 and 24 months old (to analyze the effect on labor supply in the second year after birth) at the time of the interview. [14]

Table 2 shows the distribution of mothers' characteristics such as income, education, region of living and marital status for both groups. There are no large differences in characteristics between treatment and control group. As Table 3 shows, we have 993 observations in the treatment group and 851 in the control group for the analysis of labor supply of mothers with 3–12 months old children. For mothers with children between 13 and 24 months we have about 50% more observations, 1231 in the treatment and 1321 in the control group.

4.2. Data for the estimation of the structural model: SOEP

The SOEP is a representative longitudinal micro database that provides a wide range of socio-economic information on private households in Germany. In 2010, the sample included about 19,000 respondents living in 12,800 households. [15] The SOEP provides information about employment status and working hours of individuals. Moreover, it includes detailed income information and other demographic characteristics on the individual and household level. For our analysis, we use waves from 2001 to 2006. In our sample we include mothers who have a child under the age of three at the time of the interview. With this restriction, we end up with 2655 observations, i.e., person-years.

As Table 4 shows, about two-thirds of mothers with children under the age of three do not work. The employment status, however, strongly depends on the age of the youngest child. While 80% of all mothers are not working in the first year after their youngest child is born, this share is only 59% in the second and 51% in the third year after the birth of the child.

Table 2
Descriptive statistics of mothers in treatment and control group (Microcensus).

Characteristics	Control group	Treatment group
Residence in East Germany	19%	21%
Income below median	45%	45%
Low education	30%	28%
Married	78%	75%

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender, Microcensus 2007 and 2008, own calculations.

4.2.1. Disposable net household income

Disposable net household income y_{ijt} is calculated using the STSM tax and benefit microsimulation model. [16] Based on variables drawn from the SOEP, gross earnings, taxable income, amount of income taxes, all important transfers, and, finally, net household income can be derived. Gross household income consists of the observed earnings of the father, the alternative specific gross earnings of the mother and other non labor income, such as rental and capital income. The employment state specific gross labor earnings of the mother are calculated on basis of the alternative specific working hours and a constant hourly gross wage.

To calculate the gross hourly wage we estimate a standard Mincer wage equation modeling selection effects using the information of the working population and interpret the predicted hourly wages of the non-working individuals as the mean of the distribution of offered wages. Note that in order to have sufficient observations we estimate the wage equation for all women. Following previous studies we control for marital status, other household income and in detail for the number of children in the selection equation (e.g., Mroz, 1987; Martins, 2001; Mulligan and Rubinstein, 2008). [17]

The income tax is computed by applying the income tax function to the taxable income of the household. In Germany married spouses are taxed jointly. The income tax of a married couple is calculated by applying the tax function to half of the sum of the spouses' incomes; the tax is then doubled to determine the tax liability of the couple. Income tax and employee's social security contributions are deducted from gross income, and social transfers that depend on the employment status are added to derive net household income. Social transfers include, e.g., child benefits, child-rearing benefits, unemployment compensation, housing benefits and social assistance.

From this net household income we deduct childcare costs in order to calculate disposable net household income. As described in Section 2.3, we follow Wrohlich (2011) and use the concept of "expected costs of child care" that account for the fact that subsidized child care is rationed, in particular for children under the age of three in West German communities (see also Appendix A).[18]

[13] For more information on the microcensus, see http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Content/Statistics/Mikrozensus/Aktuell.psmlhttp://www.destatis.de/jetspeed/portal/cms/Sites/ destatis/Internet/EN/Content/Statistics/Mikrozensus/Aktuell.psml.

[14] Unfortunately—due to data protection—the exact month of the interview is not available in the Microcensus, but only the quarter of the interview. Thus, although we know the exact month of birth of a child, which is necessary to define mothers in the treatment and control group, we do not know the exact age of the child at the time of the interview. We assume that all interviews take place in the last month of each quarter, thus generally overestimating the exact age of the child by 1.5 months.

[15] A description of the SOEP is provided by Wagner et al. (2007).

[16] For a detailed description of this model, see Steiner et al. (2012).

[17] The specification and the estimation results are reported in 8.

[18] In the large body of literature on labor supply and child care, only very few papers explicitly deal with access restrictions to different modes of child care. In an empirical study on maternal labor supply and child care in Norway, Kornstad and Thoresen (2007) have exact information whether each household in their data set reports access restrictions with respect to formal childcare and use this information in the model by restricting the choice set for those families. In a study for Italy Del Boca and Vuri (2007) have to rely on estimated rationing probabilities similar to our approach. These authors, however, use the rationing probability to restrict the choice set while we decided to model rationing via the budget constraint. Since both approaches rely on estimated rationing probabilities, the crucial assumption—namely that we can approximate the excess demand by a probabilistic approach—is the same. Our modeling of access restrictions via the budget constraint relies on the assumption that all families who are rationed with respect to subsidized child care could in principle buy child care in private arrangements at considerably higher costs. This assumption seems realistic.

Table 3
Employment rates of mothers by age of the youngest child (microcensus)—treatment and control group.

Mothers with children…	Aged 3–12 months		Aged 13–24 months	
Group:	Control	Treatment	Control	Treatment
Number of obs.	851	993	1231	1321
Employment rate	15%	10%	30%	32%
Part-time employment	11%	6%	22%	23%
Full-time employment	4%	4%	8%	9%

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender, Microcensus 2007 and 2008, own calculations.

Table 5 summarizes average disposable household income in the four working hours categories defined above. Consistent with the budget lines discussed in Section 2.3, work incentives are very low for mothers with young children. For example, average disposable household income between not working and marginal employment differs only by 7 euro per month. This is mainly related to the relatively high childcare costs for children in this age group. Since we assume that child care can only be bought part-time or full-time, even marginally employed mothers have to pay—by assumption—for part-time child care, which amounts on average to 219 euro per month. If the mother is not working we do not deduct childcare costs from household income. Part-time employment (20 h per week) leads to an increase of 325 euro (+11%) compared to non-participation, and full time employment (40 h) increases disposable household income by 400 euro (+14%) per month. This relatively small difference in the income gain between part-time and full-time work is due to high costs for full-time child care, which amount on average to 341 euro per month (see Appendix A).

5. Results

5.1. Results of the quasi-experimental approach

The results of the estimation exploiting the quasi-random variation show a significant and negative effect of the parental leave reform on maternal employment in the first year after giving birth. More specifically, we find that the employment rate in the first year after birth declines by five percentage points. This effect is solely driven by the decline in part-time employment. For full-time employment the effect is close to zero and not significant.

