Sick of family responsibilities?*

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Abstract

This study estimates the effect of parenthood on the within-couple gender gap in paid sick leave. We find that as a result of parenthood, females more than double their sick leave compared with their spouse. However, there is no corresponding effect on health as measured by hospital stays. By investigating possible explanations for the observed effect, we conclude that the average effect stems from a reduction in mothers' labor market attachment, which in turn lowers their threshold for taking sick leave.

Keywords: Sick leave, Parenthood, Sickness insurance, Work absence, Double burden, Health investment, Household work, Labor market work, Moral hazard

JEL-codes: C23, D13, I19, J22

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1 Introduction

In the OECD countries, expenditures on disability and sickness insurance programs are large: the average spending on such programs amounted to 10 percent of total public spending in 2005, which is more than twice as much as the spending on unemployment programs (OECD, 2009).[1] Moreover, in most EU-countries, the disability and sickness insurances are used to a larger extent by women (EurWORK, 2010). This is seen clearly in Figure 1, showing the gender gap in absence due to illness ("sick leave") in eight European countries over the period 1983 to 2008. A similar picture appears in the U.S., where Stewart et al. (2003) show that lost productive time due to self-reported personal illness is 30 percent higher among females than among males.[2] Furthermore, the American Time Use Survey[3] shows that among full-time workers (who are parents of children under 18), married fathers worked about one hour more per day than did married mothers. This difference partly reflects married mothers' greater likelihood of being absent from work.

The focus in this paper is the gender gap in sick leave. Given the large amount of resources spent on sick leave and disability, studying the causes behind the gender gap is important in itself. In addition, the gap in sick leave relates to, and probably can explain part of, the gender gap in pay. There is also a link to the gender difference in lifetime income and thereby the pension level, since lifetime income is directly affected by less hours worked.

This study has two aims: First, we estimate the effect of parenthood on the gender gap in sick leave. Our focus is on women's absence in relation to their male partners' and we explore the within-family variation over time from the birth of the first child and 15 years onwards. Equally important, we also investigate two possible explanations for the effect found.

[1]In Sweden and the US, spending was 16 and 9 percent of GDP, respectively. Spending on sickness benefits was about the same as that on disability benefits in both countries.

[2]Data is from the American Productivity Audit telephone survey, consisting of a random sample of 28,902 US workers designed to quantify the impact of health conditions on work.

[3]Source: U.S. Department of Labor (2008).

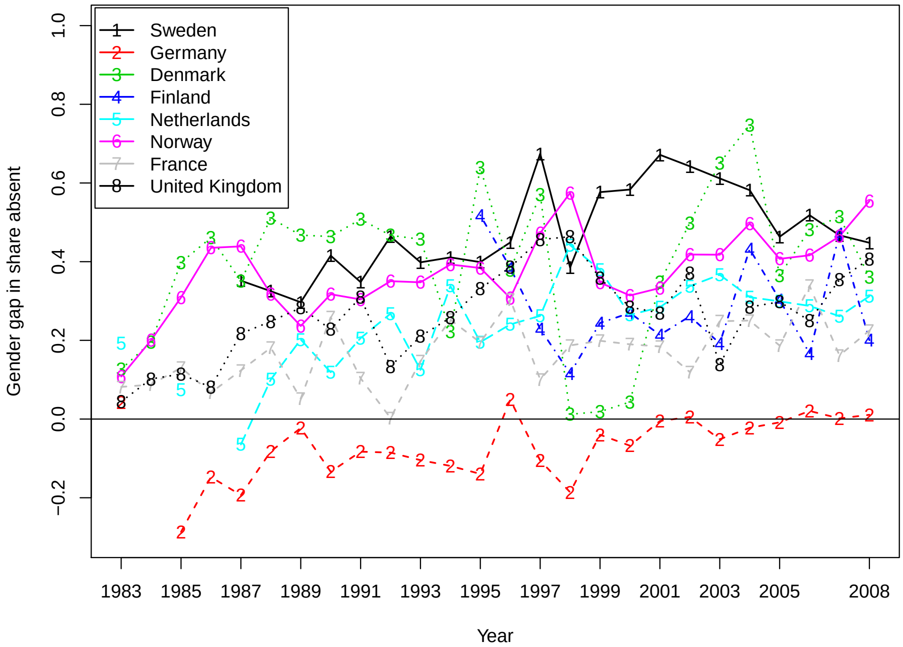

Figure 1: The percentage female–male gap in sick days during a study-period of one week among employed workers in eight European countries. Source: Eurostat.

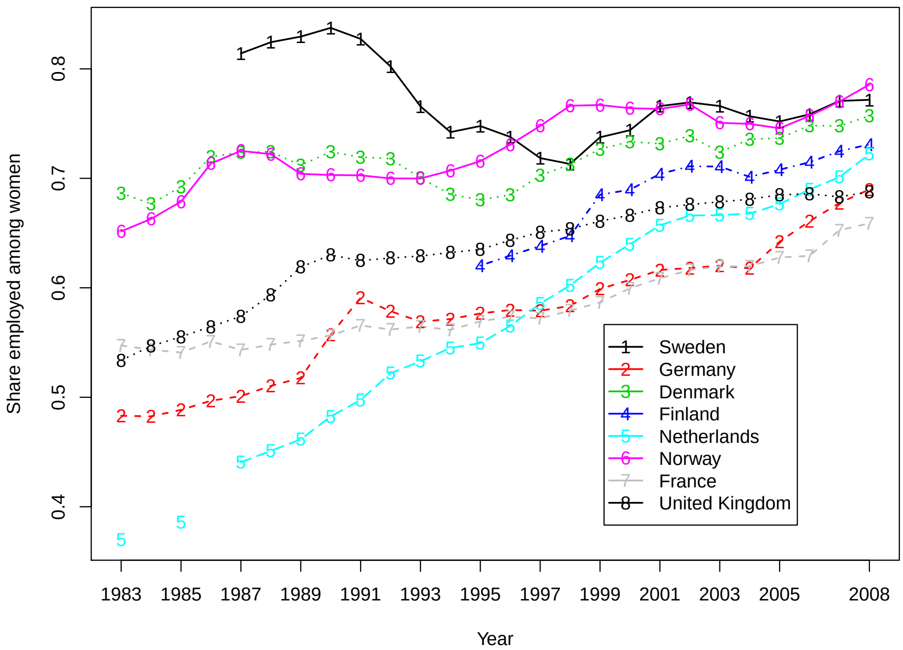

Figure 2: The percentage of women employed, in eight European countries. Source: Eurostat.

The starting point for both explanations is the fact that mothers take more responsibility for child care than men do. This fact is confirmed both in time-use studies[4], and by the fact that more women than men work part-time while having small children. According to the first hypothesis that we investigate, a larger responsibility for child care in combination with labor market work ("a dual carreer") could lead to a potential health deterioration among women (cf. Bratberg et al., 2002). We test this hypothesis by estimating the effect of parenthood on the within-couple gap in hospital stays, and comparing the results with the estimated effects on the sick leave gap.

A competing hypothesis is that the gender gap is driven by parenthood in combination with factors related to the labor market, rather than by health differences. For instance, Figures 1 and 2 show that the increase in the gender gap in sick leave coincides with an increase in female labor supply. This is a common phenomenon in most Western European countries, which suggest a relation between female labor supply and the gender gap in sick leave. It is well established that there is room for substantial discretion in the use of sickness insurance programs and that the level of absence depends on the incentives for labor market work (see, e.g., Johansson and Palme, 2005). Since mothers in general have a higher opportunity cost for labor market work than fathers (they do more household work), we expect them to have a lower threshold for reporting sick than fathers. We study this phenomenon by relating the magnitude of the effect of parenthood on the sick-leave gap to the mothers' pre-child income, and to their income trajectory since the birth of her first child.

We find substantial effects of parenthood on the within-couple gender gap in sick leave. Mothers increase their sick leave more than their spouse by between 0.3 days per month (during the child's fifth year) and 0.85 days per month (during year 17), compared to a pre-child gap of 0.17 days per month. Importantly, this difference in response is not caused by the child's illness. There are two reasons for this: (i) there is a separate insurance when caring for a sick child, which is more generous than the insurance for one's own sickness, and (ii) the outcome studied is long-term sick leave, i.e., spells longer

[4] OECD (2010a) and *American Time Use Survey* (U.S. Bureau of Labor Statistics 2008).

than 14 consecutive days. Thus, the reason for mothers' greater use of sick leave is not likely to be driven by being more exposed to a sick child's cold or influenza. Furthermore, by an extended analysis we can rule out the possibility that the effect stems from later pregnancies.

We find no support for a health deterioration among females after entering parenthood. Indeed, we find some evidence for the opposite: namely, that parenthood causes a decrease in females' hospital stays relative to the hospital stays of the spouse. Instead, the most convincing explanation we find for the effect of parenthood on the sick leave gap is the one related to the change in economic incentives among mothers due to parenthood. Mothers' increased commitment at home, induced by parenthood, appears to reduce their incentives for labor market work and thereby lower their threshold for using the sickness insurance.

An important advantage of the present study is that we have access to two different measures of health, namely the use of sickness benefits, which includes a large part of individual discretion, and the more objective one: spells of in-patient hospital care ("hospital stays"). Both measures stem from rich individual-based register data and cover the same population. Thus, the outcomes are comparable although in-patient hospital care, of course, captures more serious illness than sick leave does. In this context, it is interesting that we find a slightly negative effect of parenthood on the gender gap in in-patient hospital care but a corresponding positive effect with respect to sick leave. The two measures pointing in different directions indicates that the increase in sick leave among mothers due to parenthood stems from a change in the threshold for using the sickness insurance, and are not due to a deterioration in health.

