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PATERNITY LEAVE AND FAMILY OUTCOMES

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Abstract

The received literature documents that reserving parental leave time for fathers has been effective in increasing fathers' use of parental leave. However, whether paternity leave affects the families' decisions in any other way is still not clear. This paper exploits reforms extending the Norwegian father quota as natural experiments, and estimates causal effects of a more substantial length of paternity leave than previously studied. We find that fathers extend their leave use as more leave days are reserved for them. Yet, there is no evidence that extended parental leave use by fathers alters the traditional gender norms at home. Specifically, we find no effects on parents' earnings or working hours, which suggests no shift from market work to home production by fathers, nor a shift in the other direction by mothers. To measure parents' involvement at home, we look at absence from work due to own illness, as well as a child's illness. These measures are both unaffected by extended leave use by fathers. Moreover, there is no evidence that extended parental leave use by fathers contributes to narrowing the gender gap in income. However, extending the father-exclusive leave period comes at a non-negligible cost to the society. Taken together, this points to the conclusion that continuing expansions of the father quota needs to be justified by arguments other than the commonly used claim, that the father quota works as a policy instrument for gender equality.

JEL Classification: D13; H31; J13; J16; J18; J22
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1 Introduction

Most western countries have national policies that offer mothers paid leave from work to stay home and take care of a newborn child for at least some weeks (with the US as a rare exception). While several countries offer paid parental leave, meaning that paid leave is available to both parents, mothers are still considered the main caregivers of the family. In recent years, however, a growing number of countries have introduced policies aimed at encouraging fathers' use of parental leave, such as a "father quota" that reserves parental leave time for fathers' use exclusively. As a pioneering country, Norway introduced a father quota in 1993 that earmarked four weeks of parental leave time for fathers. Many countries have followed this example and implemented similar policies.[1] In fact, the European Union encourages its member states to enact policies promoting a more gender-equal split of the parental leave by mandating at least one month of parental leave for each parent to be provided on a non-transferable basis (Council of European Union, 2010).

The contribution of this paper is two-fold. First, we estimate the causal effects on fathers' use of parental leave and on later outcomes, when the exclusive leave period is extended to a more substantial length than has been previously studied. While reserving parental leave time for fathers has been shown to increase fathers' leave use, most of the empirical evidence on paternity leave to date rely on identification based on reforms reserving only a few weeks of the total parental leave time for fathers. It might not be surprising that reserving only a short period of leave for fathers had no clear impact on parents' long-term behavior. When discussing the literature on how paternity leave may affect mothers' career, Olivetti and Petrongolo (2017) conclude that the relatively recent introduction of reforms that enable causal estimation of potential effects imply that empirical evidence in this area is still in its infancy.

Second, this paper sheds light on and adds to the knowledge of how parental leave use by fathers affects their families. While the main intentions of a father quota are often stated as to facilitate father-child bonding, to increase fathers' long-term involvement in childcare and at home, and to promote gender equality, the literature offers no clear consensus on how paternity leave impacts families in the longer run.

The belief that paternity leave will increase fathers' long term involvement in childcare and, more generally, in household work can be explained by at least two mechanisms. First, fathers may simply want to invest more time in the child, as staying home in the

[1] For instance, Sweden introduced a "daddy-month" in 1995 that has later been expanded, and the 2007 reform of the German parental leave scheme included two bonus months of parental leave given to the parents, conditioned on the father using at least some parental leave. On the more extreme end, in Iceland the parental leave period is split into two equal parts reserved for each parents.

child's early years strengthens father-child bonding. The second mechanism is a classical Becker argument. Taking a larger share of the parental leave period may make it easier for the father to be more involved in household work as it will decrease the mother's specialization and relative advantage in home production (Becker, 1985, 1991).