In order to analyze the influence of socio-economic variables on this effect, we estimate the effect on overall, part-time and full-time employment not just for the whole sample but also for four different subgroups: mothers in West Germany, mothers in East Germany, mothers with household income below the median of the income distribution, and mothers with income above the median of the income distribution.[19] As Table 6 shows, the decline in overall employment is higher in East than in West Germany and higher for mothers with income above the median. For mothers with income below the median, we do not find significant changes. As far as part-time employment is concerned, we find a significant change only for the subgroup of mothers with income below the median. We do not find any significant changes in full-time employment, neither for the whole sample nor for any of the subgroups.

[19] Unfortunately, information on income is not as detailed in the Microcensus as in the SOEP. There are only two questions on income in the Microcensus questionnaire. The first one is the amount of the personal net income, the second one on the amount of the household net income. The personal income (and therefore also the household income) is endogenous since it depends on the maternal employment status. Thus, we take the difference between the household and the personal net income in order to net out the influence of the mother's employment.

Table 4
Distribution of working hours categories of mothers by age of the youngest child.

Labor market status	Number of observations	Overall	Age of the youngest child		
			0–1	1–2	2–3
Inactivity	1679	63%	80%	59%	51%
Marginal employment	329	12%	9%	14%	14%
Part-time employment	416	16%	7%	17%	22%
Full-time employment	231	9%	4%	9%	12%
Total	2655				

Other statistics	Mean
Mother German	0.90
East Germany	0.21
Age of the mother	32.5
No. of children under 18	1.8

Source: SOEP.v27, waves 2001 to 2006.

The lower panel of Table 6 presents the estimation results for mothers in the second year after giving birth. Generally, employment rates of mothers with children aged 13 to 24 months are higher than in the first year after giving birth. Before the reform, the employment rate of mothers with children aged 13–24 months is 30%; 22% are working part-time and 8% are working full-time. As the descriptive statistics in Table 3 show, after the reform, the employment rate increased by two percentage points to 32% (23% part-time and 9% full-time). However, as our estimation results show, this increase is not statistically significant. The only subgroup for whom we find a significant increase in employment is for mothers with below-median income. For this group, we find an increase by six percentage points. If we look only at part-time employment, we find a significant increase also for mothers in East Germany (plus seven percentage points).

Previous studies have looked at the effect of the parental leave reform on employment intentions of mothers with newborn children. Based on data from a health insurance company, Kluve and Tamm (2013) find that mothers in East Germany have higher intentions to return to work in the second year after their child is born (plus 15 percentage points). Bergemann and Riphahn (2011) find a similar magnitude based on data from the Socio-Economic Panel. Our results are lower compared to these findings, which is to be expected given that these studies look at intentions to work while we look at actual employment outcomes.

As mentioned above, we test for potential seasonality effects. In particular, we analyze the effect of the parental leave reform in the following differences-in-differences specification (adding mothers with children born from October 2005 to March 2006):

$$ls_i = \alpha_1 D_i^{Q1} + \alpha_2 D_i^{06/07} + \beta D_i^{Q1} \times D_i^{06/07} + \varepsilon_i \quad (5)$$

where D_i^{Q1} is a dummy variable indicating that a mother has a child born in January to March 2006 or January to March 2007, and $D_i^{06/07}$ is a dummy indicating that a mother has a child born from October 2006 to March 2007. The coefficient of interest is β, the effect of the interaction between D_i^{Q1} and $D_i^{06/07}$. As we show in Table C.16 in

Table 5
Distribution of disposable household income across working hours categories.

Labor market status	Age of youngest child		
	Overall	$0 < age < 1$	$1 \le age < 2$
Inactivity	2945	2944	2947
Marginal employment	2952	2957	2948
Part-time employment	3270	3259	3279
Full-time employment	3345	3320	3367

Source: SOEP.v27, waves 2001 to 2006.

Table 6
Results from the quasi experiment: change in labor supply of mothers in the first and second year after childbirth, in percentage points.

	Total employment	Part-time employment	Full-time employment	Obs. Obs.
First year				
Average	−5.304	−5.025	−0.285	1844
	(−8.265; −2.343)	(−7.541; −2.509)	(−2.068; 1.498)	
West	−4.957	−4.458	−0.505	1486
	(−8.305; −1.609)	(−7.321; −1.595)	(−2.477; 1.467)	
East	−6.523	−7.168	0.614	358
	(−12.820; −0.226)	(−12.496; −1.841)	(−3.607; 4.836)	
Below median	−4.032	−4.006	−0.020	865
	(−8.058; 0.006)	(−7.186; −0.826)	(−2.767; 2.727)	
Above median	−6.248	−5.698	−0.562	979
	(−10.533; −1.963)	(−9.494; −1.902)	(−2.891; 1.767)	
Second year				
Average	1.974	1.323	0.652	2552
	(−1.603; 5.552)	(−1.902; 4.548)	(−1.513; 2.816)	
West	0.920	0.139	0.782	2033
	(−3.041; 4.880)	(−3.532; 3.810)	(−1.313; 2.877)	
East	5.582	6.481	−0.848	519
	(−2.645; 13.808)	(−0.175; 13.136)	(−7.404; 5.709)	
Below median	5.948	4.893	1.067	1149
	(0.666; 11.229)	(0.323; 9.463)	(−2.530; 4.664)	
Above median	−1.286	−1.627	0.342	1403
	(−6.241; 3.552)	(−6.119; 2.865)	(−2.253; 2.937)	

Notes: 95% confidence intervals in parentheses. The sample consists of mothers of children born in 2007.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender, Microcensus 2007 and 2008, own calculations.

Appendix C, point estimates in this specification are slightly higher, although not significantly different from the estimates in our main specification.

Table 7
Conditional Logit: regression results.

