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SICK LEAVE BEFORE, DURING AND
AFTER PREGNANCY.



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Sick Leave Before, During and After Pregnancy

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Abstract

Using registry data on every employed Norwegian woman giving birth to her first child during the period 1995–2008, we describe patterns of certified and paid sick leave before, during and after pregnancy. By following the same women over time, we can explore how observed sick leave patterns are – or are not – related to the women’s exiting (or reentering) employment. The results show that sick leave increases abruptly in the month of conception, and continues to grow throughout the term of pregnancy. Sick leave during pregnancy has been rising substantially compared with pre-pregnancy levels over the period 1995–2008, but this increase seems unrelated to women’s growing age at first birth. In line with hypotheses of women’s “double burden”, observed sick leave rates increase in the years after birth. However, when we handle some obvious selection issues – like sick leave during a succeeding pregnancy – the increase in women’s sick leave in the years after birth dissolves. Overall, we find little, if any, sign of the relevance of “double burden” hypotheses in explaining the excessive sick leave of women compared with men.

Keywords: sick leave, pregnancy, female employment, double burden.

JEL classification:

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1. Introduction

Over the last decades female sick-related absenteeism in Norway has risen from the same levels as for men to more than 60 percent above the level of men (see Figure 1). Similar trends are found in other OECD countries. In the USA, for example, the proportion of women receiving disability benefits has risen by 150 percent over the last decades (Autor and Duggan 2006); and in Sweden female sick leave is more than 50 percent above that of men (Angelov *et al.*, 2011).

One potentially important explanation for this trend relates to the entry of possibly less healthy women into the labor market. In Norway the proportion of women participating in the labor force has increased from 60 percent in 1979 to approximately 75 percent in 2009. It is well recognized that the higher sick leave of women compared with men is explained to some extent by complications during pregnancy. The relevance of pregnancies – and related physical and mental distress – in explaining the excessive sick leave of women compared with men, has thus received attention (Bratberg *et al.* 2002; Bratberg and Naz, 2009; Markussen *et al.* 2011; Angelov *et al.*, 2011). Related to this, as well as to the wave of women taking higher education, women are typically older when they have their first child. In Norway, the proportion of women getting their first child after the age of 35 has doubled over the last two decades, with higher risks of health complications for mother and child (Joseph *et al.*, 2005; Usta and Nassar, 2008; Cleary-Goldman *et al.*, 2005).

In this paper we follow the same women from several years before pregnancy to several years after, enabling us to account for persistent differences in the woman's preferences or health when exploring effects of pregnancy on female sick leave. We study sick leave spells of more than 17 days which are certified by a medical doctor, and where the woman's lost earnings are fully compensated (up to a generous ceiling) by the publicly provided (and universally available) health insurance. Our results show that sick leave during the pregnancy of the woman's first child (compared with before pregnancy for the same woman) has increased substantially during the period 1995–2008, and we try to relate the increase to changes in employment during pregnancy, rising age at first birth, changes in twin-births, changes in diagnoses and changes in out-of-wedlock births.

It is also well recognized that the higher sick leave of women compared with men could be related to the women's enhanced integration in the labor market, without a corresponding decrease in their share of duties for the household and family. This "double burden" or "second shift" of women is believed to be particularly related to motherhood (Hochschild 1989, 1997). And in line with such "double burden"-hypotheses, we find that observed sick leave increases substantially in the years after pregnancy (compared with before pregnancy for the same women).

However, potentially complicated selection mechanisms make it hard to interpret this finding as a sign of a “double burden”. If the most sick-prone mothers leave the labor market, we are unable to measure their latent sick leave spells, which will entail that we would observe too large a decline in sick leave rates. On the other hand, if the least sick-prone mothers become pregnant again, we may somewhat erroneously attribute the higher sick absence during pregnancy to a “double burden” hypothesis. We address and explore the relevance of such selection mechanisms in several ways, including censoring women who become pregnant again. Overall, the increase in women’s sick leave from before until after giving birth disappears when we exclude the women’s sick leave during a succeeding pregnancy. Also, when looking at the men, we find little, if any, sign of the relevance of having children for explaining the excessive sick leave of women compared with men.

[Figure 1 about here]

2. Background

In this section we give a brief overview of the literature on sickness absence and labor market outcomes in relation to pregnancy and parenthood. Also, the sick leave rights, disability pension benefits, and paid parental leave rights for Norwegian residents in the period 1992–2008 are described briefly.

2.1 Previous Studies

In several OCED countries, pregnant women have on average higher sickness absence than non-pregnant women (OCED, 2004). Markussen *et al.* (2011) examine numerous determinants of sickness absence behavior in relation to employee- and workplace characteristics and economic conditions in Norway in the period 2001–2005. They study sick leave related to several family events, such as death of a family member and giving birth, and they show that the rate of entry into sick leave spells lasting more than 17 days (covered by the public insurance program, cf. Section 2.2.) rise steadily throughout the pregnancy. The absence peaks two months before birth with an entry rate 15 times higher than the month prior to conception.

Sick leave during pregnancy has been suggested as one of the main explanations for an observed gender gap in sick absence. In many countries the absence rate for women is much higher than for men and the gap has been increasing over time (e.g., for the USA, see Paringer, 1983; for Norway, see Mykletun *et al.*, 2010; Almlidutvalget, 2010; Biørn *et al.*, 2010; Dale-Olsen and Markussen 2010; for Sweden, see Angelov *et al.*, 2011). Alexanderson *et al.* (1996) have investigated this empirical pattern

and report a reduction in the gender gap by 50 percent when comparing males and females aged 16 to 44 exclusive of pregnant women.

Social and cultural factors that have been promoted as driving forces behind the gender gap include family and household responsibilities. Over the last decades, female labor force participation has increased (OCED, 2004).¹ At the same time the distribution of household work including child care is still heavily skewed towards women. In Norway it is reported that women have been spending twice as much time on domestic labor as men in families with children (Vaage 2011, Haraldsen and Kitterød, 1992) and studies from Sweden and Australia show that women in relationships spend equal numbers of hours on housework regardless of the labor attachment of their male partners (Booth and van Ours, 2009; Boye, 2009). The combination of increased labor attachment without relief of family duties, labeled “second shift” by Hochschild (1989), may affect women’s physical health and mental distress. According to Sieber (1974) the combination could be problematic for two reasons: a risk of role overload (Verbrugge, 1983, 1986) and for a risk of role conflict (Arber *et al.* 1985; Arber, 1991). The adverse health effects may in turn be reflected in higher sick absence for women with children. More recently, Hochschild (1997) has also introduced a “third shift” where the women have to repair the damage created by the first two. There are also theories on gender differences and how the combination of roles could impose more distress for women than for men (Hook 2010, Hochschild 1989, 1997). Several of these theories originate from observations of hard-working women in the USA several decades ago, and some authors have argued that Norwegian woman do not face comparably hard “second shifts” or that the “second shift” is more equally shared within Norwegian couples (Kitterød and Lappegård 2010). In line with empirical literature related to what we do, we will loosely refer to hypotheses on such excess burdens on the women as the “double burden”.²

This empirical literature, however, which addresses the effects of child rearing responsibilities on sickness absence, is scarce because of complicated selection mechanisms (see Section 3 for details). Bratberg *et al.* (2002) approach the sample selection by using the number of children below 11 years

¹ In the 1970s the female labor force participation in Norway was relatively high compared with other European countries, but approximately the same as in the USA (about 70 % for all women). During the 80s and 90s, the Norway-USA gap increased steadily. In 1981 the participation rate in Norway was about 70 percent for prime-age women (aged 25-54) and it increased to about 83 percent in 2001, among the highest in OECD. If we look at the share of part-time in female employment, Norway has witnessed a significant decline from 1983 to 2001 (46 percent to 27 percent for prime-age women) (OECD, 2004).

² Paringer (1983) advocates that the “double burden” may induce women to obtain a lower threshold to report sick than men because the payoff to the family can be greater when the woman responds earlier to illness. The long-term effects could also be positive and improve the health conditions of women. Paringer looks into the hypothesis empirically and finds some support for the theory where women with dependents are less likely to be absent in the long-run.

and the number of births as proxies for the females' domestic workload. Their findings suggest that when selection is controlled for, increasing the number of children is associated with a higher probability of sickness absence. Bratberg and Naz (2009) take a different approach by making use of parental leave policies for Norwegian fathers. If fathers participate more in child care by taking paternity leave, it may reduce the stress on mothers and potentially reduce the mother's sick leave. When controlling for selection by using a difference-in-differences approach, Bratberg and Naz (2009) show that in families where fathers take longer leave, the probability of being absent is reduced by about 5–10 percent. Other studies in OECD countries also find higher sick leave for mothers with young children (e.g. Leigh, 1983; Scott and McClellan, 1990; Åkerlind *et al.*, 1996; and Vistnes 1997). Allebeck and Mastekaasa (2004) go thoroughly through the literature in social medicine and provide an overview of the research on sick leave predictors. The field yields mixed results with a slight preponderance of studies finding higher level of sickness absence for women with children as opposed to men and women without children. Mastekaasa (2000) finds that the relationship between absence and parenthood is weak for married and cohabiting men and women, but he points out that one should be careful in giving the results a causal interpretation. Using panel data methods, Mastekassa and Olsen (1998) find no support for the notion that gender differences in absence are due to women's excessive problems in combining child care and paid work. Angelov *et al.* (2011), however, who uses a panel data similar to ours, plot the monthly sick leave rate among Swedish mothers living with the partner. The plots suggest that the women's sick leave is substantially higher after she had a child compared with before. The post-birth increase is first noteworthy one year after the birth, but the sick leave rate remains high even after ten years. As far as we understand, Angelov *et al.* (2011) do not censor women during successive pregnancies when sick leave is many times higher than in periods when the women are not pregnant. Below (e.g., Section 4.2) we will return to the potential importance of sick leave during successive pregnancies, as well as to how to measure sickness when the women are not employed.