Furthermore, reserving parental leave time for fathers has been motivated as a policy instrument for gender equality, as a more gender-equal home environment may improve gender equality elsewhere. A core topic of the gender equality discussion is that, although the labor force participation of women has increased substantially over the last decades and the difference in educational achievement between men and women has largely disappeared, an income gap between men and women still persists. To a large extent, at least for the Nordic countries, the remaining gender gap has been explained by the family gap in income, or the so-called child penalty, i.e. that women who enter parenthood experience an immediate drop in income and do not seem to fully recover throughout their career. Using a large panel of the Danish population, Kleven et al. (2018) document that the long-term child penalty is close to 20% for women, and conclude that this child penalty is in fact the primary cause of the remaining gender gap in income. The child penalty for women has historically been explained by factors including education, occupational choice, work experience, and time out of the labor force.[2] Recently, however, unequal split of family responsibilities by gender has been pointed to as the main explanation, see e.g. Angelov et al. (2016) and Gupta and Smith (2002). In addition, the generous parental leave policies in the Nordic countries have been suggested as creating a glass ceiling hindering women's career progression, see Gupta et al. (2008), Albrecht et al. (2003), and Albrecht et al. (2015).

If fathers take a larger share of the work at home, this might improve mothers' opportunities in the labor market. Taking a long time off work to care for small children might be harmful for a mother's labor market attachment as it decreases her work-related human capital (Gupta et al., 2008). When the father takes some of the parental leave period, the mother will first of all be able to return to work earlier.[3] Additionally, if a father takes more responsibilities and a larger share of the household work also later in the child's life, this will free some time for the mother to spend on market work. It is also conceivable that discrimination of women in the labor market may be reduced in the longer run, if potential employers no longer expect young women to have long birth-related absence from work, or rather, expect men and women to split both the parental leave period and later household work more equally.

Due to endogeneity in the use and takeup of parental leave by fathers, estimating

[2] See Anderson et al. (2002, 2003).

[3] See Albrecht et al. (1999) for a study on career interruptions and labor market outcomes.

causal effects of fathers' leave taking is not straightforward. Families in which the father takes parental leave may be very different from families in which the father takes no, or less, leave. In this paper, we solve the endogeneity problem by exploiting reforms that extended the father-exclusive leave period. Since the first Norwegian father quota of four weeks was introduced in 1993, the length of the quota has been extended five times, up to 14 weeks in 2013. We assess the extensions in 2005, 2006, and 2009. The first two extensions added one week each to the quota, while the 2009 extension, our main focus in this paper, was a larger extension that added four weeks, resulting in a quota of ten weeks.

Eligibility for the new rules were based on the child being born after a specific date, and since the date of birth may be seen as random around the reform date, causal effects of paternity leave are estimated using a regression discontinuity framework. Treated families, i.e. families with children born just after the reform date, are compared to untreated families who have children born just before the reform date. Along with unique and extensive individual level data on all newborns and their parents, this enables causal estimation of the effects of extended parental leave use by fathers.[4]

Our first question looks at how extending the father quota affects fathers' leave taking behavior. Here we assess both a binary indicator for whether the father takes any leave at all, and the number of days spent on parental leave by both parents.[5] We then go on to assess the main question; how, or whether, extended parental leave use by fathers affect the division of work between the parents and the pay gap between parents. Since time spent at home and the division of household work among the parents are not observed, we study the time spent doing market work and annual labor income of both parents. If taking time off with the child at an early age induces fathers to participate more at home later in the child's life, i.e. shift time from market work to home production, we expect to observe a decrease in time spent doing market work and/or in labor income. For the mother, we may expect the opposite effect, as having a partner who spends more time at home and takes relatively more responsibilities in household work will free some time for the mother to spend doing market work.

To measure involvement at home we use parents' absence from work related to own illness, aa well as to a child's illness. Parents' absence days to stay home and take care of a sick child is a direct, though not complete, measure of home involvement.[6] Sickness

[4]In a competing working paper, Hart et al. (2016) also study the 2009 extension of the Norwegian father quota. However, this paper differs both in that we include the earlier extensions as well, and in that we look at a richer set of outcome variables.

[5]The binary indicator is more interesting for fathers, as close to all mothers take at least some parental leave.