Variable	Coefficient	Standard error
Net income	1.585***	(0.226)
Net income squared	−0.0728***	(0.0148)
Net income × leisure	0.00179	(0.00149)
Leisure	0.178**	(0.0677)
Leisure squared	−0.0000318	(0.000210)
Leisure × German	−0.0133*	(0.00675)
Leisure × East	−0.0371***	(0.00411)
Leisure × mother's age	−0.00528	(0.00369)
Leisure × mother's age squared	0.00476	(0.00552)
Leisure × child aged 0–2 months	0.0669***	(0.0180)
Leisure × child aged 3–5 months	0.0520***	(0.00994)
Leisure × child aged 6–8 months	0.0471***	(0.00854)
Leisure × child aged 9–11 months	0.0406***	(0.00856)
Leisure × child aged 12–14 months	0.0288***	(0.00782)
Leisure × child aged 15–17 months	0.00756	(0.00718)
Leisure × child aged 18–20 months	0.00537	(0.00726)
Leisure × child aged 21–23 months	0.00285	(0.00709)
Leisure × child aged 24–26 months	0.00675	(0.00731)
Leisure × child aged 27–29 months	0.00483	(0.00672)
Leisure × child aged 30–32 months	−0.00141	(0.00668)
Leisure × number of children under 14	0.0114***	(0.00228)
Leisure × 2001	0.00436	(0.00579)
Leisure × 2002	−0.00495	(0.00588)
Leisure × 2003	−0.00401	(0.00610)
Leisure × 2004	−0.00112	(0.00616)
Leisure × 2005	0.00226	(0.00611)
Dummy marginal employment	−0.973***	(0.0716)
Log likelihood	−2545	
LR chi(27)	2271	
Households	2655	

Notes: Standard errors in parentheses. Note that the number of households differs from Table 4 since we included also mothers with children up to three years in the sample. Based on the estimated model a labor supply elasticity related to a 1% increase the gross wage of the mother can be derived, this elasticity amounts to 0.14 (see the main text for a detail description of the calculation).
Source: SOEP.v27, waves 2001 to 2006.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

5.2. Results from the structural model

Table 7 reports the estimated coefficients of the structural model described above. The coefficients of the income terms are significant and have the expected signs. Because of the many interaction terms, the interpretation of the coefficients of the leisure terms is not straightforward, instead we will discuss simulated labor supply elasticities below. As expected we find remarkable preference heterogeneity with respect to leisure preferences. In particular, mothers in East Germany have a significantly higher preference for time spent at work than mothers in West Germany. Labor market attachment of women in East Germany is generally higher than in West Germany which reflects the different historical and social backgrounds of the two regions. Moreover, we find a clear pattern related to the age of the youngest child. As detailed above, we model preference heterogeneity related to the age of the youngest child in a flexible way using quarterly dummies. Overall, women with a child younger than two years have a higher preference for leisure time than mothers whose child is 33 to 36 months old.[20] More specifically, during the first two years this age effect is monotonically decreasing. Mothers with children aged under 12 months have the highest preference for leisure, as shown by the coefficients of the dummy variables indicating the child's age. This age related heterogeneity underlines the necessity to model the labor supply of mothers in a flexible specification.

Turning to the labor supply elasticities: As is common in this literature, we conduct a simulation showing how labor supply behavior reacts to changes in income. This statistics allows a clear interpretation and comparison of estimation results. In particular we impose a 1% increase in mother's gross wages and based on the estimated model we simulate the related labor supply responses. In more detail, based on the discrete choice model we can predict individual probabilities for the different employment states before and after the change in the mother's gross wages and the difference in these probabilities measures the employment response. To calculate the labor supply elasticities we summarize this information and weight the state specific changes in the probabilities with the corresponding working hours, i.e. we simulate

[20] Note that, in our model, we do not distinguish between "true" leisure and household production, subsuming any time not spent working as leisure. Unfortunately the data do not allow us to disaggregate time allocation at the household level.

the change in the overall expected working hours. The overall labor supply elasticity amounts to 0.14 which is in line with previous findings for mothers with children in this age group (e.g., Bargain et al., 2014).

In a similar way, we use the results of the structural model to evaluate the labor supply effects of the introduction of the parental leave reform in 2007: We calculate the net income of all households under the counterfactual parental leave scenario and predict the induced labor supply behavior of mothers, i.e. the changes in the employment state specific probabilities. This method allows us to simulate the *ceteris paribus* effect of the parental leave reform or, in other words, the causal effect of this reform conditional on the structural assumptions. As discussed above, the introduction of the new parental leave benefit had heterogeneous impacts on the labor supply incentives of different households, e.g., depending on income, employment prior to the birth, or the number of children. Therefore, in Table 8 we report the effects for the average of all women with children in the first and second year after birth as well as results for different subgroups.

According to our simulation, mothers reduce labor supply in the first year after giving birth as a reaction to the reform. On average, the labor force participation rate of mothers with children aged up to 12 months is reduced by 3.7 percentage points. There is no significant difference of this effect between East and West Germany. However, we find differences by household income: The negative labor supply effect is larger for mothers from families whose income is above the median (see Table 8). This is in line with the financial incentives that changed more for mothers with higher income (see also Section 2.3).

The picture changes, however, for the second year after giving birth. On average, the labor force participation of mothers with children aged 13–24 months increases by 1.8 percentage points. Again, we find the expected differences in the labor supply effects across income groups: Mothers from families with income below the median increase their labor force participation rate by 2.7 percentage points. For mothers in families with income above the median on the other hand, we only observe a moderate increase of the employment rate by 0.6 percentage points. The large difference between labor supply effects in East (+3.3 pp) and West Germany (+1.4 pp) is consistent with the differences in household income. Since more families with income below the median live in East Germany, incentives to take up work in the second year after giving birth are larger in this region. Moreover, there is a larger supply of child care for children in this age group (below three) that is reflected in lower effective childcare costs making it easier for mothers to react to the incentives of the parental leave reform.

5.3. Interpretation of results from both methods

Overall, the results from the structural model and those from the quasi-experimental approach lead to the same conclusion: In the first year after giving birth, labor supply declines for mothers of all socioeconomic groups, and in the second year we find positive effects. Moreover both methods show the same pattern across different socioeconomic groups, in particular when differentiating between low and high income households or between East and West Germany. The point estimates—if significant—are usually higher in the reduced form estimation, but are estimated with lower precision than those from the structural model. In general, the confidence intervals of the effects obtained using the two methods overlap.

Notably, the results of both methods are in line with changes in incentives to work as described in Section 2.3. In the first year after giving birth, incentives to work decrease due to the new benefit scheme, therefore we find a large negative effect on participation. Incentives to work decrease more strongly for women who had high prior-to-birth earnings, and this is why we find the strongest effect for mothers with high income and mothers living in West Germany. In the second year, however, incentives change only for those who were entitled to the old scheme, i.e. low income households. This is the reason why we do not find significant changes in average employment or for mothers in West Germany or with income above the median. However, for the subgroup with income below the median we do find a significant increase in labor supply.

5.4. The effect of universal childcare and parental leave

As argued above, paid parental leave schemes provide an incentive to withdraw from the labor market for a certain period of time. The incentives change strongly when the transfers expire even if, as it is the case for Germany, employment protection is still in effect. However, the presence of a young child in the household implies opportunity costs of working if child care is very expensive and subsidized child

Table 8
Simulated effects of parental leave reform on mothers' labor supply in the first and second year after childbirth.