Apart from studies of sick leave, there is a large empirical literature examining the relationship between parenthood and economic outcomes, in particular labor market outcomes for females. Here again, the literature faces selection problems because fertility is likely to be endogenous. Studies relying on reasonable instruments do find a significant negative effect of fertility on female labor supply (Bronars and Grogger, 1994; Angrist and Evans, 1998; Jacobsen *et al.*, 1999; Agüero and Marks, 2008). In general the results are heterogeneous across different groups and cohorts, and the size of the effect is often small, although noticeable. Furthermore, parenthood is correlated with a wage penalty for mothers. Lundberg and Rose (2000) find that wages are significantly lower for mothers who experience an interruption in employment after birth as opposed to those who remain the labor market. Anderson *et al.* (2002) report that the wage penalty varies considerably by education

level, where low-skilled mothers do not suffer lower wages and college-educated mothers face a 15 percent penalty. Some studies have examined the effects of motherhood timing on career path and find that postponing motherhood increases earnings (Miller, 2011; Hotz *et al.*, 2005). Finally, paid parental leave may also affect women's fertility and decisions to return to work (Lalive and Zweimuller 2009).

2.2 The Norwegian Institutional Context

The Norwegian National Insurance (NNI) program provides important public welfare services such as sick leave money, disability pension, rehabilitation benefits, unemployment benefits and paid parental leave. The program covers all residents and participation is mandatory, but for the labor market-related programs, some tenure or previous earnings are required. Paid sick leave is provided from day one to a maximum of one year. An employee reporting absence due to sickness will be financed by the employer from day 1 to day 16, after which the NNI program covers expenses from day 17.³ The compensation ratio is 100 percent up to an established limit (about NOK 475,000 in 2011⁴), but it is common that the employer replaces forgone earnings above the limit. All workers that have been employed for more than four weeks are eligible, and there are stringent legal restrictions against firing employees on sick leave. To maintain sick-leave remuneration after a self-reporting period of three or eight days (depending on the type of firm), a medical certificate from a physician is required. If the employer is still sick and cannot return to work when the maximum coverage is exhausted at one year, the individual is required to attain adequate medical treatment and vocational training. Then he or she is eligible for rehabilitation benefits. The compensation ratio is lower than for sick leave and replaces about 66 percent of the previous earnings (up to the same limit of NOK 475,000 in 2011). At this point the individual can also apply for disability pension. The disability pension program covers all individuals aged 18 to 67 who have been a resident of Norway for at least three years prior to the onset of the disability, but there are no requirements regarding prior earnings. To be entitled to disability pension, one's earning capacity must be permanently reduced by at least 50 percent.

Paid parental leave is also provided by NNI and can currently be received for a total of 46 weeks.⁵ The division of leave between the mother and father is fairly flexible: 9 weeks are reserved for the mother

³ The sick leave scheme was extended for pregnant women in 2002. Under certain conditions the NNI would now cover the employer's expenses for sick pay from day 1 to day 16. The requirements were that the worker's sickness was related to the pregnancy and that adjustments of working tasks within the firm were not possible.

⁴ 1 US \$ \approx 5.5 NOK for 2011 (yearly average).

⁵ The benefit scheme has been changed several times since the 1990s. Encouraging fathers to take parental leave, Norway was the first country to introduce a father's quota of 4 weeks of the total of 42 weeks in 1993. The quota has been extended several times since 2005; the most recent extension in July 2011 increased the quota to 12 weeks of a total of 46 weeks. Couples have the option to extend the leave period by about 20 percent and receive about 20 percent lower benefits each month.

(the last three weeks before the due date and the first six weeks after birth) and 12 weeks are reserved for the father. The remaining period is shareable between parents and it may be combined with part-time work. To be entitled to paid parental leave, the female has to be occupationally active for at least six of the ten months prior to the due date. In addition, the annual income must be at least half a basic amount set annually by the Norwegian Parliament (the basic amount was about NOK 79,000 in 2011). The magnitude of the payments for employees is calculated on the basis of the earnings when the leave begins. The compensation ratio is 100 percent up to an established limit (about NOK 475,000 in 2011), but again, it is not uncommon that the employer replaces forgone earnings above the limit.

3. Empirical strategy

Cross-sectional regressions of sick leave on pregnancy and motherhood in observational data will typically fail to identify the relationship of interest because women who become pregnant will differ from those who do not. Couples may have different preferences for family production and labor market work, and women with preferences for family may be more prone to taking sick leave as well as wanting to have children. Estimates of the effect of pregnancy or motherhood on sick-leave may thus be upwards biased. At the same time, there is the risk of confounding changes in sick-leave patterns related to labor market fluctuations with developments due to pregnancy and motherhood, for example if a down-turn in the labor market causes couples to expedite pregnancies. Many previous studies could not solve these issues because they relied on cross-sectional data. Furthermore, to the extent that previous children affect future fertility, estimates of the impacts of a pregnancy on subsequent sick leave will be affected by whether new pregnancies are included or not included in the observation window (Lalive and Zweimuller 2009). Our panel, in which we observe couples annually for 17 years, 1992–2008, gives us a distinct advantage here, since we are able to trace sick leave and employment over many years, and we can identify subsequent births.

With access to detailed panel data, we can control for individual fixed effects and calendar year-fixed effects. Specifically, we estimate variations of the following model on a dataset of women giving birth, with observations over the period of 3 years prior to 3 years post-conception:

$$Y_{i,t} = \alpha_i + \beta_p \text{Pregnant}_{i,t} + \beta_f \text{FirstYear}_{i,t} + \beta_l \text{Later}_{i,t} + \gamma_t + \varepsilon_{i,t}, \quad (1)$$

where $Y_{i,t}$ denotes different outcome variables (typically *Sick Leave*; see Section 4 for details) for individual i in month t ; α_i is an individual fixed effect, $\text{Pregnant}_{i,t}$ is a dummy variable set to one for the months from conception to birth, $\text{FirstYear}_{i,t}$ is a dummy variable set to one for the months from birth to 12 months after birth; $\text{Later}_{i,t}$ is a dummy variable set to one for the remaining months of

observation after the first year (meaning that the pre-pregnant period is the reference period); γ_t is a vector of calendar year fixed effects and $\varepsilon_{i,t}$ is an error term with conditional expectation zero.

The two coefficients of main interest are β_p and β_l . The coefficient β_p captures the incremental effect on sick leave, relative to pre-pregnancy, of being pregnant. And similarly, β_l captures the incremental effect on sick leave, relative to pre-pregnancy, of having a child older than 12 months. There are several selection mechanisms that make it difficult to give estimates of these coefficients a causal interpretation.

First, couples may have different preferences for family production and labor market work, which could result in some women having more children than others as well as being weakly attached to the labor market or – given that they are employed – taking more sick-leave. Our inclusion of fixed effects⁶ takes out time-invariant preferences of this sort, but women with such preferences may have more children than other women. This makes it hard to compare results across parities. Moreover, spacing could be shorter for such couples, which introduces a problem in interpreting β_l . Is the estimate an effect of having the previous child, or an effect of sick-leave related to a new pregnancy? To address this we restrict the main analyses to first birth mothers only, but we will also provide some results for higher parities.

Second, expecting and having a child could affect the decision to work and thereby our ability to measure sick leave, which influences the interpretation of both β_p and β_l . Planning to leave employment after paid parental leave will influence the likelihood of being observed with sick absence in the post-childbirth period (Lalive and Zweimuller 2009). In other words, individuals who are not employed cannot be measured as being absent from work. Including these in the sample will cause a downward bias of any estimate on absence outcomes because their latent sick leave behavior (i.e. what we would have observed had they remained employed) is obviously higher. However, if we exclude the individuals or time periods where employment is zero, we will select the sample based on outcome variables, introducing more involved sample selection bias, of which we do not know the direction. As a consequence, it will be difficult to interpret the results.

⁶ By including some time-varying individual covariates (see data section), we also control for observed heterogeneity. The concern, however, is largely related to omitted-variable bias related to unobservable characteristics.

In the analysis we will try to address the relevance of such selection by providing results for a number of values for the latent sick-leave variable and ways to construct the sample.⁷ Our data enable us to ensure that the women in the sample are employed just before pregnancy, implying that the share of non-employed women just before and through the pregnancy is very low – largely attenuating the concern that selection out of employment will have noticeable impacts on our ability to measure sick leave during pregnancy. This also implies that we can check that our results are largely similar when we apply an unbalanced panel where observations in months during which the woman is non-employed are omitted.

Our ability to observe drawing of health-related welfare other than sick-leave further enables us to explore the consequences for our estimate, by setting sick leave to 100 percent for women on vocational and medical rehabilitation.⁸ For the remaining sample of non-employed women, we are also able to introduce artificial bounds on the sick leave. Following the main idea of Horowitz and Manski (1995, 2000), we assign the missing data with a small or large values to compute sensible lower and upper bounds (Lee, 2009).⁹ We create one sensible value by replacing the missing sickness absence with the average sickness absence in each period. If the mothers who are non-employed are on average not different from those who are employed (regarding sickness absence), this is a good indicator of the latent sick leave.

Third, time-varying “third factors” (confounders), sometimes labeled “external shocks”, may affect both the decision to become pregnant and sick-leave. The woman may, for example, get news that she has an insidious disease, and the news may cause her to want to become pregnant as soon as possible. The pregnancy is thus not the only reason for sick-leave; the main underlying reason is the woman’s expected future health. In cases such as this, we will overestimate the effect of the pregnancy on sick leave. But the converse can also be true. She feels less depressed or in better health than she used to, and therefore she decides to have a child. The sick-leave during pregnancy may then be lower than it

⁷ One way to handle selection into employment is to explicitly model the process determining the selection. The common approach is to impose an exclusion restriction, i.e. assume that one or more exogenous variables that do not have a direct effect on the outcome determine the selection. However, and as outlined by e.g. Bratberg *et al.* (2002), it is notoriously difficult to find a credible instrument that can be excluded from the outcome equation.

⁸ When the sick leave money is exhausted and the individual is not capable of returning to work, she can apply for rehabilitation pension and disability pensions. It is therefore natural to interpret these benefits as an extended sickness absence measure. It is possible to be partly disabled, and thereby registered as both employed and a recipient of rehabilitation or disability pension. However, for the majority of these individuals employment equals zero.