The rest of this paper is organized as follows. Section 2 provides a short literature review on gender differences in household production, labor supply, and sick leave. Section 3 describes the Swedish social insurance system. Section 4 describes the data, and Section 5 contains the main results. Section 6 presents the analysis of the possible explanations for the effect of parenthood on the gender gap. Finally, Section 7 concludes the paper.

2 Gender differences in household production, labor supply, and sick leave

Today, the dual earner family is the most common family form in the OECD countries.[5] Family responsibilities are, however, not equally shared: women are both active in the labor market and perform the majority of the household production, while men predominantly specialize in market work (see, e.g., Boye, 2008; Booth and Ours, 2005; Evertsson and Nermo, 2007; Tichenor, 1999). More effort at home would in general mean less time and effort for labor market work, which is also what we observe: time use studies in Sweden have consistently shown that labor market work is higher for men but that total time worked (household and labor market) of men and women is approximately the same (SCB, 2009). This result is well in line with time-use studies in the USA, Germany, and the Netherlands (Burda et al., 2008).

It has also been empirically established that the unequal gender division of household and market work emerges when couples have their first child (Van der Lippe and Siegers, 1994; Sanchez and Thomson 1997; Gauthier and Furstenberg, 2002; Gjerdingen and Center 2005; Baxter et al., 2008) and that fertility affects the female labor supply negatively (e.g., Angrist and Evans, 1998; Jacobsen et al. 1999) while leaving the labor supply of fathers unchanged, or if anything, increasing it (Kennerberg, 2007).

As far as we know, Angelov et al. (2011) was the first study of the effect of parenthood on sick leave. A related study is Åkerlind et al. (1996), who estimate gender differences in sick leave at different ages separately for individuals with and without children. More closely related are two studies that focus on the effect of household responsibility on sick leave. Bratberg et al. (2002) and Masterkaasa (2000) both suggest that the gender gap in sick leave stems from the psychological pressure of the dual role, or in other words, what they refer to as a double burden for women. In their empirical analysis, Bratberg et al. (2002) and Masterkaasa (2000) use the number of children as a proxy for

[5]The median employment rate for partnered mothers in the OECD countries was 66.5 percent in 2007 (OECD 2010b), and according to the U.S. Bureau of Labor Statistics (2011), the U.S. labor force participation rate of mothers with children under 18 years of age was 71.3 percent in March 2010.

family responsibilities. Bratberg et al. (2002) find some weak support for the idea, while Masterkaasaa (2000) finds no support. Paringer (1983), on the other hand, argues that women's dual role as both producers on the labor market and at home (in contrast to the more labor-market specialized man) implies that women's health is more important for the household than men's, since a household would suffer more than just lost earnings if the female is ill. In her empirical analysis, Paringer uses marital status as a proxy for household responsibilities and finds that married women are *less* absent from work for health reasons than unmarried women. The study by Paringer, however, disregards potential sorting into marriage with respect to health.

Rieck and Telle (2013) is the study closest to Angelov et al. (2011) and to the present one. Using Norwegian data, Rieck and Telle find similar short run effects as in Angelov et al. (2011), but they find no effect three years after child bearing. Rieck and Telle censor women who have a second child, implying that their results are not comparable to ours.

3 The Swedish social insurance system

All residents of Sweden aged 16 and over (employed as well as unemployed) are entitled to sickness benefits in the case of their own illness, as well as to a separate insurance system and earnings replacement in the case of their child's illness. Furthermore, all parents are entitled to paid parental leave. To understand the setting in which we measure the effect of parenthood on the gender gap in sick leave, it might help to consider a typical Swedish family around the time when they have their first child: Most Swedish mothers are on paid parental leave during the larger part of the child's first year. Then some fathers take a part of the remaining paid parental leave, and most children start attending highly subsidized daycare centers when they are between the ages of one and one and a half. The majority of Swedish mothers return to the labor market, although most work fewer hours than their spouse. In this section we briefly explain the above mentioned parts of the Swedish social insurance system and the entitlements to these benefits.

3.1 General principles

The rules for entitlement have changed over time but the general idea has always been that both the employed and the unemployed are entitled to a replacement which is proportional to lost earnings up to a cap. The replacement rate has varied over time between 75 and 90 percent of lost earnings, up to a cap equal to yearly earnings of about 7.5 basic amounts (which in 2009 corresponded to earnings in the 70th percentile of the earnings distribution). During the study period, there was no limit to the duration of the benefits of this insurance.[6]

3.2 Sickness benefits

In case of illness, the first day is not replaced. Thereafter, the employer pays sick-pay for the 14 following days. After 14 days, the Swedish Social Insurance Agency (SIA) disburses sickness benefits. For unemployed individuals, the SIA starts disbursing sickness benefits from the second day onwards. In this study, we focus on sick leave with sickness benefits, meaning that for employees, we start counting the number of days absent from the first day in the third week within a given illness period. Thus, the type of sick leave we study is not short-term sick leave but a leave due to longer-lasting reduced working capacity (longer than 14 days).

Compensation for illness periods longer than seven days requires a medical certificate from a physician with information about the expected length of the sick leave. Based on this certificate, the SIA formally decides whether an individual is entitled to compensation or not. When the entitlement period has expired, a renewal certificate is required and the process is repeated.

Although the formal decision about sickness benefits is made by the SIA, the sickness benefit claimant can influence the outcome. According to Arrelöv et al. (2006), the outcome is largely controlled by the insured's motivation. Englund (2001) also finds that doctors believe that they prescribe too long durations of medical-absences, that is, the

[6] A time limit of 2.5 year was introduced in July 2008, thereby coming into effect after the end of our panel data set.

duration is not motivated by medical considerations only.

3.3 Insurance coverage in case of a child's illness

To understand why the estimated effects in this study do not stem from children's being ill, but rather from the parents' own sick leave, it is essential to have some knowledge of the Swedish insurance system for cases of child illness. Parents are entitled to so called *temporary parental benefits* if they have to stay at home to care for an ill child under the age of 12. Parents are jointly eligible for temporary parental benefits for 120 days per child and year. After these 120 days, a further sixty days can be taken, if the need for these extra days has been approved by the SIA.

Work absence due to child illness is financially more beneficial than work absence due to one's own illness since it is compensated from the first day of work absence. Until recently, there was no formal monitoring of absence due to care for an ill child. Engström et al. (2007) show that this disharmony between the two insurances leads to a large excess use of temporary benefits and Persson (2011) finds that this also leads to unintended flows from sickness insurance benefits to temporary parental benefits. The present study focuses on sick leave spells longer than 14 days. The extent of flows from sickness benefits to the temporary parental benefits should be small. However, if anything, days on sickness benefits are an underreported measure of work absence.

3.4 Paid parental leave

Parents receive parental benefits if they stay at home to take care of their child.[7] Parental benefits are payable for 450 days for each child. One parent may give up the right to parental benefit to the other parent, with the exception of 60 days. Parents with children under eight years are also entitled to unpaid job-protected leave with a great portion of flexibility. During the child's first 18 months both parents can stay at home on a full-time basis with job protection. Thereafter, parents are allowed to reduce their working hours

[7] This holds also for persons without earnings who receive a flat rate of 60 SEK (approx. $7.6) per day.

up to 25 percent until the child turns 8 years old (SFS 1995:584).

4 Empirical strategy, data, descriptive statistics, and graphical evidence

4.1 The empirical strategy

There are several challenges associated with estimating the effect of parenthood on work absence due to a parent's own sickness. First, it is reasonable to believe that the likelihood of having a child is correlated with health and labor market success. Second, the spouses probably affect each other. To this end, we restrict the analysis to the estimation of an effect of parenthood on the gender difference in sick leave for those becoming parents. By asking how the within-couple gender gap changes when a couple enters parenthood, we control for a lot of unobserved individual characteristics that might be correlated with parenthood. In the following, we further explain our identification strategy.[8]

Both groups (men and women) are affected by the intervention (entering parenthood), but we allow the magnitude of the effect to differ between the genders. The identifying assumption is the same as in a traditional difference-in-differences setting, i.e., the intervention must be strictly exogenous. That is, the timing of when to have a child should not be determined by expected shocks to the within-family gender difference in sick leave the couple would have experienced in absence of entering parenthood. This means that the timing of entering parenthood should not be influenced by, for us, unobservable information about sick leave changes of men in comparison to women or vice versa. By controlling the pre-birth within-household gender gap in sick leave, we control, as in a traditional difference-in differences framework, for potential pre-child differences in sick leave (including health) between the genders. In addition, we control for gender differences in business cycle and pre-child differences in education, income, and age.

Even in the absence of a gender gap in health, there are some reasons to believe that

[8] A formal derivation is given in Appendix A. A similar identification strategy in the estimation of parenthood effects on the gender gap in pay is used in Angelov et al. (forthcoming).

men and women without children would differ in their sick leave behavior. Women have, for instance, lower average earnings. Since there is a cap in the insurance, this means that, women face higher average real replacement rates than men. Another potential reason for different take up rates for men and women can be the highly gender-segregated Swedish labor market (see, e.g., SOU, 2004). However, in general, the work environment for males is worse than the work environment for females (see, e.g., Broström et al., 2004; Angelov et al., 2011; Mastekaasa and Olsen, 2000), which suggests a gender gap in the opposite direction than the one we observe in the data.

4.2 Data and descriptive statistics

The data are taken from universal administrative registers from various sources covering all residents in Sweden. First, using the so called multi-generation register, we define the population as parents who had their firstborn child between 1992 and 1998. We can link parents to their biological children and have information on birth year and month as well as birth order. For this population, we have also information taken from LOUISE, which is an administrative register covering all residents in Sweden aged between 16 and 65, updated on an yearly basis for 1986–2008. This register provides information about pre-child labor market income and pre-child education.