[6]A similar measure is used by Ekberg et al. (2013) to measure effects on parents' involvement at home as response to the daddy-month in Sweden.

absence due to own illness could give us another dimension of involvement at home. Although sickness absence is meant to compensate for own illness, there is evidence of the insurance system being used to compensate for a demanding life situation or for social reasons, see e.g Markussen et al. (2011) and Carlsen (2008). Moreover, the gender gap in sickness absence has been shown to increase within a couple after a child is born, and one of the suggested explanations to this is the fatigue and exhaustion that follows the double-burden, explained by the conflict between market work and the work needed at home.[7] In this regard one can imagine a mother's sickness absence being reduced if the father of the child takes a larger share of the household work, and, potentially, that the father's sickness absence increase as his double-burden gets more stressful.

In relation to the gender equality discussion, and especially the explanation that an unequal split of family responsibilities is the driving force behind the family gap in income, it is interesting to see whether policies generating stronger incentives for extended use of parental leave by fathers has any impact on the gender gap in income. We shed light on this by estimating the effects of extended use of parental leave by fathers on the within-couple pay gap, measured as the mother's share of total household income.

Our first finding, in line with previous literature, is that extending the length of the father quota clearly leads to increased parental leave use by fathers. While the initial quota introduced in 1993 led to a sharp jump in the share of fathers taking leave, the later extensions did not alter the up-take rate substantially (about 70% of all fathers take at least some parental leave throughout the period). However, around each reform, the jumps in the average number of leave days used by fathers closely coincide with the increase in the length of the quota.

Focusing on the largest extension reform in 2009 that extended the father quota from six to ten weeks, though the results hold for the earlier extensions as well, we do not find evidence of neither a shift of time from market work to home production by fathers, nor a shift in the opposite direction for mothers. Our measures of home involvement, i.e. parents' work absence due to own illness and due to the child's sickness, are also unaffected. Additionally, the gender gap in pay within a couple does not seem to be affected by extended use of parental leave by fathers. To gain confidence in the results, a number of robustness checks are reported.

Finally, an important part of evaluating a welfare program is to look at potential benefits in relation to the costs that the program entails. We shed light on this by looking at the direct costs incurring by the extensions, as well as potential indirect costs and benefits, measured by parents' future tax payments and welfare benefits received.

[7] Of course, the observed increase in sickness absence for new mothers could also be explained by postpartum depression and birth related injuries.

Our analysis show that the expansions are costly for the society, suggesting that other aspects than the gender equality argument should motivate continuing expansions of the non-transferable quota.

This paper proceeds as follows. Section 2 discusses related literature. The institutional background and details on the reforms are provided in Section 3. The data are described in Section 4, and the identification strategy is explained in Section 5. The empirical results are presented in Section 6, and Section 7 concludes.

2 Related Literature

Since in practice the mother has historically been the parent taking the entire parental leave period, naturally the empirical literature has focused on the effects of mothers staying at home.[8] The literature on the effects of paternity leave has been more sparse. Establishing causal effects of paternity leave has been hard due to several reasons. First of all, traditionally, fathers have not taken much parental leave, and second, fathers, or *families* in which the father does take parental leave, are typically very selected groups. In recent years, however, the literature on the effects of paternity leave has started to grow, as introduction of new policies such as father quotas have enabled estimation of causal relationships. Most of the empirical evidence up to this date come from the Nordic countries, but evidence from other countries are growing rapidly. In general, the existing empirical literature shows that reserving parental leave time for fathers has been effective in increasing parental leave use by fathers. The share of Norwegian fathers taking any leave at all increased from about 3% to almost 30% over-night when the first quota was introduced, and continued to increase over the following years (Rege and Solli, 2013; Dahl et al., 2014; Cools et al., 2015).[9] Ekberg et al. (2013) find a similar effect on the uptake of Swedish fathers, and studies also from outside Scandinavia suggest that parental leave use by fathers increases when incentives are provided. See Geisler and Kreyenfeld (2012) and Kluve and Tamm (2013) for Germany, Farré and González (2017) for Spain, Patnaik (2018) for Québec, Canada, and Bartel et al. (2018) for California. There is also evidence of heterogeneity among families, for instance, father of sons and fathers of first-borns take more leave (Bartel et al., 2018), and fathers with higher socio-economic status tend to take more leave (Huerta et al., 2013).