⁹ Note that the bounds are computations of a treatment effect using a control and treatment group. Since we cannot estimate a treatment effect in the same manner, we compute the bounds by replace the missing data and then reestimating the empirical model.

would have been had she become pregnant while in the usual state of depression or deteriorated health. There could also be similar factors affecting the couple. The man, for example, may be diagnosed with testicle cancer, and the couple may therefore try to conceive a child as soon as possible. The point is that the serious diagnosis of the man can have a direct effect on the sick leave of the woman, thus contributing to an overestimation of effects of pregnancy on sick leave. Other scenarios are also imaginable, like the couple experiencing a miscarriage, which both spurs them to become pregnant again and has a direct effect on their sick leave. We address such time-varying third factors in several ways. Data on diagnoses are used to explore the presence of sick leave that is related to other factors than pregnancy, and we use the sick leave of the man to control for shocks that affect both parents similarly (by introducing interaction terms which measure the woman's sick leave as the deviation from the man's).

The concerns of these selection and omitted variable issues are accentuated when we investigate possible hypotheses related to the "double burden". The main reason for the accentuation is that many women withdraw from the labor market when they become mothers, and this withdrawal is not unlikely to be health-related. Moreover, women with one child tend to have another, with subsequently higher sick-leave during the pregnancy. Including these women in the sample will increase the estimate on sick leave of the women in the years after the first birth, but since fertility decisions could be health-related, excluding these women from the sample introduces selection that also confuses interpretations. Investigating the relevance of selection mechanisms is therefore particularly important to facilitate interpretation of the estimates of having children in relation to sick-leave.

All models are estimated using OLS, and we cluster on individuals to account for non-independence of residuals over time for the same person.

4. Data

4.1 Data Sources

We use administrative data from Norwegian registers covering the entire resident population of Norway over 1992–2008, with around 50,000 births annually.¹⁰ The data are well-suited for our purposes for several reasons. First, the panel feature allows us to track the same individual over a long time span and to observe outcome variables before, during and after pregnancy. Also, we can follow individuals from multiple cohorts over time and thereby explore trends and patterns for the outcomes

¹⁰ We use data drawn from FD-trygd, see Akselsen *et al.* (2007).

variables. Second, we are able to merge information from several different registers through encrypted personal identifiers. In this way we can combine employment status with sick-leave spells and parental leave records for each individual. Finally, the quality of the register data has several advantages over survey data. In addition to the huge sample size, attrition bias and systematic misreporting is unlikely (Røed and Raaum, 2003).

The encrypted personal identifiers are available for both children and parents, and for each child the identifier for the mother and father is provided. Date of birth, type of birth (single, twin etc.) and parity are also reported.¹¹ Households are identified by parents who are married or who lived together in the calendar year after birth.

Our measure of sick leave is based on every sick-absence spell reported to the NNI for refund (see Section 2 for details). All sick spells of every employee lasting more than 16 days are refundable, and only those spells are available in our data. The sick-spell records report the exact entry and exit dates along with changes in the clinical picture during the course (e.g., the grading).

We create a sick-leave variable by month, but we use actual date of entry and exit as available in our data source. When an absence begins on the 15th day of a given month, the ratio of absence is recorded as 50 percent. In months where the individual is not reported sick the absence is recorded as zero, and likewise, it is set to one in months during which the individual is on sick leave the whole time. The graduated sickness scaling and main diagnoses are adjusted for when changes occur during the spells.

Employment is recorded for every employee with exact entry and exit dates (self-employed individuals are excluded).¹² The lowest registered level of employment is four hours of work per week, meaning that individuals working less are recorded with no employment in the sample.

Parental leave measures the payments to the parents from the NNI, and entry and exit dates are reported. We record employment status and parental leave as either one or zero in each month. Information on drawing of disability-related welfare, that is, disability programs and health-related vocational training programs (rehabilitation), is also available from the NNI, with entry and exit dates.

Earnings are available by calendar year, and consist of labor related income from tax registers. Earnings and other annual or fixed covariates (birth dates, year, etc.) are added to the monthly panel

¹¹ Still births are not included in sample, and they are very rare compared to the sample size.

¹² Some individuals may hold multiple jobs, but we only have information about the main job before 2003. After 2003, we obtain consistency over time by only retaining the job with the highest average working hours.

according to the calendar year. When used as a control variable (and in Table 1), earnings are measured in the year prior to conception.

The main disadvantage of this dataset is that short-term sick-leave spells, to which moral hazard may be more relevant, are not included. The main advantage of observing the long-term absence is that it constitutes the majority of the sick absence days. The observed gender gap in sick leave is also more prominent for the long-term leave (Blank, 1995; Almlidutvalget 2010). Another advantage of this dataset is that each of the sick-leave spells are certified by a general practitioner, and the absence must be due to a specific diagnosis. Thus, each of the spells is associated with a diagnosis code (International Classification of Primary Care, ICPC).¹³ Knowledge of the diagnoses can provide more insight into the sickness process and the type of sickness that is prevalent during pregnancy.

4.2 Sample Definitions

To construct our main analytic sample, we keep every Norwegian woman who has her first child during the period 1995–2005. To ensure attachment to the labor force and eligibility for sick leave money and paid parental leave, we require a certain level of employment and earnings prior to birth (see subsection 2.2. for eligibility criteria regarding paid leave). In the calendar year prior to the year of conception, the annual earnings must be at least two times the basic amount (the basic amount was about NOK 79,000 in 2011) and she has to be employed in at least six of the ten months prior to giving birth.¹⁴ In Norway this means that virtually every non-part-time employee – and even most non-minor part-time employees – will earn sufficient to be eligible. Finally, and as discussed in Section 3 (and as we will return to in Section 5), in our main analytic sample we right-censor observations in the month the woman becomes pregnant with her second child.

We define the day of conception as the birth day minus 273 days (Myklebø, 2007), and based on our main analytic sample of women, we construct a monthly panel starting 36 months prior to the month of conception and ending 36 months after.¹⁵ Using the above data sources the variables (sick-leave,

¹³ ICPC-2 International Classification of Primary care, second edition. Prepared by the International Classification Committee of WONCA. Oxford: Oxford University Press, 1998.

¹⁴ We have performed the empirical analyses using different earnings levels (e.g., a half or one time the basic amount) and the results are similar to the ones presented.

¹⁵ For women giving birth between January and September in 1995 the panel is left censored (from one to nine months) due to the fact that the data records start in January 1992. The number of censored months is quite small compared to the total number of observed months so we are not concerned with potential bias from this.

employment, parental leave) are given a relative time value that corresponds to months relative to conception.

In addition to our main analytic sample for the women, we will also present results for some subsets of the women in our main analytic sample. One subset comprises all first-time-fathers of the children of the mothers in our main sample, where the exact same requirements as for the woman in our main sample are imposed. Another subset comprises the couples where both the mother and the father meet the employment and earnings restrictions imposed on the mother in our main sample. Finally, we have datasets of the subset of women who had their second and third child within our observation window (and meet all the other abovementioned requirements).¹⁶

4.3 Summary Statistics

Summary statistics are presented in Table 1. The main analytic sample comprises more than 175,000 women who have their first child within our data window. They are followed each month from three years before conception to three years after, but censored in the month of a subsequent pregnancy – yielding almost 11.9 million mother-month observations; implying that on average we observe every woman for about 68 (of 73 possible) months. The mothers are employed in 82 percent of the months, and most of the remaining months they are on parental leave (16 percent of the months). This reflects the way the dataset is constructed. Though the female labor force participation rate is high in Norway, we should keep the close labor force attachment of our sample in mind when interpreting the results. The overall sick leave rate is 5.4 percent for the women, and, as expected, we see that the sick leave rate in the sample of men is substantially lower (2.1 percent).

With respect to the impact of children on sick leave of mothers (“double burden”), which we will return to below, it is worth noting that almost half of the women in our sample get a second child within our data window.

[Table 1 about here]

¹⁶ In addition to the mentioned right-censoring, here we also have to left-censor the pre-pregnancy observations for the second and third birth according to time since the previous birth.

5. Results

We look at sick leave during pregnancy and its development over time. And we look at the development of the sick leave of the women after the child is born compared with before pregnancy, trying to shed some light on the “double burden” hypotheses.

5.1. Women’s sick leave before and during pregnancy

As is demonstrated in several previous studies (e.g. Markussen *et al.* 2011, Angelov *et al.* 2011) we too find that sick leave of women increases abruptly in the month of conception, and continues to grow through the pregnancy. This pattern is evident from Figure 2a, where the sick leave rate of women is plotted for every month from 36 before conception to 36 after.¹⁷ While the sick leave rate is 3 percent in the month before conception, it rises steadily through pregnancy and reaches almost 50 percent in the seventh month. When the expected time of delivery is reached, the sick leave rate starts to decline toward the pre-conception levels (Figure 2b).¹⁸

Remembering that we are only able to observe the sick leave of the women if she is employed, these patterns will be influenced not only by the woman’s actual ability to work for health reasons, but also by whether she actually works. The proportion of our women employed in each of these months is plotted in Figure 2c. Recalling that all of the women in our sample are required to work in six of the ten months prior to giving birth, they are employed early in the pregnancy, but we see that some of them were not employed in the earlier months. If there were no health-related selection of women out of employment, the lower employment rate in the earlier months would (by construction) imply that the non-employed women would never be registered on sick leave, resulting in our sick leave rates in Figure 2a being too low for these earlier months. Thus, the slight upward trend in sick leave prior to conception could be because of the rising employment rate in the same period. We can look at this in several ways, for example by assuming that the sick leave of those not employed equals the mean sick leave rate of those employed in the month. Doing so, the small increasing trend remains.¹⁹ Overall,

¹⁷ The figure shows the simple mean of the sick leave rate over time. We have also produced the similar figure using OLS regression with individual fixed effects and calendar year dummies (i.e., a generalization of the model given in Eq. 1), and this yields a figure with the same development of the sick leave rate over time (the same holds for Figures 3, 7 and 8).

¹⁸ Though rare, women can be on sick leave during parental leave (e.g., absence due to complications with birth, caesarean delivery). Moreover, if she is sick, the father may draw parental leave benefits.

¹⁹ If we make extreme assumptions about the sick leave of the unemployed, say, that their sick leave rate would have been 0.5, the overall sick leave is declining toward the month before conception (when everyone is employed). Below we return to this issue of latent sick leave for women not employed when discussing sick leave patterns after the child has become one year old.

however, as the employment rate in the months just around pregnancy is stable, the increase in sick leave through pregnancy is hardly a result of such selection.