The observation units are matched couples, i.e., men and women who had their first-born child together. We have added individual information on the use of sickness benefits ("sick leave") from SIA for 1986–2008, measuring spells longer than 14 consecutive days. Furthermore, data on in-patient care are retrieved from the National Board of Health and Welfare (for 1987–2005). In-patient care refers to care for a patient who is formally admitted ("hospitalized") to an institution for treatment and/or care and stays for a minimum of one night in the hospital or other institution providing in-patient care.[9] This information also stems from national registers covering the whole population. The data on sick leave and hospitalization contain information on both the starting and ending date of a spell on sickness benefits and a hospital stay. This information has been totaled

[9] In the present paper, we use the terms "in-patient care", "hospital stays", and "hospitalization" as synonyms.

on a monthly basis separately for each spouse and outcome variable.

The sampling procedure results in a pooled panel data set of matched couples who had their first child between 1992 and 1998. We can follow some parents for as long as 155 months before their first child was born (January 1986 to December 1998 for children born in December 1998) and another fraction for 203 months after (January 1992 to December 2008 for children born in January, 1992). Since we use monthly data on the two outcome variables (sick leave days and in-patient care days), the complete data set consists of over 50 million observations. To reduce the estimation time, we take 10 percent random samples of each parent cohort (at couple level). For all sampled couples, we have full coverage on all variables at all relevant points in time. The final data set consists of 5,017,248 couple-month observations.

The population is restricted to individuals who are employed before entering parenthood. Strictly speaking, we require a positive income from labor market work two years before entering parenthood in order to be included in the study population. This restriction is motivated by the fact that sickness benefits are mainly employment-based. Thus, of interest are those couples in which both spouses are in the labor market and are eligible for sickness benefits. In conditioning on pre-child labor market attachment, we also make sure that an observation with zero pre-child sick leave implies no absence due to sickness, and not that the individual lacks eligibility for sickness insurance due to non-participation in the labor force.

Table 1 presents the data used in the main analysis. This table shows that the mean age when entering parenthood is 27.4 for women and 29.6 for men. The mean annual labor market income is lower for women than men two years before entering parenthood: women's average income is 76 percent of men's. This is, in a way, expected due to the age gap before entering parenthood. The education gap is in the opposite direction.

Two years prior to childbirth, women are on sick leave on average 0.17 days per month (or about 28 percent) more than their spouse. Finally, the average days of hospital stays is 0.1 days per month (or about 50 percent) higher for women.

Table 1: Descriptive statistics

	Mothers		Fathers		Mothers-fathers	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Age	27.4	4.4	29.6	4.9	-2.2	3.7
Income (SEK)	152,023	80,386	200,066	106,074	-48,043	108,404
Education (yrs)	12.2	2	12	2.1	0.1	2.1
Sick leave (days/mo)	0.78	3.67	0.61	3.32	0.17	4.79
Hospitalization (days/mo)	0.03	0.52	0.02	0.52	0.01	0.74

Notes: The first child is born in month $t = 0$, age is measured in $t = 0$, and income, education, sick leave, and hospitalization in $t = -24$. Income is measured in SEK in 2008 prices. The December 2008 exchange rate was approximately 7.9 SEK/USD. Education is measured in theoretical years of education using the official Swedish SUN classification, which roughly follows the international ISCED 97 standard. Sick leave and hospitalization are measured in days per month.

4.3 Graphical evidence

In order to get a first look at the data, we present the within-couple gender gap in sick leave before and after the birth of the first child in Figure 3. The data plotted in Figure 3 represents raw monthly average days on sick leave for the pooled data set of matched couples. As is apparent from Figure 3, the gender difference in sick leave occurring two years after the birth of the first child is large and persistent for as long as we can follow the couples. The spike in female sick leave that occurs before the birth of the first child is due to pregnancy related health problems. During the period directly after childbirth, we observe a dramatic decrease in sick leave for women, and during this period mothers are less absent than fathers. The reason for this drop is that most mothers use paid maternity leave during the child's first year.[10]

It should be noted that besides the visible variation of the gender gap in sick leave over time since birth (on the horizontal axis), Figure 3 also contains some variation over calendar time. It is possible to control for this variation using regression analysis. As seen in Figure 1, there is some variation in the gender difference over the studied period, but there is no overall increasing trend in the gender difference in sick leave during the period from 1994 to 2010. Being able to control for potential secular trends by adding

[10]Note, however, that sickness benefits could be paid out during the parental leave if, for example, the illness prohibits the mother from taking care of the child.

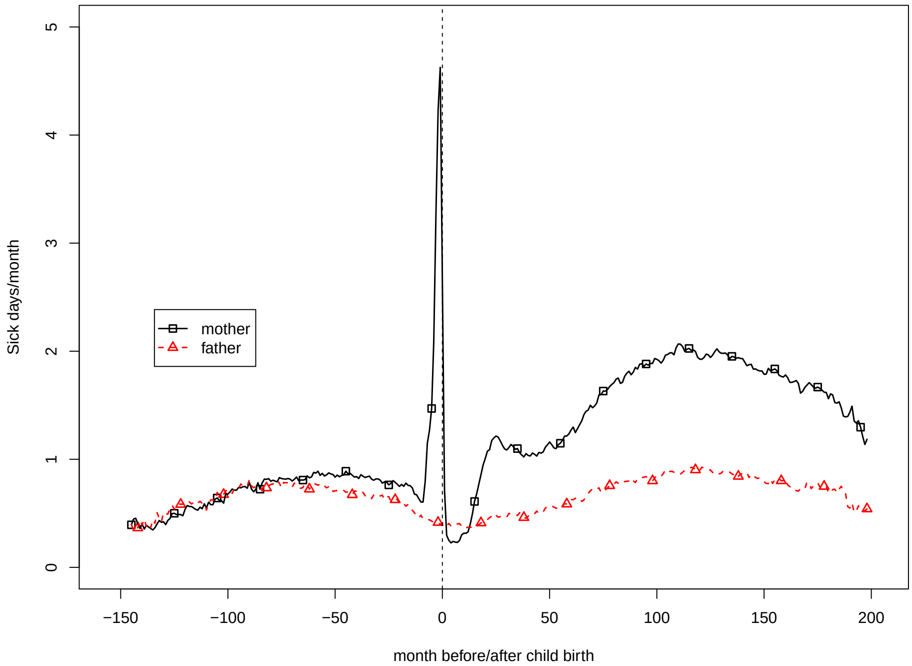

Figure 3: Average days of sick leave per month before and after the birth of the first child for mothers and fathers who had their first child at $t = 0$.

Note: The analysis is based on all Swedish residents who had their first child between 1992 and 1998, and were active on the labor market two years prior to childbirth. Data on sick leave covers the period from 1986 and 2008.

year-specific trends is a benefit with our data set, consisting of several cohorts of parents. This way, we ensure that our estimates are not confounded with calendar-time variation in the sick leave gender gap.

5 Mean effects of parenthood on the sick leave gap

5.1 Regression model

We have two time dimensions: time since birth and calendar time. Let $c = 1986, 1987, \ldots,$ 2008 index year. Let $j_i = c - c_i^*$ where c_i^* is the year of birth for couple i. This index is defined so that $j_i = 0$ in the year when the first child is born. Thus, $j_i = 1$ during the first child's first year, $j_i = 2$ during the first child's second year, etc. Morover, time since birth can also be measured in months (the frequency we use for sick leave and in-patient hospitalization). Let $t_i = m - m_i^*$ where m_i^* is the birth month and m the calendar month (1 in January 1986), hence $t_i = 0$ the month of the first born's birth. Using these definitions, we estimate the following regression model for a couple:

$$\widetilde{s}_{ic} = \alpha_{pre} + \alpha_{preg}\mathbf{1}(-9 \leq t_i \leq 0) + \sum_{s=1}^{T} \alpha_s 1[j_i = s] + \widetilde{\boldsymbol{x}}_i' \boldsymbol{\phi} + \theta_c + \omega_{ic}, \qquad (1)$$

where $\widetilde{s}_{ic} = s_{ifc} - s_{imc}$ is the (f)emale–(m)ale gap in sick leave in calendar time c, $1[\cdot]$ is the indicator function which takes the value one when the expression within the parenthesis is true and zero otherwise, and $\widetilde{\boldsymbol{x}}_i$ is a covariate vector of pre-pregnancy gender differences in education, yearly labor income, and age, measured at the latest during year $j_i = -2$. For $j_i < -2$, we set $\widetilde{\boldsymbol{x}}_i = (\boldsymbol{x}_{ifc} - \boldsymbol{x}_{imc})$, and for $j_i \geq -2$, we set $\widetilde{\boldsymbol{x}}_i = (\boldsymbol{x}_{if(c_i^*-2)} - \boldsymbol{x}_{im(c_i^*-2)})$. Our main parameters of interest are α_s for $s = 1, 2, \ldots, 17$, which measure the effect of parenthood on the female–male sick leave gap during the child's sth year since birth.

The intercept parameter α_{pre} together with θ_c controls for pre-pregnancy differences in sick leave levels. By using all available pre-child observations this allows us to control for potential gender differences in business cycle effects on sick leave. The pregnancy parameter α_{preg} takes into account the sharp increase in the relative sick leave during pregnancy which can be observed in Figure 3. As we can observe women and men for a maximum of 203 months after parenthood, we are in a position to estimate 203 ex post birth parameters. However, as we believe is clear from the analysis provided below, we do not lose any information by keeping the analysis at the yearly level.

5.2 Baseline results

Table 2 presents the estimation results using five different specifications (see equation 1). We estimate the pre-pregnancy sick leave gap (the intercept), the effect of pregnancy and delivery, and the yearly effects of parenthood starting from the year of birth. The first column presents the estimates without any controls. In column two we control only for calendar years, and in the third column we also include controls for the age difference within each couple as well as pre-child differences in income and years of education.