Whether paternity leave induces fathers to be more involved at home and invest more time in the child remains uncertain. While some studies in fact do suggest that reserving parental leave time for the father affects fathers' behavior also after the leave

[8]See Blau and Currie (2006) or Gregg and Waldfogel (2005) for a review of the literature on maternal leave.

[9]In addition, Dahl et al. (2014) find evidence on substantial peer effects between fathers in the same workplace and in family networks.

period, other studies do not support this relationship. For instance, Nepomnyaschy and Waldfogel (2007) use survey data from the US, and their findings, although not necessarily reflecting a causal relationship, suggest that fathers who take more parental leave are more involved in childcare activities later on. With a more convincing identification strategy, Kotsadam and Finseraas (2011) study the Norwegian 1993 reform and find evidence that paternity leave alters the division of household work within the family, in that parents affected by the reform are more likely to divide household chores equally. Similarly, Rege and Solli (2013) find a negative impact on fathers' future earnings, suggesting that fathers shift time from market work to spending time at home. Also, a recent working paper using a reform in Québec as identification, find strong evidence that paternity leave leads to a more equal contribution by parents in both home and market production (Patnaik (2018)). On the other hand, Cools et al. (2015) find no evidence that the Norwegian 1993 reform affected the allocation of parents' labor supply. Similarly, evaluating the Swedish 1995 reform, Ekberg et al. (2013) find no behavioral effects when they look at parents' sick leave for sick children and parents' long-term wages and employment, and Kluve and Tamm (2013) find no significant effect of parental leave on fathers' time devoted to childcare in Germany. Finally, in a recent working paper from Spain, Farré and González (2017) find no effects on parents' long-term employment outcomes.

Other effects of paternity leave have been studied. For instance, Farré and González (2017) document a drop in higher order fertility after a father quota was introduced in Spain. Others study the effects on child outcomes, for instance Cools et al. (2015), who documents positive effects on children's school performance. Moreover, some studies have estimated the effects of paternity leave on gender norms and attitudes towards gender equality. Kotsadam and Finseraas (2011) document that parents affected by the Norwegian 1993 reform report a lower conflict level over the division of household work, and Kotsadam and Finseraas (2013) estimate a reduction of the gender gap in household work among adolescents affected by the 1993 reform.

3 Background

3.1 The Norwegian Parental Leave System

Parental leave has been a long-running important political issue in Norway. Maternity leave for mothers of newborns was introduced as early as 1909. The modern parental leave scheme dates back to 1977, when a comprehensive reform was carried out. Most importantly, full earnings compensation was grant for those on leave, the leave period was increased to 18 weeks in total, and parents were from now on free to split most of the leave period between them as they chose.[10] Since 1977 the parental leave period has been extended several times.[11] Even if parents were free to split the leave period, very few fathers used this opportunity. Several fathers took a few days off to stay with the mother and child immediately after birth. Beyond that, the entire parental leave period was, in practice, used by mothers.

To strengthen fathers' responsibilities in childcare, increase father-child bonding and promote gender equality, a father quota was introduced in the parental leave system on April 1, 1993. The total leave period was extended by seven weeks, where four of these weeks were reserved for fathers' use exclusively, meaning that the parents would lose these weeks if the father did not use them. As Table 1 shows, the father quota has been extended several times since the initial introduction, up to a maximum of 14 weeks in 2013. Since 2009 the parental leave period has been threefold; one part reserved for the mother (in 2009, nine weeks in addition the six weeks immediately following birth), one part for the father, and the remaining weeks for the parents to share. The main focus in this paper will lie on the extension that happened in 2009, where four weeks was added to the already six weeks long quota, but the extensions in 2005 and 2006 will also be explored.