	Total employment	Marginal employment	Part-time employment	Full-time employment
First year				
Average	−3.65	−1.09	−1.51	−1.06
	(−4.19; −3.11)	(−1.28; −0.88)	(−1.75; −1.26)	(−1.33; −0.87)
West	−3.64	−1.15	−1.50	−0.98
	(−4.19; −3.09)	(−1.35; −0.94)	(−1.75; −1.25)	(−1.25; −0.80)
East	−3.70	−0.84	−1.54	−1.33
	(−4.27; −3.12)	(−1.00; −0.65)	(−1.77; −1.26)	(−1.67; −1.07)
Below median	−2.93	−0.99	−1.12	−0.82
	(−3.39; −2.47)	(−1.15; −0.80)	(−1.31; −0.92)	(−1.04; −0.67)
Above median	−4.76	−1.24	−2.10	−1.42
	(−5.43; −4.04)	(−1.47; −0.98)	(−2.42; −1.75)	(−1.79; −1.15)
Second year				
Average	1.79	−0.18	0.95	1.01
	(1.49; 2.06)	(−0.22; −0.14)	(0.77; 1.10)	(0.83; 1.22)
West	1.39	−0.03	0.86	0.56
	(1.15; 1.62)	(−0.06; −0.01)	(0.71; 1.01)	(0.45; 0.69)
East	3.31	−0.75	1.31	2.75
	(2.76; 3.79)	(−0.90; −0.61)	(1.00; 1.52)	(2.25; 3.30)
Below median	2.72	−0.31	1.43	1.59
	(2.26; 3.15)	(−0.39; −0.25)	(1.15; 1.66)	(1.31; 1.93)
Above median	0.58	−0.00	0.33	0.25
	(0.49; 0.66)	(−0.02; 0.01)	(0.28; 0.38)	(0.21; 0.31)

Notes: 95% confidence intervals in parentheses. Confidence intervals were simulated by parametric bootstrap.
Source: SOEPv27, waves 2001–2006, own calculations.

Table 9
Disposable income by working hours category for families with children aged 13–24 months: parental leave and child care reforms.

Employment status	Pre-reform	Parental leave reform	Childcare reform	Both reforms
Not employed	2954	2839	2954	2839
Marginal employment	2953	2852	3105	3003
Part-time employment	3281	3234	3433	3386
Full-time employment	3362	3361	3678	3678

Source: Calculations based on SOEP.v27, waves 2001 to 2006.

care is rationed. Therefore, in this last section, we use the structural model to simulate the employment effect of introducing universal child care for children older than one year and then we evaluate the combined employment effect of the child care reform and the parental leave reform.

For the simulation we use again the pre-reform child-rearing benefit scheme of 2006 as the base line scenario and we keep all rules of the tax and transfer system (law as of 2006) constant, except the parental leave benefits and childcare costs. In the simulation of increasing availability of subsidized child care to universal childcare, we set the probability that a child has access to a slot in a subsidized childcare facility p_i (see Eq. A.1) to 1 for all children older than one year.

Before we discuss the employment effects, we first describe the induced financial incentives related to providing universal subsidized child care for mothers with children aged 13–24 months. As detailed above, in contrast to the parental leave benefit reform, universal subsidized childcare increases financial attractiveness of employment for all mothers: average monthly costs for full-time child care decreased from 341 to 128 euro (−62%) for a family with one child aged one year (see Appendix A). In Table 9 we show average disposable incomes for households with children aged 13–24 months i) in the pre-reform scenario (see as well Table 5), in a scenario ii) with the parental leave (isolated), iii) with universal childcare (isolated) and iv) with both parental leave and universal childcare. The childcare reform (column three) leads to a stronger increase in disposable income in employment states with positive working hours as compared to not working than the parental leave reform (column two). For example, mothers in the second year after giving birth can on average increase the household's disposable income by 330 euro (+11%) if they work part-time (as compared to not working) under the pre-reform scenario. If the parental leave benefit reform is considered, the difference in disposable income between non-working and part-time work increases to 395 euro per month (+14%). If only the childcare reform is considered, this difference is about 480 euro per month (+16%). The differences between full-time work and non-working are even more pronounced. Under the pre-reform scenario, a mother can increase her family's disposable income by 408 euro (+14%) by taking up full-time work (compared to not working). After the parental leave reform, this amount increases to 522 euro (+18%) because out-of-work income is reduced. Under the childcare reform (isolated), however, this amount increases to as much as 724 euro per month (+25%). The combination of both reforms results in an income difference between full-time employment and not working of 839 euro (+30%). These differences in financial incentives suggest that labor supply effects of the childcare reform exceed the reactions to the parental leave benefit reform for mothers with children in the second year for all income groups.

Tables 10 and 11 show the simulated employment effects for both reforms and for the combination of parental leave and universal childcare. We present the effects for mothers in the first (Table 10) and the second year (Table 11) after childbirth. Note, in the simulated scenario universal child care is only guaranteed for children older than one year, younger children are not affected. Thus the positive employment effect of the child care reform presented in Table 10 is related to the behavior of mothers with additional children older than one year who are directly affected by the reform.

Table 10
Simulated effects of parental leave and childcare reform on mothers' labor supply in the first year after childbirth.