Table 2: Baseline specification and robustness checks

	(1)	(2)	(3)	(4)	(5)
intercept	0.0917***	-0.0186	0.0426*	0.0422*	0.0490*
	(6.62)	(-1.01)	(2.08)	(2.07)	(2.08)
pregnancy (1st child)	1.698***	1.709***	1.701***	1.686***	1.735***
	(50.11)	(46.24)	(45.82)	(46.52)	(42.12)
year 1 (1st child)	-0.169***	-0.156***	-0.162***	-0.197***	-0.211***
	(-7.48)	(-4.85)	(-5.03)	(-6.63)	(-6.23)
year 2 (1st child)	0.345***	0.326***	0.323***	-0.0875*	-0.0730
	(12.21)	(8.16)	(8.10)	(-2.29)	(-1.70)
pregnancy (2nd child)				2.072***	2.047***
				(41.44)	(35.33)
year 1 (2nd child)				-0.389***	-0.408***
				(-8.77)	(-7.96)
year 2 (2nd child)				-0.105*	-0.146*
				(-2.01)	(-2.42)
year 3	0.564***	0.493***	0.493***	0.219*	0.240*
	(17.03)	(10.59)	(10.61)	(2.29)	(2.44)
year 4	0.469***	0.335***	0.337***	0.334***	0.356***
	(14.07)	(6.51)	(6.56)	(3.79)	(3.72)
year 5	0.501***	0.277***	0.281***	0.259***	0.297***
	(13.66)	(4.73)	(4.80)	(3.90)	(3.84)
year 6	0.640***	0.321***	0.327***	0.283***	0.339***
	(15.51)	(4.65)	(4.75)	(4.10)	(4.24)
year 7	0.839***	0.445***	0.452***	0.366***	0.415***
	(17.99)	(5.47)	(5.58)	(4.75)	(4.70)
year 8	0.934***	0.492***	0.501***	0.405***	0.518***
	(18.95)	(5.23)	(5.35)	(4.69)	(5.21)
year 9	0.984***	0.533***	0.543***	0.437***	0.555***
	(19.03)	(4.94)	(5.06)	(4.44)	(4.91)
year 10	1.031***	0.627***	0.640***	0.529***	0.651***
	(19.27)	(5.16)	(5.29)	(4.76)	(5.10)

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Table 2 – Continued

	(1)	(2)	(3)	(4)	(5)
year 11	0.976***	0.640***	0.655***	0.549***	0.665***
	(17.87)	(4.85)	(4.98)	(4.54)	(4.81)
year 12	0.975***	0.709***	0.727***	0.619***	0.768***
	(16.73)	(4.99)	(5.14)	(4.73)	(5.14)
year 13	0.922***	0.747***	0.765***	0.650***	0.812***
	(14.72)	(4.92)	(5.06)	(4.62)	(5.04)
year 14	0.883***	0.801***	0.819***	0.706***	0.863***
	(13.12)	(4.99)	(5.12)	(4.71)	(5.02)
year 15	0.815***	0.836***	0.854***	0.739***	0.924***
	(10.89)	(4.88)	(5.01)	(4.60)	(4.99)
year 16	0.726***	0.860***	0.882***	0.769***	1.023***
	(8.34)	(4.67)	(4.81)	(4.42)	(5.12)
year 17	0.603***	0.830***	0.852***	0.739***	0.948***
	(5.04)	(4.02)	(4.14)	(3.74)	(4.16)
calendar year controls	no	yes	yes	yes	yes
age and pre-child controls	no	no	yes	yes	yes
N	5,017,248	5,017,248	5,017,248	5,017,248	3,966,168
R^2	0.005	0.006	0.008	0.011	0.011

Notes: Standard errors are clustered at couple level, but not reported for conciseness. Significance levels are denoted by * (p<0.05), ** (p<0.01), and *** (p<0.001). The full set of controls consists of calender year controls, age difference, and pre-child controls for differences in income and education.
(1) No controls, (2) Calender year, (3) Full set of controls, (4) Baseline with second child effects, and (5) Couples with at most two children

Columns (1)–(3) show the estimates that are statistically significant at the one percent level and tell the same story: in the long run, the female–male gender gap in sick leave increases due to parenthood. Before explaining the interpretation of each regression coefficient, we discuss how the different model specifications affect the long-term estimate of the gender gap in sick leave.

Including calendar year controls reduces the magnitude of the estimated effects for years 3 through 13 since the birth of the first child and leaves the rest of the estimates virtually unchanged. Adding age and pre-child controls does not change the results, except for the intercept term, which captures the mean difference before pregnancy.

We can test the validity of the strict exogeneity assumption by checking whether there is a trend with respect to time to birth in the residuals $\widehat{\omega}_{ic}$ (see Appendix A for a fomal discussion). We take the results in column 3 as the base for the test and use a second degree polynomial regression of $\widehat{\omega}_{ic}$ on time to birth. The F-test with two degrees of freedom has a p-value of 0.17, and none of the individual parameter estimates is significant. Thus, we feel reasonably reassured that the identification assumption is met.

In the following we discuss the estimates in the third column. The results confirm what was already seen from the graphical analysis displayed in Figure 3. Pregnancy drastically increases the gender gap in sick leave: the effect is 1.7 days per month during this period. This increase is most likely due to mothers' pregnancy-related illnesses. But during the first year after birth, the effect is instead negative: i.e., fathers increase their sick leave more than mothers do, leading to an effect of -0.16 days per month. During the second year, the gender gap in sick leave increases by 0.32 days per month, which is a substantial increase. This result is to some extent driven by the high frequency of siblings' being born about two years after the first childbirth (we will return to this later). Finally, our main parameters of interest are the long-term effects from year 3 onwards. The estimates range from 0.28 (year 5) to 0.88 days per month (year 16), which corresponds to the shift in the sick leave gap in Figure 3, now using a regression approach. There seems to be a gradual increase in the effect of pregnancy approximately between year 5 and 14, and no change further away from birth.

How should one interpret these results in light of the fact that most women have more than one child? On the one hand, pregnancy itself and the days around childbirth are associated with a sharp increase in the sick leave gap. Thus, the shift in sick leave after the birth of the first child could potentially be explained by subsequent births and short-term pregnancy-related illnesses. On the other hand, the estimated effect during the first year is negative, suggesting a short-term negative effect directly after giving birth.

In order to take this potential problem into account, we estimate a second child effect, which is presented in the fourth column in Table 2. In this analysis, the dummy for the first child's second year captures sick leave differences only as long as the mother is not pregnant with her second child. As soon as the second pregnancy begins (i.e., 9 months before the birth of the second child), the second-child pregnancy dummy captures the sick leave difference. The first-child second year estimates now capture the dynamics of the gender gap in sick leave for a) the minority of couples that only have one child during this period, and b) the period after the birth of the first child and before the birth of the second child among the majority of couples who do have a second child. In contrast, the variation used to estimate the second-child parameters stems solely from couples that have at least two children. The long-term effects (for year 3 since the birth of the first child and thereafter) are estimated using a dummy variable that has the value one if a) more than two years have passed since the birth of the first child, and b) for couples that have a second child, either more than two years have passed since the second birth, or the mother is not yet pregnant with the second child.[11]

A comparison of the first- and second-child estimates from the fourth column in Table 2 suggests that the positive pregnancy effect is somewhat higher for the second than for the first child (2.07 compared to 1.69 sick-days/month). The negative first-year effect is about twice as large in absolute terms for the second child compared to the first child (-0.389 and -0.198, respectively), but the second-year effects are both positive and have about the same magnitude.

Finally and most importantly, the long-term yearly effects of parenthood are of the same magnitude whether we include second-child effects or not. To further push this point, we have estimated the specification with second-child controls for the sub-sample

[11] An example might be useful. Assume that couple A has their first child in June 1996, and no children thereafter. The long-term effect for year 4 is captured by a dummy variable valued one for monthly sick leave observations that occur from June 1999 to May 2000. Assume further that another couple (B) have their first child in June 1996 and a second child in June 1999. Then no variation from couple B is used in the estimation of the effect for year 4. Instead, the sick leave observations for couple B from June 1999 to May 2000 are used in the estimation of the effect for year 1 (second child).

of couples that have at most two children (see column 5). The results are qualitatively unchanged, but the long-term estimates are even somewhat higher for this group. This is an important result, as it implies that the long-term results of parenthood that we estimate are not driven by later pregnancies.

We condition on being eligible for sickness benefits before entering parenthood. Parenthood could, however, cause mothers to leave the labor force to a larger extent than the fathers. If anything, this would attenuate the estimated effect toward zero. However, in order to investigate whether a potential change in the composition of individuals eligible for sickness benefits after entering parenthood may affect the results, we have re-estimated the model using two other samples. In the first, we require a positive income also after the birth of the first child. In the second, we restrict the incomes to be greater than 50,000 SEK ($6,300) two years before childbirth but also after childbirth. The results from these analyses (not displayed, but obtainable on request) show (1) that the estimated effects are virtually the same as those given in Table 2, and (2) that the long-term effects for the last sample are, as expected, smaller but the effect for year 15 is still as much as 0.54 sick days/month. Thus, qualitatively, the results do not change with the sample restrictions made. The primary reason is that most mothers in Sweden stay in the labor force also after they have entered parenthood.

6 Family responsibilities and sick leave

In this section we discuss and investigate possible explanations for the estimated effect of parenthood on the sick leave gap. We have two ideas. The first focuses on women's dual responsibility associated with parenthood, which may cause a relative deterioration in female health (cf. Bratberg et al., 2002). The second concerns changes in economic incentives within the household. We first discuss these ideas and then present the empirical results.

6.1 A gender-differential change in health

Bratberg et al. (2002) claim that the gender gap in sick leave stems from the psychological pressure of the dual role of women, the so called "double burden". As the average total time spent on working is the same for men and women (SCB, 2009), we believe that this hypothesis should not be interpreted as an effect from a higher work load of the women on average, but rather as a potential effect of the psychological strain of switching between roles.[12] The role strain theory argues that having multiple roles is detrimental for an individual's health and may thus increase the sick leave. Thus, according to this hypothesis, women's health would deteriorate after entering parenthood.