The pattern shown in Figure 2a is summarized in Table 2, which reports fixed effects estimates of the mean sick leave i) during *pregnancy*, ii) during the child's *first year* (when the mother is typically on parental leave) and iii) *later*, all relative to the sick leave before conception (reference category). In specification (1) the model in Eq. (1) is estimated without any control variables (but individual fixed effects and calendar year dummies are always included), and the result indicates that sick leave is on average 16 percentage points higher during pregnancy than before. The average sick leave rate of these women before conception is 2 percent, which implies that being pregnant raises the average sick leave rate eightfold. From specification (2) we see that the point estimate is virtually unaffected by flexible inclusion of age control, and from specification (3) we see that inclusion of additional control variable barely moves the point estimate. In the following, we will therefore relate the discussion to the result in specification (1). Specification (4), where pregnant is split into first, second and third trimesters, shows that the average increase (relative to before conception) is 1, 12 and 27 percentage points, confirming the pattern from Figure 2 that sick leave increases steadily through pregnancy.²⁰

Figure 3 shows the share of the women on sick leave by their medical diagnosis. Before the time of conception, we observe a general pattern in Norway: almost half of the women on sick leave are diagnosed with musculoskeletal illnesses, and about 20 percent with psychological illnesses. As expected, pregnancy-related diagnoses (pregnancy, child bearing and family planning) comprises a small proportion of the women on sick leave long before the conception, while it increases and becomes large as the time of conception approaches and the pregnancy matures. The share for each diagnosis tends to return to pre-pregnancy patterns some time after birth.

[Figures 2 and 3 about here]

[Table 2 about here]

5.2. Pregnancy-related sick leave over time

²⁰ Thus, in the last trimester, our estimate of the relative increase (about 13.5 times) is high, and in the same magnitude as the one estimated by Markussen *et al.* (2011) who used data for the period 2001–2005 and found that women's sick leave peaked seven months into pregnancy where it was about 15 times higher than before pregnancy.

If sick leave during pregnancy has risen over time, this may help explain why the sick leave of women (compared with men) has increased over the last decades. There could be several reasons why sick leave during pregnancy has risen. For example, mothers' age at first parity has increased substantially (cf. Figure 5), and it is well known that complications during pregnancy are much more prevalent for women well into mature adulthood. High age at first birth, or use of fertility enhancing treatment, also raises the prevalence of twins, which could affect sick leave during pregnancy (Joseph *et al.*, 2005; Usta and Nassar, 2008; Cleary-Goldman *et al.*, 2005).

Figure 4 shows the development of the sick leave rate during pregnancy relative to the pre-pregnancy level (cf. Eq. 1, but now the annual β_p s are obtained from a model with *Pregnant* interacted with calendar years). Since the plotted estimates are deviations from the sick leave before pregnancy, we are controlling for trends in the overall sick leave pattern of women. It is evident from the figure that the sick leave of pregnant women has increased substantially from the mid 1990s.²¹

[Figure 4 about here]

There are several possible explanations for the substantial increase in sick leave during pregnancy. If, for instance, pregnant women's tendency to remain employed during the pregnancy has risen, our ability to measure their health situation has also risen, with an associated increase in the *measured* sick leave rates. However, this does not seem to be the case as the percentage of women in our sample who were employed at the end of the second trimester was similar in 1995 (97.2 percent) and 2005 (97.3 percent).

In Figure 5 we have plotted the development of some other potential explanations of the rapid increase in sick leave during pregnancy. As expected from women's general postponing of childbirth, we see that the proportion of women getting their first child after age 35 has almost *doubled* from 1995 to 2008. Moreover, we also see that there has been some increase in twin births, but the rate of births to single mothers has been fairly stable. However, none of these reasons appear important in explaining the increasing sick leave of women during pregnancy (Figure 6). In Figure 6a we plot the development of sick leave during pregnancy of women having the first child after age 35 relative to the sick leave of

²¹ Fevang *et al.* (2011) studies effects on sick leave of the reform in 2002 (cf. footnote 3) and find a decline in the long-term sick leave of pregnant women compared with non-pregnant woman. When comparing the development of sick leave of the pregnant women with the sick leave of the same women before pregnancy, as we do in Figure 4, there appears to be no clearly visible increase around 2002.

women who have their first child before age 35. In fact, the increase in sick leave has been lower for these older women compared with the younger ones. Thus, the increase in sick leave during pregnancy has occurred among women becoming mothers before age 35, and we find that the increase has been highest for women aged 18–25. Also for single mothers the increase in sick leave during pregnancy has increased less than the increase for non-single mothers. For mothers giving birth to twins, however, the sick leave during pregnancy has risen more than for mothers giving birth to one child. But it is unlikely that this increase for mothers of twins is important in explaining the large increase in sick leave during pregnancy for all mothers, since they comprise only 2 percent of all mothers in the sample. Overall, this might indicate that the rise in mothers' sick leave during pregnancy is driven by younger (non-single) mothers.²²

An increasing number of studies have explored peer effects in relation to sickness absence (e.g., Ichino and Maggi, 2000; Hesselius *et al.* 2009; Dale-Olsen *et al.*, 2010; Rieck and Vaage, 2012), and they tend to find that social interaction effects are present in the context of sick leave. If younger mothers are more prone to be absent (due to a number of reasons, for example, that they are more concerned during pregnancy and that being absent from work is considered beneficial for the child), changes in norms and absence cultures might work as an amplifier in increasing sick leave over time.

[Figures 5 and 6 about here]

5.3. Sick leave after parental leave – “double burden”

If sick leave of mothers with children has risen over time, this may help explain why the sick leave of women (relative to men) has increased steadily over the last decades. A number of studies in sociology and economics have pointed to the “double shift” of women (Hochschild, 1989; 1997; Sieber 1974; Paringer, 1983). Women spend the first shift in paid work, and then they go home to work their second shift caring for the family. This “double burden” of women may have accentuated over time for women with children, if they have increasingly tended to enter and to remain in the workforce during the childhood of the children. In the 1970s it was not uncommon for women to stay out of the labor market during the child's first year and even on into the child's adolescence. Today, a large proportion of Norwegian mothers are employed outside of the home, potentially resulting in a “double burden”,

²² We have also looked at differences across educational groups. Surprisingly, there appear to be no, or only small, differences in the sick leave growth across these groups. If anything, it looks like the sick leave rate has increased somewhat more among the higher-educated than the lower-educated.

with associated physical and mental distress. To explore such hypotheses empirically, some authors have compared the sick leave of women with and without children, sometimes trying to model the selection into motherhood (Alexanderson *et al.*, 1996; Bratberg *et al.*, 2002). One previous study has compared the sick leave of women in the years after birth with the sick leave of the same women before they became pregnant (Angelov *et al.*, 2011). Overall, the results from these studies are not clear, but some studies indicate that women's sick leave is higher in the years after birth compared with before (Angelov *et al.*, 2011).

However, and as noted in some previous studies, there are at least three main complications in interpreting such results. First, the sick leave of women may increase as they grow older, thus making it difficult to assume that sick leave levels in the years after birth would have been the same as before birth in the absence of the birth. This can be addressed by using the age profile of another group to estimate the counterfactual: such as women who do not have children or men. Second, mothers who become pregnant again would tend to increase the overall sick leave of women since we have demonstrated that sick leave is much higher during pregnancy (but sick leave during another pregnancy cannot *per se* be attributed to a “double burden”). Third, in addition to affecting the mother's “burden”, having children can also affect her labor force participation, which in turn affects our ability to measure the mothers' sickness. Thus, it is hard to interpret observed sick leave rates as signs of (no) disadvantageous effects on latent sick leave of having children because concurrent maternal labor market withdrawal could also be health-related. In the following we will try to explore the relevance of these concerns.

In Figure 2 we show sick leave of women who have their first child,²³ and we drop observations for these mothers when they enter another pregnancy.²⁴ We see that the sick leave tends to return to pre-pregnancy levels around the time when the paid parental leave period in Norway expires (month 20). Indeed, the regression results reported in Table 2 show that the sick leave in the time after 20 months after conception is lower than before conception (*Later*). From Figure 2c, however, it is evident that a substantial proportion of the mothers remain non-employed in the period when the child has turned one year old (this is also shown in Table 3, specification 2). This implies that we would not be able to measure their sick leave, which results in our estimate for *Later* being downward biased. We now try to investigate the relevance of this bias in several ways.

²³ We have also looked at this when the sample includes women who become pregnant again during the three years after conception of their first child. As expected, this results in sick leave in *Later* being higher than the pre-pregnancy sick leave.

²⁴ Admittedly, this could also introduce a bias. If, say, mothers with little sick leave tend to have another child earlier than other mothers, then our sample would comprise mothers with more and more sick leave. This would bias the estimate on *Later* upward.

First, we assume that the sick leave of the non-employed women would have been the same as the mean sick leave rate of those remaining in employment. From specification 3 of Table 3, we see that this increases the *Later* estimate slightly, but the sick leave is still lower in the years after birth than before pregnancy. However, we may suspect that the women leaving their job do so because they are too sick to work (possibly as a result of the double burden), in which case *Later* remains downward biased. In specification 4 and 5 (Table 3), we handle obvious cases of such health-related selection by assuming that every woman who leaves employment and goes on health-related welfare programs (disability pensions and health-related vocational training programs), would have been on sick leave had they remained employed. As we see, this also affects the estimate only slightly; again with sick leave after 20 months being lower than before pregnancy.

We can calculate what the sick leave rate of the mothers who are not employed (and not pregnant and not on health-related programs) would need to be to allow us to estimate a positive coefficient for *Later*. The requirement is that the sick leave of the non-employed women would have had to be above 23 percent. Recalling that the sick leave over all months is about 5 percent, that the sick leave during pregnancy is about 18 percent, that the sick leave in the last trimester is about 29 percent, and that we have provided mothers on health-related program a sick leave rate of 100 percent, a sick leave rate of 23 percent seems high.

In specification 2 of Table 4, we apply a difference-in-difference approach by introducing the sick leave pattern of the men over time as a reference category. This should handle time effects that are common for the women and men (this changes the sample somewhat; see specification 1 for the *Later* estimate on this sample). Doing so reduces the magnitude of the estimate somewhat, but it remains significantly negative. When we also assume that the sick leave of those not-employed (and that those on health-related welfare are sick) equals the mean of those remaining (for both men and women), the estimate for *Later* remains significantly negative (cf. specification 3, Table 4).