The parental leave system covers the entire working population, and as the rules are relatively simple and easily accessible, it is reasonable to assume that all expectant parents are well informed about the current rules governing the system. Parents must inform their employer and submit a joint application to a Labor and Welfare Administration (NAV) office to qualify for the benefits.[12] In general, eligibility for parental leave is determined on the basis of each parent's labor market participation. Specifically, the requirement states that a parent is eligible for parental leave benefits if he or she earned pensionable income in at least six out of the ten months prior to birth. However, for a father to be eligible for the father quota, the mother needs to meet the work requirement.[13] The system offers full job protection and an earnings replacement rate of 100% up to a ceiling of six times the basic amount (G).[14,15] In addition, several employers (e.g. all workers

[10] The length of the paid parental leave period that parents could split was 12 weeks. The remaining six weeks (the weeks immediately following birth) was for medical reasons reserved for the mother.

[11] See Carneiro et al. (2015) for details.

[12] The deadline for the application varies depending on the case processing time at the local NAV office, but it is usually eight to ten weeks before starting the parental leave period.

[13] There are further restrictions to the mothers activity when the father uses the general parental leave period, i.e. she needs to work or be under education.

[14] The basic amount is adjusted each year, and amounts to 92,576 NOK (about 11,500 USD) in year 2016.

[15] Before year 2000, earnings replacement was based on the mother's earnings. After July 1st this year, the father's own previous earnings creates the basis for payment when on leave. As can be seen in Figure 2, there is a small, but visible jump in the average number of leave days taken by fathers around the year 2000.

employed by the state) top-up the payments when the earnings threshold is exceeded.

Similarly for all the reforms, they had no retroactive effect. Eligibility for the new rules were determined based on the birth date of the child, e.g. fathers of children born before July 1, 2009 were eligible for the exclusive use of six weeks of parental leave by the quota, and fathers of children born after July 1, 2009 were eligible for four additional weeks, that is, ten weeks in total.

Figure 1 shows the uptake rate of parental leave by fathers over time. As shown in the figure, the initial reform in 1993 led to a sharp increase in the fraction of fathers taking leave. While only about 3% of all fathers took any leave at all before the reform, this number increased to about 30% over night, and continued to rise over the years. However, after a while it seems to stabilize at around 70%, and we do not see similar jumps around the later reforms. Figure 2 shows fathers' average leave days over the period, with evident jumps in the average number of leave days around each extension reform.

The rest of this paper focuses primarily on the 2009 extension, but results for the main outcomes are shown for the reforms in 2005 and 2006 in the Appendix.[16] The main reason for focusing on the 2009 reform is that it extended the length of the father quota to a substantial period of ten weeks. In addition, while in the 2005 and 2006 reforms the one week added to the quota was compensated by extending the total parental leave period by one week, the four weeks added to the quota in 2009 were not compensated by the same number of weeks added to the total leave period. This means that in 2009, the period that the parents were able to share, but was essentially used by mothers, decreased by two weeks. Thus, an even larger share of the total parental leave period was now reserved for the father.

4 Data

This paper uses unique individual level data on the entire Norwegian population. The data stems from several different administrative registers, linked together by Statistics Norway. The sample considered in the preferred specification entails all eligible[17] parents who have a child three months before and three months after the reform dates, while in robustness checks the sample window is expanded up to six months before and after the reform dates.[18] A rich set of individual demographic and socio-economic background characteristics are available. In particular, controls included in the regressions are parents' marital status, age, and education, and, in addition, indicators for the gender of the child,

[16] The initial reform in 1993 is well covered in the literature, see Dahl et al. (2014); Cools et al. (2015); Rege and Solli (2013), and data are not yet available for the later reforms in 2011, 2013, and 2014.

[17] As in Dahl et al. (2014) we predict eligibility based on both parents earnings exceeding 1 G in the year prior birth.

[18] Twins and triplets etc. are excluded as including these types of births would complicate the analysis.

as well as an indicator for first-borns.[19] The parents can be linked to their children using unique identifiers, which is essential to the identification strategy, and the exact date of birth of the child is available for all the children born in the period of interest. A register with information on parental leave use is also available for all the parents in this period. Specifically, to assess how parents respond to extending the father-exclusive leave period, we look at the number of leave days taken by each parent for a child. In addition, we include a binary indicator for whether the father took any leave at all.[20]

The registers further provide a number of interesting outcomes for the parents. For all parental outcomes, to capture potential effects immediately after birth, as well as potential effects when the child grows older, we look at outcomes measured at different ages of the child. To avoid too much noise in the measures, we average over two years. Specifically, we look at outcomes averaged over the ages 0-1, 2-3, and 4-5.