	Parental leave reform	Childcare reform	Both reforms
Total employment			
Average	−3.65	2.29	−1.65
	(−4.19; −3.11)	(1.93; 2.67)	(−1.96; −1.33)
West	−3.64	2.18	−1.76
	(−4.19; −3.09)	(1.83; 2.55)	(−2.08; −1.44)
East	−3.70	2.69	−1.25
	(−4.27; −3.12)	(2.23; 3.12)	(−1.52; −0.96)
Below median	−2.93	2.24	−0.92
	(−3.39; −2.47)	(1.86; 2.61)	(−1.14; −0.71)
Above median	−4.76	2.37	−2.76
	(−5.43; −4.04)	(1.99; 2.76)	(−3.21; −2.27)
Marginal employment			
Average	−1.09	1.04	−0.10
	(−1.28; −0.88)	(0.85; 1.21)	(−0.17; −0.03)
West	−1.15	1.07	−0.15
	(−1.35; −0.94)	(0.88; 1.25)	(−0.23; −0.07)
East	−0.84	0.92	0.09
	(−1.00; −0.65)	(0.74; 1.08)	(0.04; 0.14)
Below median	−0.99	1.02	−0.02
	(−1.15; −0.80)	(0.83; 1.19)	(−0.05; 0.03)
Above median	−1.24	1.08	−0.23
	(−1.47; −0.98)	(0.88; 1.26)	(−0.35; −0.11)
Part-time employment			
Average	−1.51	0.63	−0.93
	(−1.75; −1.26)	(0.51; 0.73)	(−1.10; −0.75)
West	−1.50	0.59	−0.97
	(−1.75; −1.25)	(0.49; 0.69)	(−1.14; −0.78)
East	−1.54	0.76	−0.79
	(−1.77; −1.26)	(0.60; 0.87)	(−0.95; −0.60)
Below median	−1.12	0.62	−0.53
	(−1.31; −0.92)	(0.50; 0.73)	(−0.65; −0.40)
Above median	−2.10	0.63	−1.54
	(−2.42; −1.75)	(0.52; 0.74)	(−1.78; −1.25)
Full-time employment			
Average	−1.06	0.62	−0.62
	(−1.33; −0.87)	(0.50; 0.80)	(−0.78; −0.50)
West	−0.98	0.52	−0.64
	(−1.25; −0.80)	(0.40; 0.68)	(−0.81; −0.51)
East	−1.33	1.00	−0.55
	(−1.67; −1.07)	(0.79; 1.30)	(−0.69; −0.42)
Below median	−0.82	0.60	−0.37
	(−1.04; −0.67)	(0.48; 0.77)	(−0.48; −0.29)
Above median	−1.42	0.66	−0.99
	(−1.79; −1.15)	(0.52; 0.86)	(−1.25; −0.81)

Notes: 95% confidence intervals in parentheses. Confidence intervals were simulated by parametric bootstrap.
Source: SOEPv27, waves 2001–2006, own calculations.

Overall, as expected, we find positive labor supply effects of the childcare reform in the first and second year after childbirth. In the first year the childcare reform mitigates the negative labor supply effects of the parental leave reform (column three). In particular when considering the combined effect of parental leave and universal childcare the total reduction in average labor supply amounts only to 1.7 percentage points which is less than half of the isolated effect of the parental leave reform. We find a lower reduction of the combined reform for women in East and West Germany and for the two income groups.

Obviously, the positive effect of the childcare reform is larger when focussing on mothers with a child aged 13–24 months; we find an increase in the employment rate related to the introduction of universal childcare by more than five percentage points which is stronger than the isolated effects of the parental leave reform. This finding holds for all groups that we compare, i.e by region and income. As explained above, the positive labor supply effects of the parental leave reform in the second year result mainly from mothers in low income households. In contrast the employment effect of the childcare reform turns out to be relatively homogeneously distributed across households. This is due to the fact that the financial benefits from the childcare reform

Table 11
Simulated effects of parental leave and childcare reform on mothers' labor supply in the second year after childbirth.

	Parental leave reform	Childcare reform	Both reforms
Total employment			
Average	1.79	4.83	6.74
	(1.49; 2.06)	(4.05; 5.54)	(5.68; 7.73)
West	1.39	4.77	6.30
	(1.15; 1.62)	(3.99; 5.48)	(5.30; 7.25)
East	3.31	5.07	8.46
	(2.76; 3.79)	(4.26; 5.76)	(7.18; 9.62)
Below median	2.72	4.98	7.91
	(2.26; 3.15)	(4.14; 5.75)	(6.63; 9.15)
Above median	0.58	4.64	5.23
	(0.49; 0.66)	(3.91; 5.27)	(4.43; 5.94)
Marginal employment			
Average	−0.18	1.31	1.07
	(−0.22; −0.14)	(1.07; 1.52)	(0.87; 1.26)
West	−0.03	1.46	1.39
	(−0.06; −0.01)	(1.20; 1.70)	(1.14; 1.62)
East	−0.75	0.74	−0.16
	(−0.90; −0.61)	(0.56; 0.92)	(−0.39; 0.05)
Below median	−0.31	1.40	0.99
	(−0.39; −0.25)	(1.14; 1.64)	(0.79; 1.17)
Above median	−0.00	1.18	1.17
	(−0.02; 0.01)	(0.97; 1.39)	(0.96; 1.37)
Part-time employment			
Average	0.95	1.23	2.16
	(0.77; 1.10)	(1.00; 1.38)	(1.77; 2.45)
West	0.86	1.31	2.20
	(0.71; 1.01)	(1.08; 1.48)	(1.80; 2.50)
East	1.31	0.90	1.98
	(1.00; 1.52)	(0.64; 1.08)	(1.47; 2.33)
Below median	1.43	1.34	2.75
	(1.15; 1.66)	(1.07; 1.53)	(2.22; 3.14)
Above median	0.33	1.08	1.39
	(0.28; 0.38)	(0.89; 1.21)	(1.16; 1.56)
Full-time employment			
Average	1.01	2.30	3.52
	(0.83; 1.22)	(1.86; 2.77)	(2.87; 4.24)
West	0.56	2.00	2.71
	(0.45; 0.69)	(1.62; 2.44)	(2.18; 3.30)
East	2.75	3.44	6.64
	(2.25; 3.30)	(2.78; 4.11)	(5.41; 7.92)
Below median	1.59	2.23	4.17
	(1.31; 1.93)	(1.80; 2.71)	(3.40; 5.06)
Above median	0.25	2.38	2.67
	(0.21; 0.31)	(1.91; 2.90)	(2.15; 3.24)

Notes: 95% confidence intervals in parentheses. Confidence intervals were simulated by parametric bootstrap.
Source: SOEPv27, waves 2001–2006, own calculations.

are similar across the income distribution. Turning to the employment effects of the combination of universal child care and parental leave (Column three): In this scenario we find the largest employment effects. In particular the employment rates of mothers which children aged 13–24 months increase by nearly 7 percentage points. The effects are relatively homogenous but slightly higher for mothers in East Germany and with below medium income. Importantly the employment effects are largely related to part-time and full-time employment which implies as well a considerable increase in working hours.

6. Conclusion

Most developed countries need strategies to respond to the ageing of their societies and the shrinking of the working age population. While male employment is already high both in terms of employment rates and working hours, female employment—despite a considerable catching-up process—is still lagging behind. This means that there is further growth potential that could mitigate the economic consequences of demographic ageing. One of the key factors behind the gender gap in employment rates are child-related employment interruptions. Thus, one goal of family policies is to improve the reconciliation of family life and employment of mothers. In this paper we look specifically at two important family policies and evaluate the related employment effect for mothers. First, we analyze the effect of Germany's 2007 parental leave reform. Second, we simulate how employment would react if additionally child care for very young children above one year, would be available at low costs to all mothers.