[Tables 3 and 4 about here]

Though there seems to be no evidence of higher sickness for these women after they become mothers, the full impact on health of a “double burden” could take some time to reveal itself. In Table 5, we look at a longer period after birth as well as the sick leave of mothers of more than one child.

In specification (1) we have followed mothers who gave birth in 1995–2000 from our main sample six years after birth, without censoring months of subsequent pregnancies.²⁵ We see that this shows higher sick leave (after the child turned one compared with before pregnancy) for women with children.

Censoring observations when the mother is not employed (specification 2) hardly affects the estimate. However, once we exclude observations of mothers that become pregnant again, the point estimate becomes negative (regardless of whether sick leave of non-employed women are set to mean in month or censored, cf. specifications 3 and 4).

From specifications 5 and 6 we also see that there is little evidence that sick leave after the child has turned one is increasing with the number of children of the mother. Overall, we conclude that there are very limited, if any, signs of a “double burden” on women when “double burden” is operationalized as having children. Our results underline, however, that there are complex selection mechanisms that must be handled carefully if effects of having children on women’s sick leave are to be estimated credibly. In line with the fact that sick leave is much higher during pregnancies, attempts to estimate “double burden” hypotheses without handling higher sick leave during succeeding pregnancies are particularly hard to interpret.

[Table 5 about here]

5.4. Sick leave and fatherhood

While there are obvious reasons why the sick leave of women increases during pregnancy, there are fewer reasons to expect that the father’s sick leave should be directly affected by the pregnancy. This is also evident from Figure 7, where we see that the sick leave pattern of the father changes little around the time of conception (note that the scaling is very different in Figures 7 and 8 compared with the previous figures). If anything, there might be a tiny tendency toward reduction in his sick leave relative to the pre-conception trend. If so, this might occur if the man’s obligations at home are perceived as being somewhat lessened due to the fact that the pregnant woman is on sick leave. However, his sick leave increases abruptly around the time of birth. About one year after birth, his sickness absence seems to start converging to the pre-birth trend. Since the father’s employment is largely unaffected by the pregnancy and birth (Figure 7c), concerns for selection issues with respect to our ability to measure sick leave are thus smaller for men than for women.

²⁵ Since we want to track the mothers 6 years after birth, our data window forces us to limit the sample to births in the years 1995–2000 (thus excluding births in 2001–2005).

In Figure 8, we have split the sickness of the father by reason; one category comprises the father's own sickness and another captures sick leave because of sickness of dependents (others). We see that the increase in the fathers' sick leave around the time of birth due to his own sickness is small, but his sick leave because of sickness of dependents increases a lot in relative terms in the pre- to post-birth period.

[Figures 7 and 8 about here]

6. Concluding Remarks

We have studied the development of sick leave of the same women before, during and after pregnancy, using every employed woman in Norway giving birth to her first child over the period 1992–2008. Confirming results of several previous studies, we show that sick leave increases abruptly at the time of conception and grows through the pregnancy. For the fathers, there is no increase in sick leave around conception, but a peak around the time of birth. Potentially concerning, we find that the sick leave of women during pregnancy (relative to before pregnancy) has nearly doubled from 1995 to 2008, and it appears that the increase in sickness absence is mostly among the younger mothers.²⁶

We also investigate possible adverse effects of having children on sick leave. One of the explanations put forth to explain why women tend to have substantially higher sick leave rates than men in many western countries is that they work “double shifts”: a first shift in paid work and then a second shift in the household. Several previous studies have tried to identify empirical support for hypotheses of a “double burden”, but the results are divergent. It is well recognized that health-related selection of mothers out of the labor force makes it hard to interpret the results of such studies, and we show empirically that our results are highly sensitive to assumptions about selection.

Overall, our results indicate that women's higher sick leave rates – both compared with men and maybe also with women a couple of decades ago – can hardly be explained by their having to care for children. The recent rise in fathers' involvement in household work and time spent with children – possibly associated with paternal leave quotas in Norway (Rege and Sollie, 2010; Vaage 2011) – as well as the rapid expansion of utilization of publicly provided child care, also suggest less explanatory power of traditional theories on women's “double burden”. The limited relevance of theories of

²⁶ Moreover, the rising sick leave does not seem to have increased socio-economic differences; in our sample sick leave has not risen more among the lower-educated than the higher-educated.

mother's "double burden" in the current Norwegian context has also been emphasized by previous authors (e.g., Kitterød and Lappegård 2010).

Although the important selection issues complicate the interpretation of our results, we find that once some obvious sources of selection are handled, there are very limited signs of any appreciable effect of having children on women's sick leave. In particular, we *do* find that sick leave of the mothers is higher after the child has turned one compared with before pregnancy, but this seems to be accounted for by higher sick leave rates during the women's subsequent pregnancies: When we exclude periods of subsequent pregnancies, the higher sick leave after the child has turned one dissolves. Thus, attempts to empirically investigate "double burden" hypotheses which do not handle higher sick leave during subsequent pregnancies are particularly hard to interpret.

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Tables and Figures

Table 1. Descriptive statistics

| | Main sample of first-birth mothers | | Subsample of first-time fathers | | Subsample of couples | | Subsample of second-birth mothers | | Subsample of third-birth mothers | |
|--------------------------------------|------------------------------------|---------|---------------------------------|---------|----------------------|---------|-----------------------------------|--------|----------------------------------|---------|
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Sickness absence | 0.054 | | 0.021 | | 0.035 | | 0.067 | | 0.070 | |
| Employment | 0.820 | | 0.918 | | 0.878 | | 0.809 | | 0.793 | |
| Parental leave | 0.163 | | 0.023 | | 0.095 | | 0.340 | | 0.308 | |
| Age | 26.90 | 4.320 | 29.42 | 5.16 | 28.24 | 4.76 | 29.57 | 3.364 | 31.57 | 3.185 |
| Education | 13.46 | 3.633 | 13.12 | 3.67 | 13.44 | 3.63 | 14.06 | 3.252 | 14.60 | 3.127 |
| Earnings in NOK | 215,431 | 100,042 | 293,089 | 166,057 | 258,427 | 142,473 | 219,076 | 94,212 | 217,033 | 100,440 |
| Share w/disability or rehab. pension | 0.01 | | | | | | | | | |
| Share of twin births | 0.02 | | | | | | | | | |
| Share of females | | | | | 0.50 | | | | | |
| Nr of observations | 11,893,687 | | 9,183,690 | | 16,186,306 | | 4,694,162 | | 804,101 | |
| Nr of individuals | 175,042 | | 135,264 | | 238,158 | | 80,420 | | 13,179 | |

Note: The main sample consists of employed mothers giving birth to their first child in the period 1995–2005, and we follow them three years before to three years after conception (though right-censuring at time of a subsequent conception); see Section 4.2 for details. Based on our main sample of mothers, we have constructed several (true) subsamples. One subsample consists of the children’s fathers (for whom we impose the same restrictions as we did for the mothers in the main sample). Another subsample is the conjunction of these two samples (mothers and fathers) for which the mother and the father are registered as a couple. Another subsample comprises the mothers who have their second child and a subsample of these again who have their third child. See Section 4.2 for details.

Table 2. Estimated effects on sick leave

| | (1) | (2) | (3) | | (4) |
|--|------------------------|-------------------------------|------------------------|---------------------------|------------------------|
| Pregnant | 0.1613*** (0.0005) | 0.1614*** (0.0005) | 0.1610*** (0.0005) | 1 st trimester | 0.0147*** (0.0004) |
| First year | -0.0555*** (0.0005) | -0.0550*** (0.0005) | -0.0575*** (0.0005) | 2 nd trimester | 0.1284*** (0.0007) |
| Later | -0.0534*** (0.0006) | -0.0523*** (0.0006) | -0.0544*** (0.0006) | 3 rd trimester | 0.2684*** (0.0007) |
| | | | | First year | -0.0721*** (0.0005) |
| | | | | Later | -0.0622*** (0.0006) |
| Covariates (in addition to individual and calendar year fixed effects) | None | Forth order polynomial in age | All (see note) | | None |
| Sample | Main sample of women | Main sample of women | Main sample of women | | Main sample of women |
| N | 11,893,687 | 11,893,687 | 11,893,687 | | 11,893,687 |
| R ² | 0.074 | 0.040 | 0.041 | | 0.107 |

Note: FE estimates of the development of sick leave before, during and after pregnancy; cf. Eq. (1), using our main sample of mothers (see Section 4.2.). The covariates included in (3) are forth order polynomial in age, total number of years of education, one binary variable for whether the mother and father is living together, nine binary variables for marital status, and one binary variable for whether the mother is on disability or rehabilitation pension. Standard errors reported in parentheses are robust and clustered on personal id. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

Table 3. Estimated effects on sick leave after the child has turned one year

| | (1) | (2) | (3) | (4) | (5) |
|--|------------------------|------------------------|----------------------------------|--|--|
| Dependent variable | Sick leave | Employed | Sick leave | Sick leave | Sick leave |
| Later | -0.0534*** (0.0006) | -0.2596*** (0.0014) | -0.0484*** (0.0013) | -0.0514*** (0.0006) | -0.0417*** (0.0005) |
| Sickness absence when employment is zero | Set to zero | Set to zero | Set to average absence per month | Set to 1 for disability and rehab. pension, zero otherwise | Set to 1 for disability and rehab. pension, otherwise equal to average absence per month |
| N | 11,893,687 | 11,893,687 | 11,893,687 | 11,893,687 | 11,893,687 |
| R ² | 0.074 | 0.019 | 0.083 | 0.072 | 0.078 |

Note: FE estimates of the development of sick leave before, during and after pregnancy; cf. Eq. (1), using our main sample of mothers (see Section 4.2.). All covariates in Eq. (1) are included in the models, but only the estimate for *Later* is reported. Standard errors in parentheses are robust and clustered on personal id. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

Table 4. Estimated effects on sick leave after the child has turned one year in two parent families

| | (1) | (2) | (3) |
|--|--------------------------------------|-------------------------------------|--|
| <i>Later</i> | -0.0528*** (0.0004) | -0.0212*** (0.0005) | -0.0124*** (0.0005) |
| Sickness absence when employment is zero | Set to zero | Set to zero | Set to 1 for disability and rehabilitation pension, otherwise equal to average absence per month for each gender |
| Sample | Subsample of couples, the women only | Subsample of couples, men and women | Subsample of couples, men and women |
| N | 8,093,153 | 16,186,306 | 16,186,306 |
| R ² | 0.074 | 0.066 | 0.069 |