However, the dual role could also lead to improved health among women. There is a large literature theorizing about the benefits of multiple roles (the role enhancement theory), as it might make an individual feel that his or her life is more meaningful. This effect would, hence, work in the opposite direction, namely, by improving the individual's health.[13] Yet another theory is suggested by Paringer (1983). The idea is that, due to women's dual role, female health is likely to be more important for the household than male health, since female illness does not only imply lost earnings, but also creates an additional cost in terms of lost home production. In this setting, it may be rational for the household to take more precautions in the case of a negative female health shock, by increasing female work absence more than for a similar male health shock, or in other words: to be more risk averse when it comes to the health of the mother. According to the role enhancement theory and Paringer's hypothesis, we would observe an increased female–male gap in sick leave, but a long-term improvement in female health.

To investigate how well these empirical predictions correspond to the empirical outcomes, we apply the same empirical strategy as in the previous analysis, but instead of sick leave as outcome variable, we directly focus on the effect on health by analyzing in-patient care data.

[12] The similarity in total time worked corresponds well with statistics from time use studies in the USA, Germany, and the Netherlands (Burda et al., 2008).

[13] For more discussion about multiple roles and their implications, see the literature review in, e.g., Mastekaasa (2000).

6.2 Economic incentives

It is well known that insurance coverage may change individual behavior. Due to asymmetric information about employee health, the sickness insurance system (with high replacement rates) can be used by employees as a way of adjusting working time (Allen, 1981; Johansson and Palme, 1996). Individuals can use sick leave as a way of increasing their leisure time so that their real wage equals their marginal value of leisure.[14] A similar argument applies to the case when there is a need for an increase in home production, as happens when parenthood implies a new and inevitably time-consuming task at home. Thus, a response to this new home commitment could be to reduce the female labor supply, as many women do. However, another way of reducing the labor working time is to increase the time on sickness benefits. We refer to this potential effect as an ex ante moral hazard effect.

In comparison to low-income mothers, high-income mothers have most likely better opportunities to deal with the new commitment at home. They have more opportunities to adjust their contracted labor supply, to buy household goods on the market, to employ flexible working hours, and to telecommute. Thus, it is reasonable to assume that low-income mothers have stronger incentives to increase their time on sickness benefits than high-income mothers. An informal test of this ex ante moral hazard behavior is thus given by studying whether the magnitude of the effect of parenthood varies with mothers' pre-birth income level. A negative relation between pre-birth income and the effect of parenthood on the sick leave gender gap would support the idea that our main effect is partly driven by ex ante moral hazard among mothers.

Economic theory together with empirical evidence tells us that ex post moral hazard is important in the Swedish sickness insurance system (see, e.g., Johansson and Palme, 2005). That is, sick leave increases when the cost of being absent drops. Now, as women reduce their working time after parenthood, the cost of being absent may be reduced. For high-income women there may be a direct effect but there is also a potentially more important indirect effect. The direct effect stems from the fact that there is a cap in

[14] Real wage = (income + benefits)/(contracted working hours − time on sickness benefits).

the sickness insurance system: for women with incomes above the cap, the real replacement rate is lower than the nominal replacement rate in the insurance. Consequently, a reduction in working hours as a result of parenthood for these women implies an increase in real replacement rates. The indirect effect stems from a change in employers' expectations about a worker's performance due to this reduction in working time. A high level of presence at work is arguably taken as a signal of aspiration and productivity by most employers. Thus, work absence as measured by sick leave and/or a reduction of working hours due to household work might negatively affect future advancement in the workplace. Fewer opportunities and possibilities of advancement will then affect work incentives, which in turn lowers the threshold for using the sickness insurance. Seen from this perspective, the fact that many women reduce their labor supply after entering parenthood means that their cost of being absent falls with their lower labor market attachment.

We investigate the hypothesis of ex post moral hazard behavior due to a change in female labor market attachment after parenthood by studying whether a higher income increase between the pre-child level measured in year $j_i = -2$ and year $k = s - 1$ is related to a lower effect of parenthood on sick leave during year s. As an example, we ask whether the effect of parenthood 10 years after childbirth is lower for women with a high income increase between year -2 and year 9. We use yearly labor income, which is a combined result of hours worked and the hourly wage, as a measure of labor supply since we lack an appropriate measure of labor supply in terms of hours worked. By using lagged values, we mitigate the obvious measurement problem, namely that there is a mechanical relation between labor income and the number of days of sick leave.

6.3 Empirical results

6.3.1 Health

In order to investigate whether there is an effect of parenthood on the gender gap in health, we use the same empirical specification as previously (see equation 1), but now using hospitalization data as outcome. In particular, where we previously used the within-couple gap in days per month on sick leave, we now use the corresponding gap in days per month of hospital stays. As we have hospitalization data for a shorter period of time (1987 to 2005 instead of 1986 to 2008 as is the case for sick leave), we re-estimate, for the sake of the comparison, the effect on sick leave for this shorter period. In order to keep the analysis simple, we use couples with at most two children. This simplifies the analysis because we do not need to control for subsequent childbirths (which by definition imply a hospital stay) among those with more than two children (a minority of couples).

The separate results on hospitalization and sick leave are presented in figure 4 (see Table 3 Appendix B for the estimates). First, it is clear that the results on sick leave are very similar to the ones presented previously for the longer time period (cf. column 5 in Table 2 and figure 4). Furthermore, as expected, there is a substantial increase in hospitalization for women both during the first and the second pregnancy (0.61 and 0.43 in hospitalization days/month, respectively). However, besides the pregnancy effects, there is no evidence of a long-term increase in the female–male gap in hospitalization. In fact, if anything, there is some evidence for the opposite: after the birth of the first child, the average monthly number of hospital stays among mothers seems to decrease somewhat relative to fathers' hospital stays. This result provides some support for the theory proposed by Paringer (1983), namely that women, who are the main household producers, use work absence as a means of investment in their health.

6.3.2 Economic incentives

In the following we present heterogeneous effects depending on mothers' pre-birth income and the income trajectory after the birth of the first child. The complete results are presented in detail in Table 4 in Appendix C, while here, we present the essence of the results graphically. To keep the discussion simple, we focus on how the effect during the 10th year after the birth of the first child varies with the mother's pre-birth income as well as income trajectory. As explained in Appendix C, the signs of the parameter estimates are the same also for other years, and thus by focusing on the effect during year 10 we gain simplicity without losing generality.

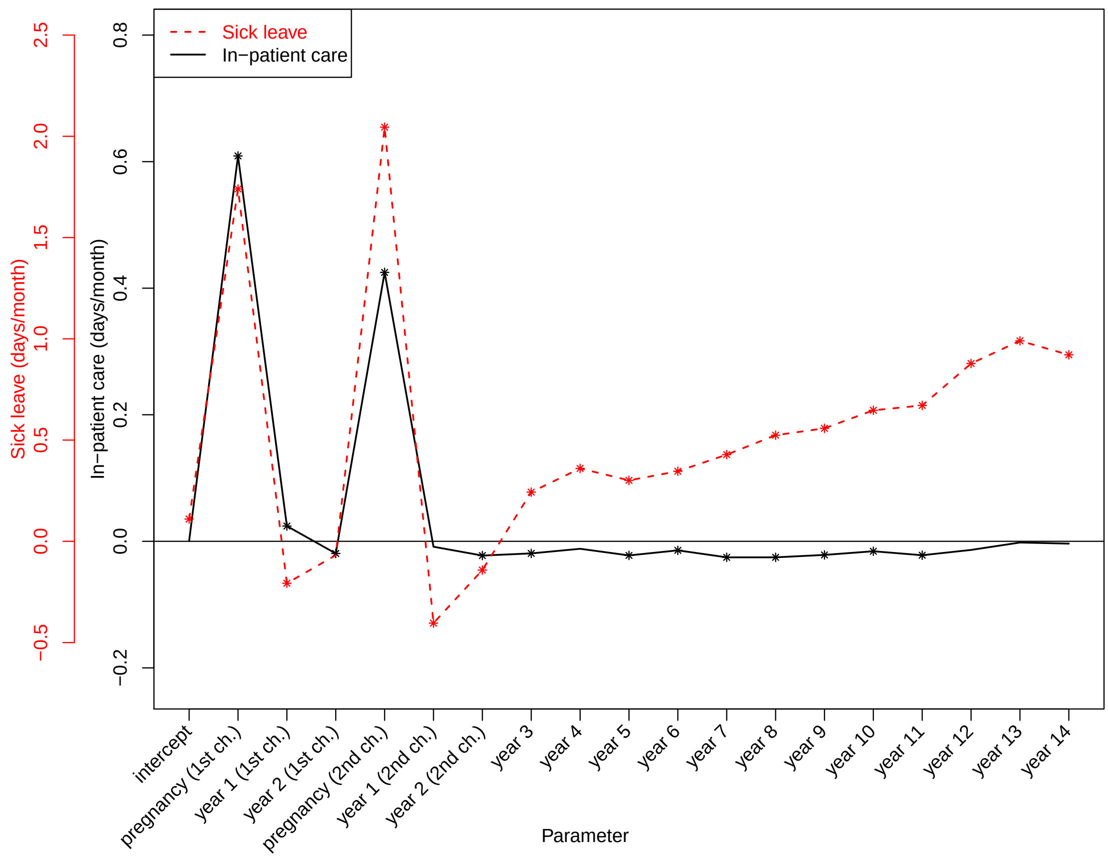

Figure 4: The effect of parenthood on the gender gaps in sick leave and in-patient care, respectively.