For the empirical evaluation we use two different methods: In particular for the evaluation of the parental leave reform we exploit quasi-experimental variation in a reduced form estimation and apply a structural model of labor supply behavior. For the analysis of the combined effect of universal child care and the parental leave reform we use the structural model. For the quasi-experimental approach we exploit the timing of the 2007 parental leave benefit reform in Germany, which only affected mothers with children born on or after 1.1.2007.

Overall, the empirical results from the structural model and those from the quasi-experimental approach lead to the same conclusion: In the first year after giving birth, labor supply declines for mothers of all socio-economic groups, and in the second year we find positive effects. Moreover both methods show the same pattern across different socio-economic groups, in particular when differentiating between low and high income households or between East and West Germany.

Moreover, our results suggest that child care is central for maternal employment. Based on the structural model we show that introducing universal child care in addition to the parental leave affects labor supply of women considerably. In particular we find that universal child care for children older than one year together with the parental leave reform increases employment for mothers with children aged 13–24 month by about 7 percentage points. Importantly, we find that the effect is large and positive for different socio-economic groups and that both part-time and full-time employment increases.

Appendix A. Calculation of childcare costs

As described in Section 2.3 we use the concept of "expected costs of child care", that allows us to take rationing with respect to subsidized child care into account. Expected costs of child care, *ec*, consist of a weighted average of parents' fees to subsidized child care and costs of private child care, i.e.

$$ec_i = c_i^s \cdot p_i + c_i^{ns} \cdot (1 - p_i) \tag{6}$$

where ec_i are the expected childcare costs for child *i*, c_i^s are the fees for a childcare slot in a subsidized facility, p_i is the probability that a child has access to a slot in a subsidized childcare facility and c_i^{ns} are the costs for privately organized child care.

The fees for subsidized childcare slots mostly depend on household income, number of children and region of residence. We estimate parents' fees based on data from the SOEP from the years 2005 and 2007 [21] separately for part-time and full-time care using Tobit models. This method is chosen since about a third of all parents do not have to pay at all for center-based child care. Table A.12 shows the regression results.

p_i is the probability that a child has access to a slot in a subsidized childcare facility, whereas $(1 - p_i)$ is the probability that a child is rationed with respect to subsidized child care, i.e. the probability that parents demand a childcare slot but are not offered one. This probability is harder to estimate since it is not observed in the data. In the SOEP, we only observe whether a child is in a subsidized childcare facility or not. If the child does not attend childcare, we do not know whether there is no demand for childcare or whether there is demand but no supply. Thus, the probability has to be estimated based on a partial

[21] Information on parents' fees is not available in every SOEP wave.

Table A.12
Estimation of parents' fees for center-based childcare (Tobit).

Explanatory variables	Part-time care		Full-time care	
	Coeff.	St. err.	Coeff.	St. err.
Dummy variable child is aged 0–1	66.21	20.33	6.72	25.24
Dummy variable child is aged 2	39.36	8.32	43.22	12.01
Dummy variable child is aged 3	−.744	5.4	16.13	9.0
Number of siblings in child care	−7.35	3.32	−17.89	6.84
Number of children in household	−12.88	2.29	−27.12	4.36
Net household income	.001	.0001	.001	.0001
Constant	55.83	6.26	102.89	11.48
s.e. (ancilliary parameter)	57.42	1.32	71.83	2.31
Log-likelihood	−5697.9337	−2970.6039		
Number of observations	1165	575		
Left-censored	153	66		

Notes: Dummies for state of residence are included in the estimation but not reported.
Source: SOEP.v27, waves 2005 and 2007.

observability model that has been suggested by (Wrohlich, 2008). The likelihood function of the partial observability model is

$$L = \Pi_{NC=1}[\Phi(X_D\beta_D)]^C[1-\Phi(X_D\beta_D)]^{1-C} \cdot \Pi_{NC=0}[\Phi(X_D\beta_D, X_S\beta_X)]^C \cdot [1-\Phi(X_D\beta_D, X_S\beta_X)]^{1-C}$$

where $NC = 1$ are the children who are known to be not restricted in their access to subsidized child care and $NC = 0$ are the children who might be restricted. Children are known not to be restricted in their access to childcare if (i) they have attended a childcare center already the year before or (ii) they live in a county where in their age group the share of available slots per 100 children is more than 90. X_D denotes the variables in the demand equation, X_S the variables in the supply equation and β_D and β_S the respective coefficients. C is the outcome variable "child is in center-based child care," which is the joint outcome of the two latent variables demand for and supply of center-based child care. Identification of β_D and β_S comes from exclusion restrictions (e.g. X_D includes individual characteristics such as education level of the mother that are not part of X_S, while X_S includes regional availability of childcare slots, which is not part of X_D), as well as from the fact that some children are known not to be restricted since they have attended a childcare center already the year before. Estimation results are reported in Table A.13 below.

Table A.13
Estimation results of demand and supply of center-based childcare (partial observability model).

Explanatory variables	Demand equation		Supply equation	
	Coeff.	St. err.	Coeff.	St. err.
Mother has univ. degree	.1227	.0788	–	–
Mother has univ. degree × child aged 0–3	.4737	.17	–	–
Net household income (equivalized)	.0002	.00004	–	–
Mother has German nationality	.2637	.061	–	–
Father is living in the same household	.0022	.0722	–	–
Child is aged 0–1	−1.566	.1156	–	–
Child is aged 2	.709	.1406	–	–
Number of siblings aged 0–3	.136	.0476	–	–
Number of siblings aged 4–6	.9878	.0781	–	–
Number of siblings aged 7–10	.1689	.0403	–	–
Number of siblings in child care	.6539	.0798	.1536	.0608
Local availability of child care slots	–	–	1.2144	.11056
Dummy for the year 2002	−.4809	.0543	−0.3128	0.1235
Child is aged 0–1 × year 2002	−.8477	.2288	–	–
Child is aged 2 × year 2002	−.3296	.2218	–	–
Constant	1.215	.0984	−0.5378	0.0944
Number of observations	9990			
Log pseudolikelihood	−4378.9576			
Wald chi2(24)	685.01			

Notes: Dummies for the state of residence and for the urbanicity of the county of residence are included in both equations but not reported.
Source: SOEP.v27, waves 2002 and 2006.

Table A.14
Components of child care costs for children under three years.

	Parents' fees in euro/month	Probability of being rationed (1 − p)	Expected costs of child care in euro/moth
Part-time care	122	0.31	219
Full-time care	128	0.31	381

Source: SOEP.v27, waves 1999-2009.