The main question we try to shed light on in this paper is whether extended use of paternity leave induces a more gender-equal home environment, i.e. that fathers take a larger share of the responsibilities in childcare and at home. The administrative registers unfortunately do not provide data on parental time use at home. However, we do have detailed information both on time spent at work and on income. Assuming leisure is fixed, a reduction in fathers' work hours and/or labor income may be interpreted as a shift of time from market work to home production. Opposite effects for mothers, i.e. increased work hours and/or labor income, may be seen as a response to having more free time to spend doing market work due to a more equal division of household work and thus, less of the mothers' time being tied to household work. For the work time variables we look at the average number of work hours per week.[21] In addition, we construct a binary indicator for whether the parent works at all, defined as having positive work hours, as well as an indicator for whether the parent works part time, defined as average work hours falling below 30 hours per week.[22] As the income measure we use labor income that includes income from paid work, and not e.g. taxable welfare benefits.[23]

In addition to income and working hours, we also look at two dimensions of parents' absences from work. First, we look at absence due to staying home to take care of a sick child, and second, we look at absence due to own illness. All employees are covered by the

[19] Parents background characteristics included as controls are measured in the year prior to birth.

[20] A binary leave-taking indicator for mothers would not be very interesting, as close to all mothers take at least some leave days.

[21] The work time variables are the contractual (agreed) work hours and work days, and thus, do not necessarily reflect the actual work time. For example, sickness absence is not included. Self employed as well as individuals registered with positive work time but no income are excluded from the sample in the regressions on work time.

[22] In Norway, a regular work week is set to 37.5 hours per week.

[23] Income is CPI adjusted to 2010 value.

National Insurance Act (Folketrygdloven, 1997) which entitles them to sickness benefits that compensate for the loss of labor income due to illness or injury.[24] Additionally, employed parents are entitled to care benefits if they need to stay at home to take care of a child due to the child's illness, or illness of the regular caregiver. For the first child, up to 10 sick days can be taken per year by each parent. Parents with more than one child can take up to 15 days each per year, and longer periods are provided to parents of a child with special needs. The register data provides the number of care benefit days claimed by each parent every year. The care benefit days are recorded from day eight when claimed for a child with regular illness (or the regular caregiver's illness), and from the first day for care benefit days claimed for a child with special needs.[25]

Data on absence days due to own illness stem from the sickness absence register ("Sykefraværsregisteret") administrated by the Norwegian Labor and Welfare Administration (NAV), and covers all certified absence spells from day one.[26] As argued in the introduction, data on absence spells due to own illness gives us another dimension of parent's involvement at home. Although sickness absence is meant to compensate for own sickness, there is evidence of the insurance system being used to compensate for a demanding life situation or for social reasons (Markussen et al., 2011). Additionally, the stressful double-burden, explained by the conflict between market work and the work needed at home, has been put forward as one explanation to the observed increasing gender-gap in sickness absence within a couple after a child is born. If the father of the child takes a larger share of the household work, it is conceivable that the double-burden is less stressful for the mother, and hence, we may observe a reduction in the sickness absence for the mother. Similarly, we expect to observe an increase in the father's sickness absence increase as his double-burden gets more stressful.

The data available also enables us to assess an interesting question in the gender equality debate, namely whether a policy promoting a more gender-equal environment at home also leads to more gender equality in the workplace. Specifically, to assess this we use as an outcome the mothers' share of the total household income.

Finally we assess the costs related to the extended leave periods. The costs naturally depend on the direct costs of the father quota expansions, but also any indirect costs that the expansions incurred. The register from which we calculate the number of leave days

[24]The wage loss associated with a sickness absence is compensation up to a ceiling of 6 G (about $ 60,500) for absences lasting up to one year. Several employers also compensate the income loss exceeding this ceiling (Markussen et al., 2011).