Note: Significance at the 5% level for a particular parameter estimate is annotated by $*$. The effect estimates, along with their standard errors, are presented in Table 3 in Appendix B. The analysis is based on a 10% representative sample of Swedish residents who had their first child between 1992 and 1998, and were active on the labor market two years prior to childbirth. The specification contains calender year dummies, age difference, and pre-child controls for differences in income and education. The data cover the period 1987–2005, since this is the period of coverage for the in-patient care data. Estimated for couples with at most two children.

Panel a) in Figure 5 depicts how the effect of parenthood 10 years after the birth of the first child varies with the mother's pre-child income. Figure 5 reveals a negative relation between the mother's pre-child income and the effect of parenthood 10 years after the first child is born. We have chosen the range of the horizontal axis to represent the range of the empirical distribution of mothers' pre-child incomes, with almost all the mass between 50,000 and 400,000 SEK measured in 2008 prices (approximately between \$6,300 and \$50,600). As the figure shows, although the relation is negative as expected, the slope is not steep and the relation implies a positive effect of parenthood on the

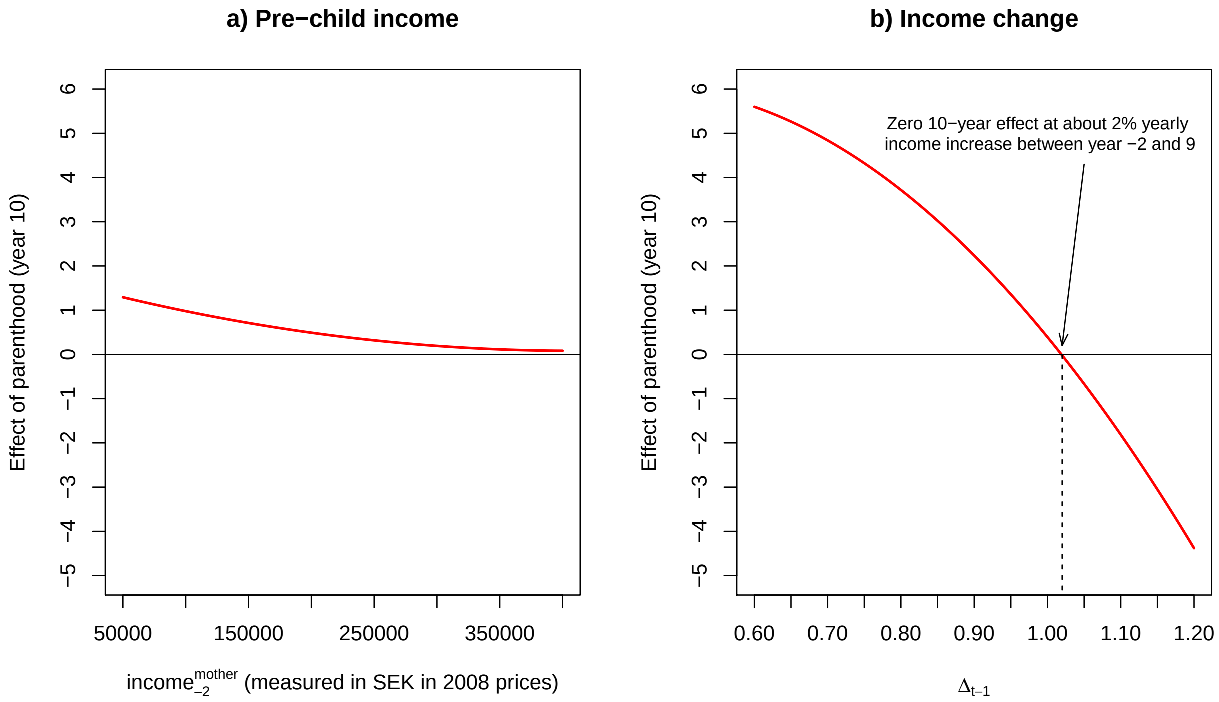

Figure 5: Illustration of how the year 10 effect of parenthood varies with y_{-2}^{mother} and with $\Delta_{j-1} = (y_{j-1}^{mother}/y_{-2}^{mother})^{\frac{1}{j+1}}$, where y_j^{mother} is the mother's yearly income j years after birth. See Appendix C for details. Estimates for panel a) and b) come from the third and fifth columns in Table 4 in Appendix C.

gender gap in sick leave even for mothers in the top of the earnings distribution.

Next, in panel b) in Figure 5, we present how the magnitude of the effect during year 10 varies with the mothers' income trajectories. The income trajectories are the changes in income between two years before giving birth and each year after giving birth. To minimize the mechanical link between sick leave and income, we measure the income the year before we measure the sick leave.

The range of the horizontal axis has been chosen so that it covers most of the empirical distribution of women's income changes for the period starting two years before the birth of the first child and ending nine years after. As seen from the figure, the effect of parenthood varies significantly with the mother's income trajectory. For mothers with the highest income trajectories, the effect of parenthood is even negative. In other words, for mothers that have the best labor market attachment, having a child even decreases the female–male gap in sick leave.

To summarize, a mother's labor market attachment is found to be an important determinant of the effect of parenthood on the gender gap in sick leave. In contrast, although we find some statistical evidence for the importance of mothers' pre-child incomes, the latter is not significant in economic terms.

7 Conclusion

Entering parenthood increases women's sick leave rate in comparison to the corresponding rate for men. The effect is long-lasting and persists for as long as the data allow us to follow the couples: up to 16 years after the birth of the first child. Moreover, we show that the effect estimates are not confounded by later pregnancies. We test for two possible mechanisms that could explain these results.

First, we find no support for a deterioration of health among women after entering parenthood. Instead, we find some evidence for the opposite, namely that in the long run, the mothers' hospitalization rate decreases somewhat relative to that of the fathers. This result supports either the idea of Paringer (1983) that households invest in the health of the main household producer, and/or the role enhancement theory.

We find some weak evidence that the effect of parenthood on sick leave varies across women with different pre-birth incomes. This result supports the idea that, depending on their income, women face different opportunities to reconcile their commitments to home and to work on the labor market. This in turn affects their incentives for using the sickness insurance.

However, we find a much more significant factor for the magnitude of the effect, namely mothers' income trajectories since childbirth. Many mothers change their intensive-margin labor supply due to parenthood, particularly in Sweden, where a lower labor supply from parents is indirectly encouraged by the flexible and generous parental leave system. We find that a mother's income trajectory since giving birth is strongly related to the magnitude of the effect: the less favorable the income trajectory, the higher the effect of parenthood on the sick leave gap. Mothers' labor supply is measured one year prior to sick leave, and, thus, this result suggests that the lower labor supply induces an increase in sick leave rather than the other way round. Our interpretation of this result is that a lower labor supply induces a lower threshold for using the sickness insurance.

References

Allen, S. G. (1981). "An empirical model of work attendance," *Review of Economics and Statistics* 63(1), 77–87.

Åkerlind, I., K. Alexandersson, G. Hensing, M. Leijon, and P. Bjurulf (1996). "Sex differences in sickness absence in relation to parental status," *Scandinavian Journal of Public Health* 24(1), 27–35.

Angelov, N., P. Johansson, E. Lindahl, and E.-A. Lindtröm (2011). "Kvinnors och mäns sjukfrånvaro,"IFAU report 2011:2.

Angelov, N., P. Johansson, and E. Lindahl (forthcoming). "Parenthood and the Gender Gap in Pay," *Journal of Labour Economics*, forthcoming 2016.

Angrist, J. D., and W. N. Evans (1998) "Children and their parents' labor supply: Evidence from exogenous variation in family size," *American Economic Review* 88(3), 450–477.

Arrelöv, B., C. Edlund, and H. Goine, (2006) "Grindvakterna och sjukförsS̈jukförsäkring, kulturer och attityder."E. Palmer (ed.) Försäkringskassan analyserar 2006:16.

Bago d'Uva, T., O. O'Donnell, and E. van Doorslaer (2008a), "Differential health reporting by education level and its impact on the measurement of health inequalities among older Europeans," *International Journal of Epidemiology* 37(6), 1375–1383.

Bago d'Uva, T., E. van Doorslaer, M. Lindeboom, and O. O'Donnell (2008b). "Does reporting heterogeneity bias the measurement of health disparities?" *Health Economics* 17(3), 351–375.

Baker, M., M. Stabile, and C. Deri (2004). "What do self-reported, objective, measures of health measure? *Journal of Human Resources* 39(4), 1067–1093.

Baxter, J., B. Hewitt, and M. Haynes (2008). "Life course transitions and housework: Marriage, parenthood, and time on housework," *Journal of Marriage and Family* 70, 259–272.

Booth, A. L., and J. C. Van Ours (2005). "Hours of work and gender identity: Does part-time work make the family happier?" CEPR Discussion Paper No. 5438, Center for Economic Policy Research, London.

Boschini, A., C. Håkansson, Å. Rosén, and A. Sjögren (2011). "Trading off or having it all? Completed fertility and mid-career earnings of Swedish men and women," IFAU Working paper 2011:15.

Boye, K. (2008) "Happy hour? Studies on well-being and time spent on paid and unpaid work," Swedish Institute for Social Research Dissertation Series No. 74.

Bratberg, E., S. Å. Dahl, and A. E. Risa (2002). "The double burden—Do combinations of career and family obligations increase sickness absence among women?" *European Sociological Review* 18, 233–249.

Broström, G., Johansson, P. and Palme, M. (2004) "Economic incentives and gender differences in work absence behavior"Swedish economic Policy Review, vol 11, s. 33-63.

Burda, M., D. Hamermesh, and P. Weil (2008). "The distribution of total work in the EU and US." In: T. Boeri, M. Burda, and F. Kramarz (eds.), *Working Hours and Job Sharing in the EU and USA: Are Europeans Lazy? Or Americans Crazy?* Oxford University Press.

Englund, L. (2001). "Förändringar i distriktsläkarnas sjukskrivningspraxis mellan åren 1996 och 2001 i ett svenskt landsting." Falun: Centrum för Klinisk Forskning Dalarna.