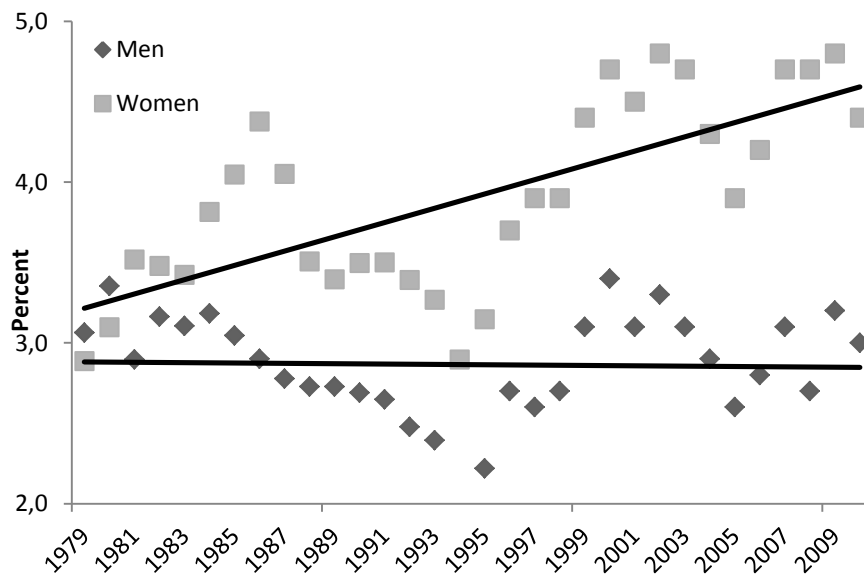
Note: FE estimates of the development of sick leave before, during and after pregnancy; cf. Eq. (1). As indicated, we use subsamples based on the intersection of the father sample and the mother sample (Section 4.2.) for which we can form couples. All covariates in Eq. (1) are included in the models, but only the estimate for *Later* (i.e., total effect for the women) is reported here. Standard errors in parentheses are robust and clustered on personal id. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

Table 5. Estimated long term effects on sick leave after the child has turned one year

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|--|--|--|--|---|--|
| Later | 0.0226*** (0.0007) | 0.0235*** (0.0009) | -0.0096*** (0.0007) | -0.0267*** (0.0005) | -0.0909*** (0.0009) | -0.0845*** (0.0024) |
| Sickness absence when employment is zero | Set to 1 for disability and rehab. pension, otherwise equal to average absence per month | Set to 1 for disability and rehab. pension, otherwise censored | Set to 1 for disability and rehab. pension, otherwise equal to average absence per month | Set to 1 for disability and rehab. pension, otherwise censored | Set to zero | Set to zero |
| Sample | Subsample of women followed 6 years after birth | Subsample of women followed 6 years after birth | Subsample of women followed 6 years after birth, excluding new pregnancies | Subsample of women followed 6 years after birth, excluding new pregnancies | Subsample of women with a second parity | Subsample of women with a third parity |
| N | 17,169,185 | 11,619,180 | 15,947,914 | 10,721,570 | 4,694,162 | 804,101 |
| R ² | 0.074 | 0.040 | 0.043 | 0.031 | 0.086 | 0.096 |

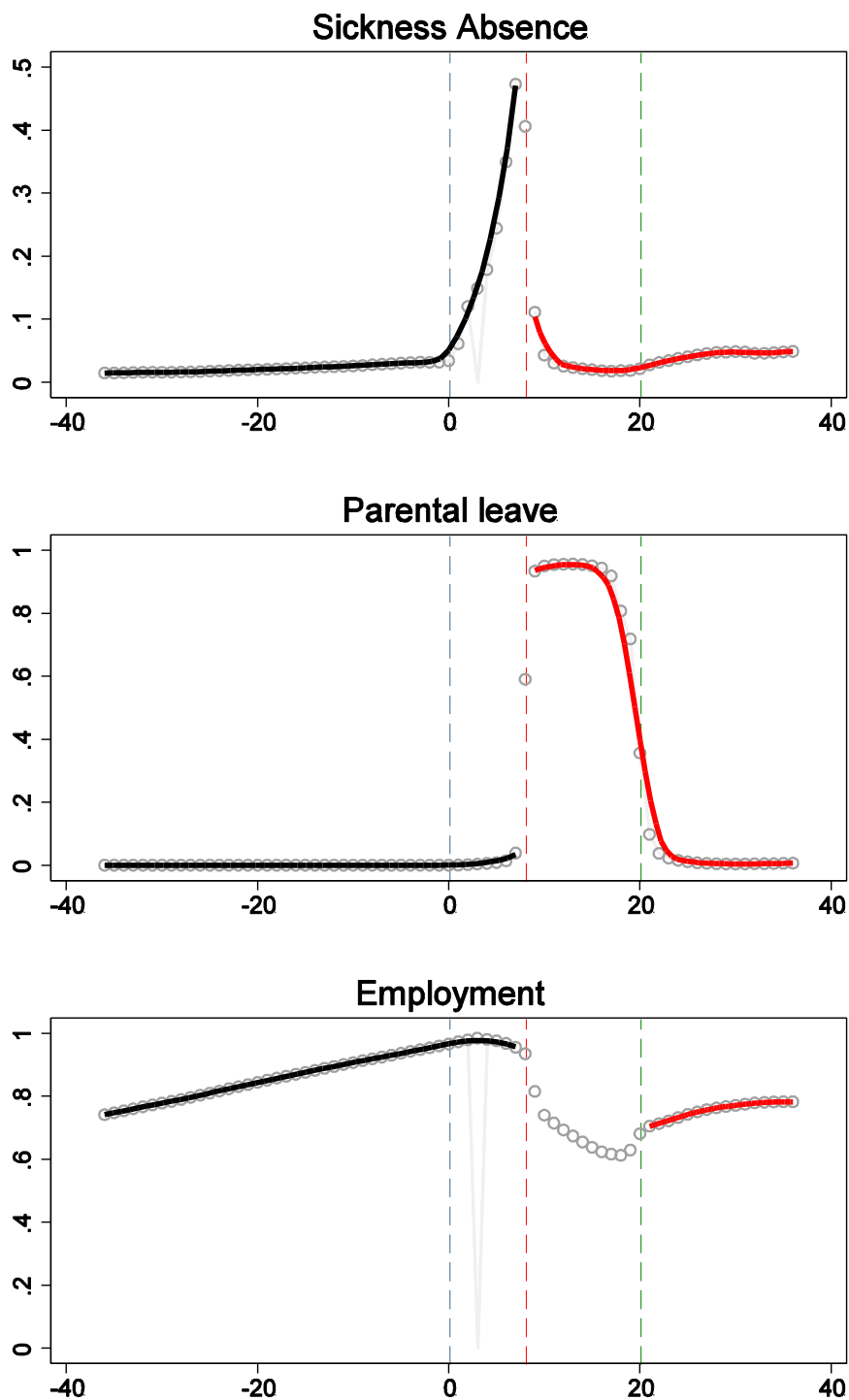
Note: FE estimates of the development of sick leave before, during and after pregnancy; cf. Eq. (1). From the main sample of mothers (cf. Section 4.2) we construct the indicated samples where we follow the mothers six years after conception (still meaning that *Later* is set to one for all periods from the child is 12 months to the end of the observation window): one sample where subsequent pregnancies are included, one where the mothers have their second child in the period, and one where the mothers have their third child in the period (in the two latter samples the women are followed three years after conception, as in the main sample). All covariates in Eq. (1) are included in the models, but only the estimate for *Later* is reported here. Standard errors in parentheses are robust and clustered on personal id. *** significant at 1 percent level, ** significant at 5 percent level, * significant at 10 percent level.

Figure 1: Sick leave rate for women and men in Norway 1979–2010



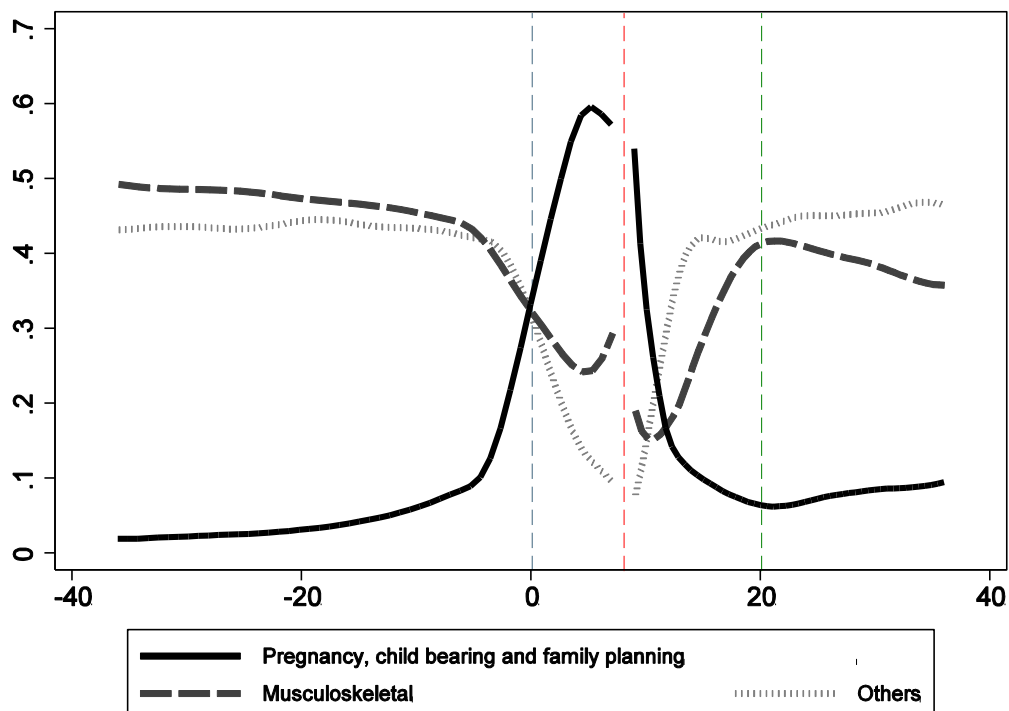
Note: Based on the annual Norwegian Labor Force Surveys; see Kostøl and Telle (2011).