The costs of private child care c^{ns}, i.e. costs for a nanny or other forms of privately organized day care is set at 5 Euro per hour. Table A.14 below shows predicted parents' fees, predicted rationing probabilities and predicted expected costs of child care for several subgroups. These costs are deducted from net household income that enters the mothers' utility function as described in Section 2.3.

Appendix B. Wage estimation

In the following table we present the results of the wage estimation. These are based on Mincer-wage equations controlling for selection into employment using the Heckman correction. Following previous studies on female labor supply we use the number of children, marital status and other household income as exclusion restriction (e.g. Mroz, 1987; Martins, 2001; Mulligan and Rubinstein, 2008). Wage equations are estimated separately for East and West Germany.

Table B.15
Wage regression.

Variable	West Germany		East Germany	
	Coeff.	St. err.	Coeff.	St. err.
Wage regression				
Age	0.029***	(16.40)	0.041***	(11.99)
Age squared	−0.000***	(−16.62)	−0.001***	(−11.69)
Education				
No degree	*Reference cat.*			
General elementary	0.047*	(2.31)	0.140	(1.81)
Middle vocational	0.055**	(2.69)	0.162*	(2.11)
Vocational + Abi	0.078***	(3.58)	0.243**	(3.05)
Higher vocational	0.073***	(3.34)	0.215**	(2.74)
Higher education	0.185***	(8.24)	0.323***	(4.12)
Experience (years)				
Full-time	0.007**	(3.00)	0.002	(0.82)
Full-time squared	0.001	(0.15)	0.004	(0.97)
Part-time	0.001	(0.31)	0.006*	(2.27)
Part-time squared	−0.006	(−0.41)	−0.011	(−1.31)
Tenure	0.015***	(4.97)	0.021***	(14.92)
Tenure squared	−0.032***	(−3.34)	−0.034***	(−8.88)
Past unemployment	−0.037***	(−4.89)	−0.072***	(−12.54)
Disability degree	0.001*	(2.05)	−0.001	(−0.82)
Disability degree squared	−0.002**	(−2.66)	0.000	(0.23)
German nationality	−0.206***	(−7.42)		
Firm size dummies	*Yes*			
Occupation dummies	*Yes*			
Industry dummies	*Yes*			
Region dummies	*Yes*			
Year dummies	*Yes*			
Selection regression				
Age	0.056***	(10.75)	0.065***	(6.12)
Age squared	−0.002***	(−25.29)	−0.002***	(−16.12)
Education				
No degree	*Reference cat.*			
General elementary	0.114*	(2.42)	0.555***	(3.97)
Middle vocational	0.351***	(7.65)	0.908***	(6.70)
Vocational + Abi	0.615***	(12.16)	1.494***	(10.22)
Higher vocational	0.527***	(10.19)	1.489***	(10.48)
Higher education	0.884***	(18.23)	1.746***	(12.73)
Experience				
Full-time	0.078***	(32.27)	0.095***	(18.96)
Full-time squared	−0.003	(−0.41)	0.032*	(2.45)
Part-time	0.215***	(68.68)	0.180***	(27.01)
Part-time squared	−0.464***	(−38.10)	−0.232***	(−7.82)

Table B.15 (*continued*)

Variable	West Germany		East Germany	
	Coeff.	St. err.	Coeff.	St. err.
Disability degree	0.002	(1.24)	0.001	(0.37)
Disability degree squared	−0.007**	(−2.90)	0.003	(0.71)
Health status				
Very good	*Reference cat.*			
Good	0.005	(0.22)	0.024	(0.54)
Satisfactory	−0.054*	(−2.18)	−0.133**	(−2.83)
Bad	−0.196***	(−6.59)	−0.384***	(−6.98)
Very bad	−0.726***	(−13.88)	−0.739***	(−7.98)
Married (1 = yes)	−0.223***	(−13.03)	0.202***	(7.38)
No. of children				
No children	*Reference cat.*			
1	−1.728***	(−57.22)	−1.294***	(−25.54)
2	−1.126***	(−39.61)	−0.569***	(−10.42)
3	−0.674***	(−35.67)	−0.342***	(−9.86)
4+	−0.263***	(−10.44)	−0.203***	(−4.62)
Other household income	−0.000***	(−17.97)	−0.000***	(−12.81)
German nationality	0.217***	(10.06)		
Region dummies	*Yes*			
Year dummies	*Yes*			
λ	0.057***	(5.36)	0.065**	(2.89)
Observations	54,921		17,526	

t statistics in parentheses.
* p < 0.05.
** p < 0.01.
*** p < 0.001.

Appendix C. Robustness check for the quasi-experimental approach

Table C.16
Results from the difference-in-differences analysis: change in labor supply of mothers in the first and second year after childbirth, in percentage points.

	Total employment	Part-time employment	Full-time employment	Obs. Obs.
First year				
Average	−6.026 (−10.401; −1.651)	−6.639 (−10.353; −2.925)	0.531 (−2.11; 3.217)	3863
West	−5.961 (−10.891; −1.031)	−6.145 (−10.389; −1.900)	0.100 (−2.780; 2.979)	3155
East	−5.769 (−15.092; 3.555)	−8.052 (−15.373; −0.731)	2.468 (−4.117; 9.052)	708
Below median	−2.441 (−8.458; 3.577)	−3.479 (−8.323; 1.365)	0.806 (−3.161; 4.774)	1826
Above median	−9.407 (−15.689; −3.125)	−9.746 (−15.262; −4.230)	0.259 (−3.280; 3.799)	2037
Second year				
Average	3.439 (−1.597; 8.477)	2.082 (−2.440; 6.604)	1.354 (−1.699; 4.406)	5063
West	1.529 (−4.041; 7.100)	0.079 (−5.048; 5.206)	1.459 (−1.568; 4.486)	4071
East	10.930 (−0.769; 22.628)	10.412 (0.988; 19.838)	0.637 (−8.558; 9.831)	992
Below median	10.725 (3.393; 18.057)	8.016 (1.783; 14.249)	2.670 (−2.400; 7.741)	2306
Above median	−2.889 (−9.779; 4.002)	−3.445 (−9.859; 2.970)	0.554 (−3.084; 4.192)	1403

Notes: 95% confidence intervals in parentheses. The sample consists of mothers of children born in 2007.
Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender, Microcensus 2006, 2007 and 2008, own calculations.