Engström, P., P. Hesselius, and M. Persson (2007). "Excess use of Temporary Parental Benefit," IFAU Working Paper 2007:18.

Evertsson, M., and M. Nermo (2007). "Changing resources and the division of housework: A longitudinal study of Swedish couples," *European Sociological Review* 23, 455–470.

EurWORK (2010). "European Foundation for the Improvement of Living and Working Conditions" European Observatory of Working Life.

Gauthier, A., and F. F. Furstenberg, Jr. (2002). "The transition to adulthood: A time use perspective," *The Annals of the American Academy of Political and Social Science*, Vol. 580, 153–171.

Gjerdingen, D. K., and B. A. Center (2005). "First-time parents' postpartum changes in employment, childcare, and housework responsibilities," *Social Science Research* 34, 103–116.

Jacobsen, J. P., P. J. Wishart, and J. L. Rosenbloom (1999). "The effects of child-bearing on married women's labor supply and earnings," *Journal of Human Resources* 34(3), 449–474.

Johansson, P., and M. Palme (1996). "Do economic incentives affect work absence? Empirical evidence using Swedish micro data," *Journal of Public Economics* 59, 195–218.

Johansson, P., and M. Palme (2005). "Moral hazard and sickness insurance," *Journal of Public Economics* 89, 1879–1890.

Kennerberg, L. 82009) "Hur förändras kvinnors och mäns arbetssituation när de får barn? " Rapport 2007:9, IFAU.

King G, Murray CJL, Salomon J, Tandon A. Enhancing the validity and cross-cultural comparability of measurement in survey research. American Political Science Review. 2004;98:184Ũ191

Kapteyn, A., J. P. Smith, and A. van Soest (2007). "Vignettes and self-reports of work disability in the United States and the Netherlands." *American Economic Review* 97(1), 461–473.

Mastekaasa, A. (2000). "Parenthood, gender and sickness absence," *Social Science & Medicine* 50, 1827–1842.

OECD (2009), "Sickness, disability and work, keeping on track in the economic downturn." Background paper. High-level forum, Stockholm, 14–15 May 2009.

OECD (2010a) "How good is part-time work?", Chapter 4 of *Employment Outlook: Moving Beyond the Job Crisis.*

OECD (2010b), "Gender Brief", OECD Social Policy Division.

Paringer, L.(1983) "Women and absenteeism: Health or economics?," *American Economic Review papers and proceedings* 73(2), 123–127.

Persson, M. (2011) "Substitution between temporary parental leave and sickness absence," IFAU Working Paper 2011:19.

Rieck, M., K. Elseth, and K. Telle (2013). "Sick leave before, during and after pregnancy," *Acta Sociologica* 56, 117–137.

Sanchez, L., and E. Thomson (1997). "Becoming mothers and fathers: Parenthood, gender, and the division of labor," *Gender and Society* 11, 747–772.

SCB (2009) "Tid för vardagsliv — Kvinnors och mäns tidsanvändning 1990/91 och 2000/01," Levnadsförhållanden, report 99 Statistiska Centralbyrån.

SFS (1995) Svensk författningssamling: Föräldraledighetslagen 1995:584.1995:584.

SOU (2004) Den könsuppdelade arbetsmarknaden, SOU 2004:43. Statens offentliga utredningar.

Stewart, W. F., J. A. Ricci, E. Chee, and D. Morganstein (2003). "Lost productive work time costs from health conditions in the United States: Results from the American Productivity Audit." *Journal of Occupational Environmental Medicine* 45(12), 1234–1246.

Tichenor, V. J. (1999). "Status and income as gendered resources: The case of marital power," *Journal of Marriage and Family* 61, 638–650.

U.S. Bureau of Labor Statistics (2008). *American Time Use Survey,* U.S. Department of Labor, USDL-09-0704.

U.S. Bureau of Labor Statistics (2011) *Women in the Labor Force: A Databook.* U.S. Department of Labor, Report 1034, December 2011.

Van der Lippe, T., and J. Siegers (1994). "Division of household and paid labor between partners: Effects of relative wage rates and social norms," *Kyklos* 47: 109–136.

Appendix A: Identification strategy

Let $\{S_{jct}(1)\}_{t=1}^{T}, j = f, m,$ be the potential sick leave process after becoming a parent and let $\{S_{jct}(0)\}_{t=1}^{T}, j = f, m$ be the corresponding potential sick leave process if not becoming a parent. f denotes the father and m the mother, $t > 0$ is the time period after parenthood and c is calendar time. The estimand of interest is

$$\alpha_t = E\left\{\widetilde{Z}_{ct}|\text{parent}\right\}, t > 0,$$

where

$$\widetilde{Z}_{ct} = (S_{fct}(1) - S_{mct}(1)) - (S_{fct}(0) - S_{mct}(0)). \tag{2}$$

The interest is, thus, in estimating the effect for those who become parents.

We have data at calendar time $c = 1986 - 2008$ and we observe couples becoming parents at different calender times $c_i^* = 1992, ..., 1998$. This variation means that we observe the same couples before and after the child birth. Since we sample parents $i = 1, ..., n$ at different calender times $S_{ifct}(1) - S_{imct}(1)$ is observed:

$$S_{ifct}(1) - S_{imct}(1) = \widetilde{s}_{ic},\ t > 0 \text{ if } c > c_i^*.$$

The challenge therefore consists in estimating the within-couple differences in sick leave in the absence of a child. In order to estimate this sequence we assume that the gender difference in sick leave in the absence of a child is additively separable in a business cycle or calendar time effect, θ_c, and a idiosyncratic term ω_{ic}, hence

$$S_{ifct}(0) - S_{imct}(0) = \theta_c + \omega_{ic}.$$

It is reasonable that the time period couple i have there first born, t_i, is independent of the overall trends and cycles of gender differences in sick leave. This means that we can estimate θ_c using the still-to-be parents in our sample. The implication is that α_t

can be estimated using the following regression model:

$$\widetilde{s}_{ic} = \sum_{\tau=1}^{T} \alpha_\tau 1[(c - c_i^*) = \tau] + \theta_c + \omega_{ic}, c = 1988, ..., 2008, \tag{3}$$

where $\widetilde{s}_{ic} = s_{ifc} - s_{imc}$, and $1[\cdot]$ is the indicator function which takes the value one when the expression within the parenthesis is true and zero otherwise.

Our identification assumption is that the timing of parenthood should not be based on parents' unobserved expectations of shocks to the gender gap in sick leave in the absence of a child, or equivalently, that the error terms are idiosyncratic. Note that it takes on average 9 months from conception to birth and, also, that the timing of parenthood could be distorted due to miscarriages and fertility problems. This means that if the couples having a child at c_i^* were optimizing on ω_{ic} for $c < c_i^*$, we can test the maintained assumption by checking whether there is a trend with respect to time to birth in the residuals $\widehat{\omega}_{ic}$ for $c < c_i^*$.

Appendix B: Estimation results for in-patient care

Table 3: In-patient care and sick leave.

	In-patient care	Sick leave
intercept	0.000739	0.110***
	(0.00390)	(0.0292)
pregnancy (1st child)	0.609***	1.740***
	(0.00442)	(0.0412)
year 1 (1st child)	0.0241***	-0.207***
	(0.00395)	(0.0340)
year 2 (1st child)	-0.0192***	-0.0688
	(0.00328)	(0.0429)
pregnancy (2nd child)	0.425***	2.045***
	(0.00454)	(0.0580)
year 1 (2nd child)	-0.00857	-0.404***
	(0.00480)	(0.0510)
year 2 (2nd child)	-0.0225***	-0.142*
	(0.00387)	(0.0605)
year 3	-0.0191*	0.243*
	(0.00957)	(0.0980)
year 4	-0.0118	0.360***
	(0.00930)	(0.0958)
year 5	-0.0223***	0.301***
	(0.00581)	(0.0774)
year 6	-0.0143*	0.346***
	(0.00594)	(0.0799)
year 7	-0.0253***	0.428***
	(0.00652)	(0.0886)
year 8	-0.0253***	0.524***
	(0.00619)	(0.1000)
year 9	-0.0215***	0.558***
	(0.00646)	(0.115)
year 10	-0.0157*	0.647***
	(0.00725)	(0.132)
year 11	-0.0220**	0.671***
	(0.00830)	(0.147)
year 12	-0.0136	0.878***
	(0.00740)	(0.165)
year 13	-0.00191	0.990***
	(0.00875)	(0.192)
year 14	-0.00364	0.921***
	(0.00952)	(0.238)
N	3,309,312	3,309,312
R^2	0.026	0.012

Notes: Standard errors are clustered at couple level but suppressed for conciseness. Significance levels are denoted by * (p<0.05), ** (p<0.01), and *** (p<0.001). Both specifications contain calender year dummies, age difference, and pre-child controls for differences in income and education. The data cover the period 1987–2005, since this is the period of coverage for the in-patient care data. Estimated for couples with at most two children.

Appendix C: Results on the role of economic incentives

In the following, we present the heterogeneous effects depending on a mother's pre-birth income and her income trajectory after the birth of the first child, based on the discussion in Section 6.2. The results are presented in Table 4. In order to have a reasonable measure of a mother's income trajectory, the estimates in Table 4 are based on a sample where the mother's pre-birth income at $t = -2$ is higher than 50,000 SEK (approximately \$6,300), measured in 2008 prices. The first column presents estimates from the baseline specification for this sample with the full set of controls. The estimates are close to the case with the full sample: for instance, the year 10 effect of parenthood is estimated to be 0.642 sick days/month and the corresponding number for the baseline sample is 0.640 (see Table 2).