Figure 2a-2c: Pre- and post-conception behavior for females



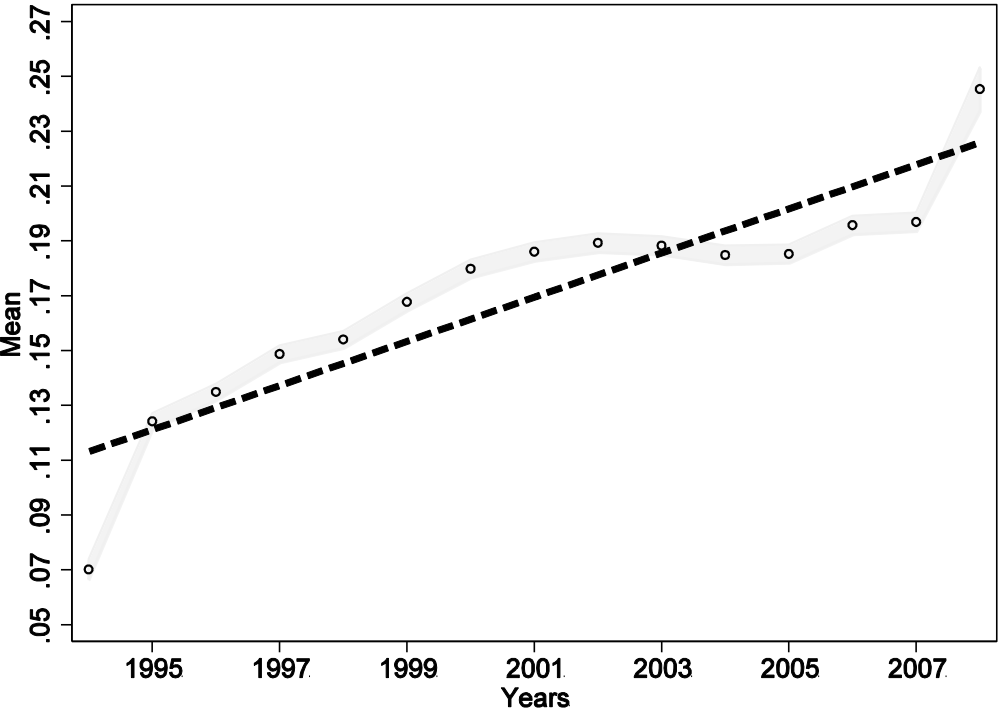
Note: Mean of indicated variable from 36 months before to 36 months after conception. Main sample of mothers (see Section 4.2.). The dashed line at 0 indicates the estimated month of conception, the middle dashed line splits the time window by month of first childbirth, and the dashed line at 20 indicates the 12th month after birth, which is typically the month at which paid leave ends.

Figure 3: Main diagnoses for women on sick leave



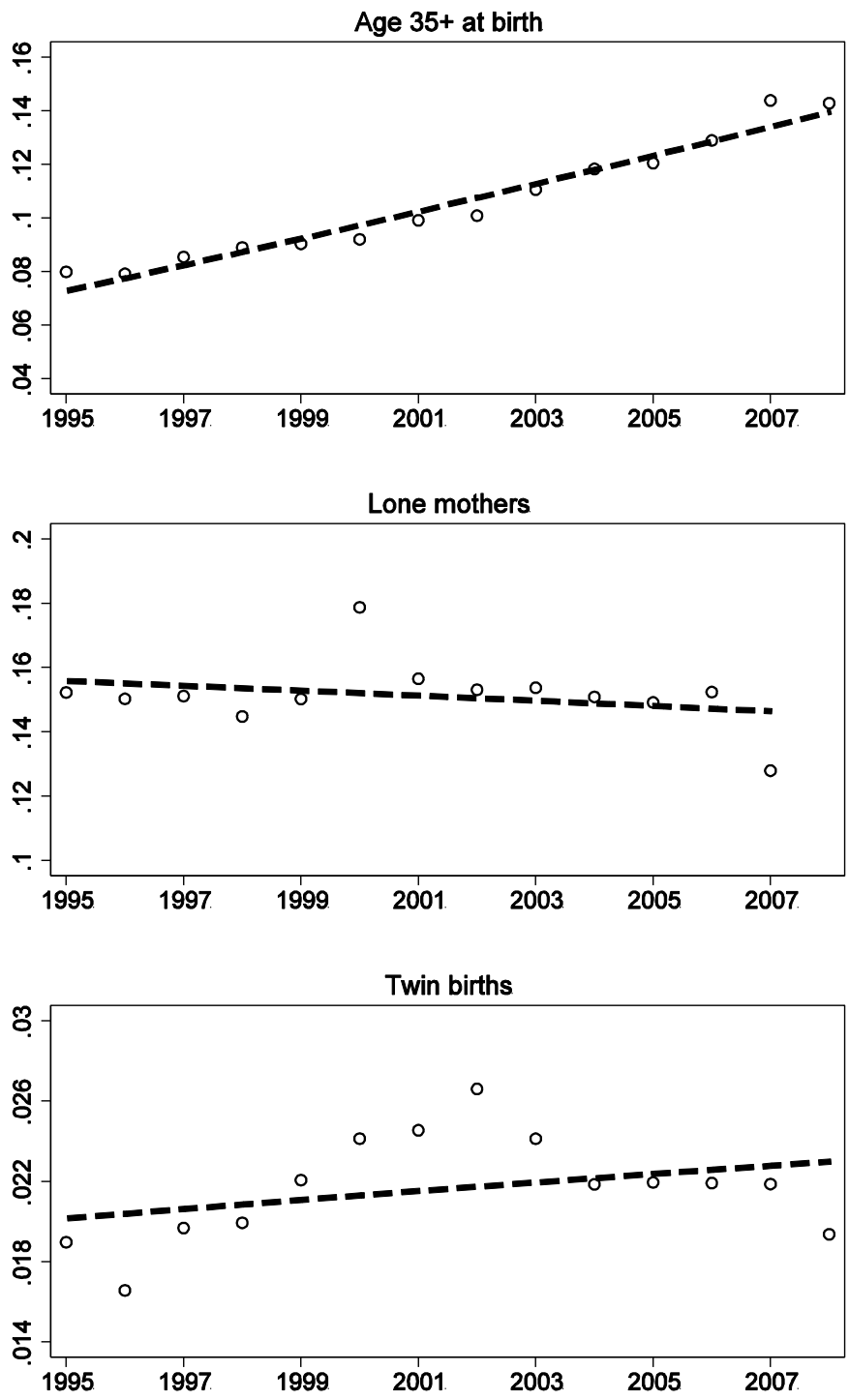
Note: Fraction of those on sick leave under the indicated diagnoses categories from 36 months before to 36 months after conception. Main sample of mothers (see Section 4.2). The dashed line at 0 indicates the estimated month of conception, the middle dashed line splits the time window by month of first childbirth, and the dashed line at 20 indicates the 12th month after birth, which is typically the month at which paid leave ends.

Figure 4: Sickness absence during pregnancy over time



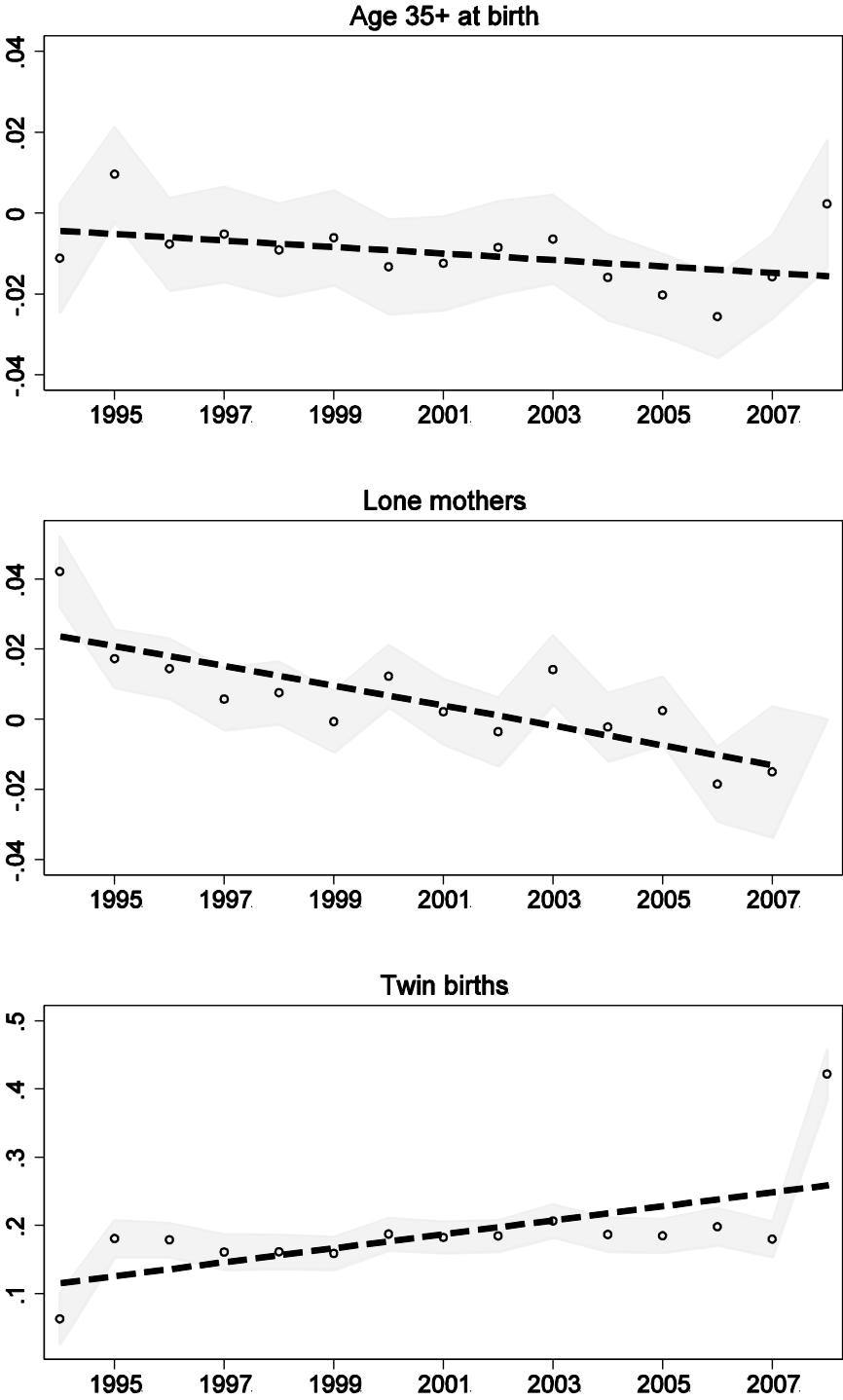
Note: The figure displays the interaction effects of calendar year and the pregnant dummy, using the approach given in Eq. (1), and thus shows how sick leave during pregnancy relative to pre-pregnancy increases over calendar time. Main sample of mothers (see Section 4.2.). Of the covariates in Eq. (1), *first year* and *later* are not included in the model since we only are interested in the coefficient for *pregnant* over time, and we thus follow the mothers three years before conception and during pregnancy only.