References

Aaberge, R., Dagsvik, J.K., Strøm, S., 1995. Labor supply responses and welfare effects of tax reforms. Scand. J. Econ. 635–659.
Apps, P., Kabatek, J., Rees, R., van Soest, A., 2012. Labor supply heterogeneity and the demand for childcare of mothers with young children. IZA Discussion Paper 7007.
Baker, M., Gruber, J., Milligan, K., 2008. Universal child care, maternal labor supply, and family well-being. J. Polit. Econ. 116 (4), 709–745.
Bargain, O., Orsini, K., Peichl, A., 2014. Comparing labor supply elasticities in Europe and the US — new results. Journal of Human Resources 49 (3), 723–838.
Bauernschuster, S., Schlotter, M., 2015. Public child care and mothers' labor supply—evidence from two quasi-experiments. J. Public Econ. 123, 1–16 (March).
Bergemann, A., Riphahn, R.T., 2011. Female labour supply and parental leave benefits—the causal effect of paying higher transfers for a shorter period of time. Appl. Econ. Lett. 18 (1), 17.
Berlinski, S., Galiani, S., 2007. The effect of a large expansion of pre-primary school facilites on preschool attendance and maternal employment. Labour Econ. 14 (3), 665–680.
Blau, D.M., Robins, P.K., 1988. Child-care costs and family labor supply. Rev. Econ. Stat. 70 (3), 374–381.
Blundell, R., Duncan, A., McCrae, J., Meghir, C., 2000. The labour market impact of the working families' tax credit. Fisc. Stud. 21 (1), 75–104.
Cascio, E.U., 2009. Maternal labor supply and the introduction of kindergartens into American public schools. J. Hum. Resour. 44 (1), 140–170.
Datta Gupta, N., Smith, N., Verner, M., 2008. The impact of nordic countries' family friendly policies on employment, wages and children. Rev. Econ. Househ. 6 (1), 65–89 (March).
Del Boca, D., Vuri, D., 2007. The mismatch between employment and child care in Italy: the impact of rationing. J. Popul. Econ. 20 (4), 805–832.
Haan, P., Wrohlich, K., 2011. Can childcare policy encourage employment and fertility? Evidence from a structural model. Labour Econ. 18 (4), 498–512.
Havnes, T., Mogstad, M., 2011. Money for nothing? Universal child care and maternal employment. J. Public Econ. 95 (11), 1455–1465.
Killingsworth, M.R., 1983. Labor Supply. Cambridge University Press, Cambridge; New York.
Kluve, J., Schmitz, S., 2014. Social norms and mothers' labor market attachment: the medium-run effects of parental benefits. IZA Discussion Paper 8115.
Kluve, J., Tamm, M., 2013. Parental leave regulations, mothers' labor force attachment and fathers' childcare involvement: evidence from a natural experiment. J. Popul. Econ. 26 (3), 983–1005.
Kornstad, T., Thoresen, T.O., 2007. A discrete choice model for labor supply and child care. J. Popul. Econ. 20 (4), 781–803.
Lalive, R., Schlosser, A., Steinhauer, A., Zweimüller, J., 2013. Parental leave and mothers' careers: the relative importance of job protection and cash benefits. Rev. Econ. Stud. 81 (1), 219–265.
Lokshin, M., 2004. Household childcare choices and women's work behavior in Russia. J. Hum. Resour. 39 (4), 1094–1115.
Martins, M.F.O., 2001. Parametric and semiparametric estimation of sample selection models: an empirical application to the female labour force in portugal. J. Appl. Econ. 16 (1), 23–39.
Michalopoulos, C., Robins, P.K., Garfinkel, I., 1992. A structural model of labor supply and child care demand. J. Hum. Resour. 27 (1), 166–203.
Mroz, T.A., 1987. The sensitivity of an empirical model of married women's hours of work to economic and statistical assumptions. Econometrica J. Econ. Soc. 55 (4), 765–799.
Müller, K.-U., Wrohlich, K., 2014. Two steps forward-one step back? Evaluating contradicting child care policies in Germany. Discussion Paper of DIW Berlin 1396.
Mulligan, C.B., Rubinstein, Y., 2008. Selection, investment, and women's relative wages over time. Q. J. Econ. 1061–1110.
Neugart, M., Ohlsson, H., 2013. Economic incentives and the timing of births: evidence from the german parental benefit reform 2007. J. Popul. Econ. 26 (1), 87–108.
Nollenberger, N., Rodrguez-Planas, N., 2015. Full-time universal childcare in a context of low maternal employment: quasi-experimental evidence from Spain. Labour Econ. 36, 124–136.
Powell, L.M., 2002. Joint labor supply and childcare choice decisions of married mothers. J. Hum. Resour. 37 (1), 106–128.
Ribar, D.C., 1995. A structural model of child care and the labor supply of married women. J. Labor Econ. 13 (3), 558–597.
Schlosser, A., 2005. Public preschool and the labor supply of Arab mothers: evidence from a natural experiment. Discussion Paper, Dept. of Economics. The Hebrew University of Jerusalem.
Schönberg, U., Ludsteck, J., 2014. Maternity leave legislation, female labor supply, and the family wage gap. J. Labor Econ. 32 (3), 469–505.
Simonsen, M., 2010. Price of high-quality daycare and female employment. Scand. J. Econ. 112 (3), 570–594.
Spiess, C.K., Wrohlich, K., 2008. The parental leave benefit reform in Germany: costs and labour market outcomes of moving towards the Nordic model. Popul. Res. Policy Rev. 27 (5), 575–591.
Steiner, V., Wrohlich, K., 2004. Household taxation, income splitting and labor supply incentives: a microsimulation study for Germany. CESifo Econ. Stud. 50 (3), 541–568.
Steiner, V., Wrohlich, K., Haan, P., Geyer, J., 2012. Documentation of the Tax-Benefit Microsimulation Model STSM: Version 2012. Data Documentation 63, DIW Berlin.
Tamm, M., 2013. The impact of a large parental leave benefit reform on the timing of birth around the day of implementation. Oxf. Bull. Econ. Stat. 75 (4), 585–601.

van Soest, A., 1995. Structural models of family labor supply: a discrete choice approach. J. Hum. Resour. 30 (1), 63–88.
Wagner, G.G., Frick, J., Schupp, J., 2007. The German Socio-Economic Panel Study (SOEP): scope, evolution and enhancements. Schmollers Jahrbuch J. Appl. Soc. Sci. Stud. 127 (1), 139–170.
Wrohlich, K., 2008. The excess demand for subsidized child care in Germany. Appl. Econ. 40, 1217–1228.
Wrohlich, K., 2011. Labor supply and child care choices in a rationed child care market. Discussion Paper of DIW Berlin 1169.