The rest of Table 4 presents a heterogeneity analyses with respect to mothers' pre-child incomes (column 2), mothers' pre-child incomes in level and squared (column 3), mothers' income trajectories since before giving birth in levels (column 4), and in levels and, in order to take the functional form assumption into account, squared (column 5).[15] Below, we discuss the results in columns 3 and 5, which both contain levels as well as squares of the interaction variables.

First, consider column 3 in Table 4, where we empirically investigate whether the magnitude of the effect varies with a second-degree polynomial in the mother's pre-birth income level. Generally, the point estimates for the interaction term between the effect of parenthood and the mother's pre-child income have the expected negative sign, and some are statistically significant. For a particular year t after childbirth, these are the effects denoted by year $t \times y_{-2}^{mother}$, where y_{-2}^{mother} is the income of the mother two years before childbirth, in Table 4. The estimates are very small (see also the graphical representation in Section 6.3.2). The point estimates for the interaction between the effect of parenthood and the mother's pre-child income squared are statistically insignificant.

[15] We have also estimated "non-parametric" models, in which the pre-child incomes are included as factors in which the groupings are made on income quintiles. The results from this estimation are qualitatively the same as the results obtained from this parametric specification. The main advantage of the parametric specification is that it makes the presentation of the results easier.

These parameters are denoted by year $t \times (y_{-2}^{mother})^2$ in Table 4. Panel a) in Figure 5 in the main text is based on column 3 in Table 4: the baseline year 10 effect estimate of 1.654, the estimate of the interaction between pre-child income level and the year 10 effect of -0.00000770, and the estimate of the interaction between pre-child income squared and the year 10 effect of 9.43e-12.

Looking at our second hypothesis, namely, whether the effect of parenthood is larger for mothers with a low income trajectory, we check whether the magnitude of the effect of parenthood t years after childbirth varies with a mother's income trajectory between year -2 (i.e., two years before giving birth) and year $t-1$ (i.e., the year before we measure the sick leave). The results from this analysis are presented in column 5, where we have included the level as well as the square of the interaction variable defined in terms of an income ratio. The interaction terms with the level year $t \times (\Delta_{t-1})$, where $\Delta_{t-1} = y_{t-1}^{mother}/y_{-2}^{mother}$, and square year $t \times (\Delta_{t-1})^2$ of the interaction variable are both statistically and economically significant, for all years. Panel b) in Figure 5 in the main text is based on column 5 in Table 4: the baseline year 10 effect estimate of 2.562, the estimate of the interaction between Δ_9 and the year 10 effect of 15.91, and the estimate of the interaction between pre-child income squared and the year 10 effect of -18.08. The empirical distribution of Δ_9 also contains a mass at 0, i.e., women that have withdrawn from the labor force in year 9. Those observations are used in the estimation but not shown in the figure; for Δ_9, the value of the effect is estimated to be 2.562.

Table 4: Heterogeneity analysis with yearly effects for the sample of couples where y_{-2}^{mother} >50,000 SEK in order for Δ_{t-1} to be meaningful. ($\Delta_{t-1} = (y_{t-1}^{mother}/y_{-2}^{mother})^{\frac{1}{t+1}}$ with t being time in years since birth.)

		With interaction terms			
	Baseline	y_{-2}^{mother}	$(y_{-2}^{mother})^2$	Δ_{t-1}	Δ_{t-1}^2
intercept	0.0321	0.0335	0.0334	0.0329	0.0322
pregnancy	1.770***	2.355***	2.390***	1.769***	1.756***
year 1	-0.125***	-0.230**	-0.217	-0.126***	-0.139***
year 2	0.347***	0.318**	0.518**	0.342***	0.328***
year 3	0.531***	0.642***	0.742***	0.689***	0.317**
year 4	0.352***	0.545***	0.821***	0.711***	0.424***
year 5	0.304***	0.604***	1.057***	1.383***	0.999***
year 6	0.322***	0.656***	1.131***	2.085***	1.366***
year 7	0.425***	0.778***	1.080***	2.573***	1.523***
year 8	0.471***	0.961***	1.095***	2.854***	1.522***
year 9	0.529***	1.196***	1.467***	3.879***	2.479***
year 10	0.642***	1.300***	1.654***	4.029***	2.562***
year 11	0.695***	1.497***	1.657***	4.146***	2.644***
year 12	0.761***	1.756***	1.746***	4.299***	2.930***
year 13	0.768***	1.488***	1.633***	3.562***	2.312***
year 14	0.821***	1.578***	1.772***	3.216***	2.020***
year 15	0.896***	1.584***	1.733***	3.445***	2.270***
year 16	0.918***	1.186***	1.272*	3.237***	2.145***
year 17	0.930***	1.009*	1.436	1.815*	0.944
pregnancy$\times y_{-2}^{mother}$		-0.00000332***	-0.00000370		
year 1$\times y_{-2}^{mother}$		0.000000634	0.000000503		
year 2$\times y_{-2}^{mother}$		0.000000187	-0.00000204		
year 3$\times y_{-2}^{mother}$		-0.000000623	-0.00000171		
year 4$\times y_{-2}^{mother}$		-0.00000111	-0.00000417*		
year 5$\times y_{-2}^{mother}$		-0.00000173**	-0.00000678**		
year 6$\times y_{-2}^{mother}$		-0.00000194**	-0.00000722**		
year 7$\times y_{-2}^{mother}$		-0.00000206**	-0.00000536*		
year 8$\times y_{-2}^{mother}$		-0.00000287***	-0.00000425		
year 9$\times y_{-2}^{mother}$		-0.00000390***	-0.00000683**		
year 10$\times y_{-2}^{mother}$		-0.00000388***	-0.00000770**		
year 11$\times y_{-2}^{mother}$		-0.00000474***	-0.00000637*		
year 12$\times y_{-2}^{mother}$		-0.00000590***	-0.00000561		
year 13$\times y_{-2}^{mother}$		-0.00000433***	-0.00000581*		
year 14$\times y_{-2}^{mother}$		-0.00000457***	-0.00000662		
year 15$\times y_{-2}^{mother}$		-0.00000420**	-0.00000575		
year 16$\times y_{-2}^{mother}$		-0.00000178	-0.00000260		
year 17$\times y_{-2}^{mother}$		-0.000000688	-0.00000546		
pregnancy$\times (y_{-2}^{mother})^2$			9.11e-13		

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Table 4 – Continued

	Baseline	With interaction terms y_{-2}^{mother}	$(y_{-2}^{mother})^2$	Δ_{t-1}	Δ_{t-1}^2
year 1×$(y_{-2}^{mother})^2$			2.95e-13		
year 2×$(y_{-2}^{mother})^2$			5.47e-12		
year 3×$(y_{-2}^{mother})^2$			2.67e-12		
year 4×$(y_{-2}^{mother})^2$			7.56e-12		
year 5×$(y_{-2}^{mother})^2$			1.25e-11*		
year 6×$(y_{-2}^{mother})^2$			1.31e-11*		
year 7×$(y_{-2}^{mother})^2$			8.15e-12		
year 8×$(y_{-2}^{mother})^2$			3.40e-12		
year 9×$(y_{-2}^{mother})^2$			7.21e-12		
year 10×$(y_{-2}^{mother})^2$			9.43e-12		
year 11×$(y_{-2}^{mother})^2$			4.02e-12		
year 12×$(y_{-2}^{mother})^2$			-7.46e-13		
year 13×$(y_{-2}^{mother})^2$			3.73e-12		
year 14×$(y_{-2}^{mother})^2$			5.25e-12		
year 15×$(y_{-2}^{mother})^2$			3.98e-12		
year 16×$(y_{-2}^{mother})^2$			2.09e-12		
year 17×$(y_{-2}^{mother})^2$			1.24e-11		
year 3×Δ_{t-1}				-0.216*	2.085***
year 4×Δ_{t-1}				-0.470***	1.374***
year 5×Δ_{t-1}				-1.290***	1.498**
year 6×Δ_{t-1}				-2.016***	4.229***
year 7×Δ_{t-1}				-2.412***	7.604***
year 8×Δ_{t-1}				-2.653***	11.44***
year 9×Δ_{t-1}				-3.682***	12.91***
year 10×Δ_{t-1}				-3.723***	15.91***
year 11×Δ_{t-1}				-3.796***	19.04***
year 12×Δ_{t-1}				-3.894***	19.42***
year 13×Δ_{t-1}				-3.122***	21.31***
year 14×Δ_{t-1}				-2.720***	23.76***
year 15×Δ_{t-1}				-2.902***	24.19***
year 16×Δ_{t-1}				-2.673***	21.75***
year 17×Δ_{t-1}				-1.190	18.73***
year 3×Δ_{t-1}^2					-2.020***
year 4×Δ_{t-1}^2					-1.643***
year 5×Δ_{t-1}^2					-2.484***
year 6×Δ_{t-1}^2					-5.594***
year 7×Δ_{t-1}^2					-9.004***
year 8×Δ_{t-1}^2					-12.76***
year 9×Δ_{t-1}^2					-15.16***
year 10×Δ_{t-1}^2					-18.08***
year 11×Δ_{t-1}^2					-21.20***

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Table 4 – Continued

	Baseline	With interaction terms y_{-2}^{mother}	$(y_{-2}^{mother})^2$	Δ_{t-1}	Δ_{t-1}^2
year 12×Δ_{t-1}^2					-21.79***
year 13×Δ_{t-1}^2					-23.01***
year 14×Δ_{t-1}^2					-25.08***
year 15×Δ_{t-1}^2					-25.72***
year 16×Δ_{t-1}^2					-23.23***
year 17×Δ_{t-1}^2					-19.06***
N	4,319,772	4,319,772	4,319,772	4,319,772	4,319,772
R^2	0.008	0.008	0.008	0.014	0.024

Notes: Standard errors are are clustered at couple level but omitted for conciseness. Significance levels are denoted by * (p<0.05), ** (p<0.01), and *** (p<0.001). The regressions include calender year dummies, age difference, and pre-child controls for differences in income and education.