Figure 5: Proportions by birth year



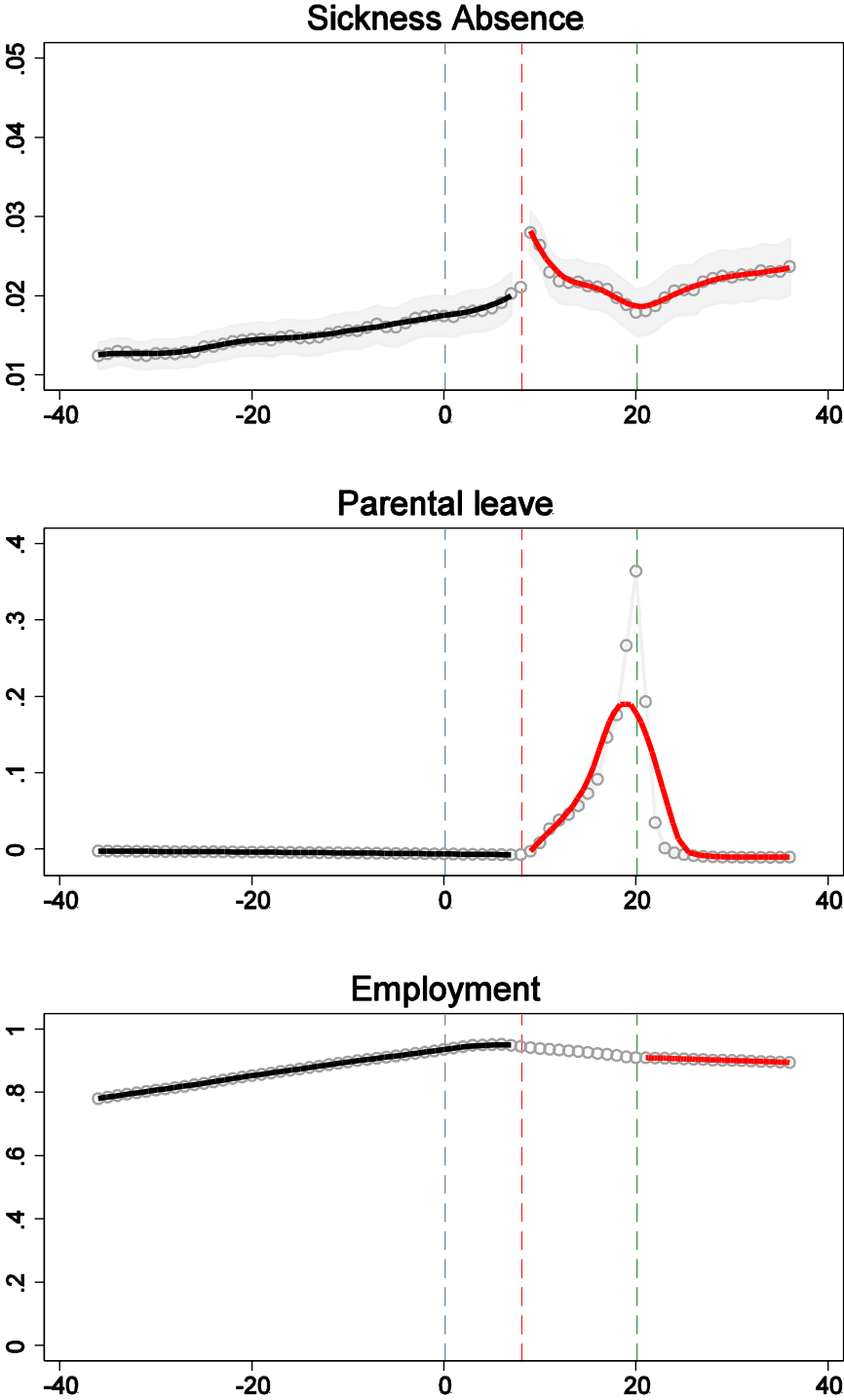
Note: The figures are generated by averaging the proportions by birth year in our main sample of mothers (Section 4.2).

Figure 6: Additional effects during pregnancy on sickness absence



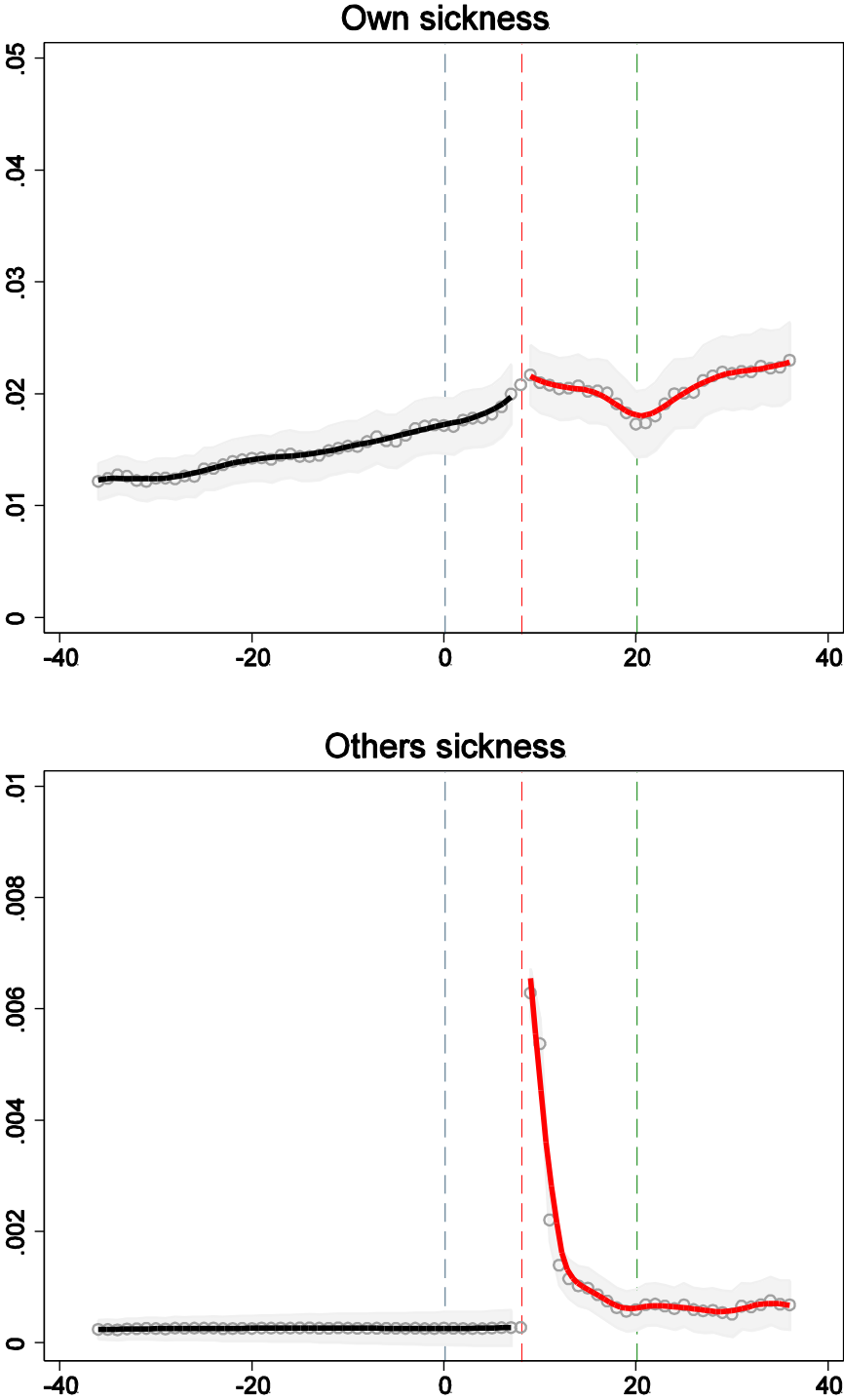
Note: The figures display the interaction effects of calendar year, the pregnant dummy and the given variable (cf. the approach given by Eq. (1)), and thus shows how the sick leave during pregnancy *relative to pre-pregnancy* increases over calendar time for mothers in the indicated category. Main sample of mothers (see Section 4.2.). Of the covariates in Eq. (1), *first year* and *later* are not included in the model since we only are interested in the coefficient for *pregnant* over time, and we thus follow the mothers three years before conception and during pregnancy only.

Figure 7: Pre- and post-conception behavior for males



Note: Mean of indicated variable for father from 36 months before to 36 months after conception. Sample of fathers (see Section 4.2.). The dashed line at 0 indicates the estimated month of conception, the middle dashed line splits the time window by month of first childbirth, and the dashed line at 20 indicates the 12th month after birth, which is typically the month at which paid leave ends.

Figure 8: Sickness absence types for males



Note: Fraction of those on sick leave under the indicated diagnoses categories from 36 months before to 36 months after conception. Sample of fathers (see Section 4.2). The dashed line at 0 indicates the estimated month of conception, the middle dashed line splits the time window by month of first childbirth, and the dashed line at 20 indicates the 12th month after birth, which is typically the month at which paid leave ends.

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