[25]Employed individuals may also be entitled to care benefits for other reasons, however, the register provides separate codes for the absence days related to a child's illness.

[26]All sickness absence spells lasting longer than the allowed number of self-reported days needs to be certified by a physician. Employees are as a general rule entitled to three self-reported absence days per spell (up to eight days in some work places).

also includes the reimbursements recived by each parent related to the leave period.[27] We calculate the direct costs of the program by adding the reimbursements claimed by both parents for the total leave spell. Further, extending the parental leave period may also involve indirect costs. We calculate both parents' future tax payments, as well as any future welfare benefits received. For these measurements, we calculate the total taxes paid, and the total welfare benefits received up until the child is five years old.

5 Identification

Fathers who take parental leave at all, or more parental leave, may be systematically different from fathers taking less leave, or none at all. Simply comparing fathers who take different periods of leave may thus lead to biased results. To deal with this endogeneity problem, we exploit the extensions of the father quota as natural experiments. Both the introduction of the initial father quota, and the later extensions, were introduced on a specific date (cf. Table 1). Parents of children born after this specific date were eligible for the (additional) father specific leave days, whereas parents of children born before this date were not. As date of birth may be considered random around the cut-off date, apart from being affected by the policy change, families with children born just before and just after that specific date should be similar on average and can be compared in a regression discontinuity (RD) framework.[28] We discuss threats to this identification strategy in Section 4.2.

5.1 Regression Discontinuity (RD) Design

Causal effects of the father quota extensions are estimated using a regression discontinuity design (RD). While the initial introduction of the father quota induced a sharp increase in the fraction of fathers taking leave from about 3% to 30%, the later expansions primarily induced increases in the average number of leave days taken by fathers. By taking advantage of the discontinuity in fathers' leave days arising due to the over-night implementation of the expansions, families with children born just before one reform are compared to families of children born just after the reform.

The reduced form equation is given as:

$$y = \alpha + 1[t \geq c]\Big(g_L(t-c) + \theta\Big) + 1[t < c]g_R(c-t) + e \qquad (1)$$

Where y is the relevant outcome, t is the birth date, c is the cutoff date, and $g_L(.)$

[27]As mentioned, the parental leave system replaces earnings up to a ceiling of 6 G. We do not have data on whether an individual receives reimbursements on top of this by the employer.

[28]A similar approach is taken by Dahl et al. (2014) studying the 1993 reform/introduction of the father quota.

and $g_R(.)$ are unknown functions on the left and right side of the cutoff, respectively. The estimated coefficient of interest, θ, gives us the "intention to treat" (ITT) effect on outcome y, i.e. the estimated effect of being exposed to the reform, not necessarily making use of the additional leave days.[29]

The availability of a graphical presentation of results is a key advantage of the RD design, and when presenting the results in Section 6, all main results are presented both graphically and in tables. In all the figures, outcomes are plotted against the birth date of the child, and the birth date is normalized so that the day the reform was implemented, i.e. July 1st the year of the reform, is labeled as zero. Each dot in the figures corresponds to the average of that outcome for parents giving birth in a one week bin. For the tables, all coefficients are estimated using Equation 1, including linear trends in birth day on each side of the cut-off, and triangular weights that ascribe more weight to observations closer to the cutoff. Standard errors are clustered on day of birth, and to gain precision, we also include some pre-determined covariates. The controls included are parents' marital status, age, and age squared, and education measured in the year prior to birth, as well as an indicator for the gender of the child and for first-borns.

5.2 Robustness

As in all empirical analysis, results may be sensitive to the choices made. To increase the credibility of the results, we check their sensitivity against a number of robustness checks.[30] We start by investigating the sensitivity to the choice window width. In the main specification we include births in a three months window around the cutoff date. Expanding the sample window might improve the statistical precision of our estimates. However, including observations further away from the cutoff date will also increase the risk of biased estimates. We accommodate this by experimenting with different sample windows (up to +/- six months).

Next, we assess the sensitivity of our results to a variety of specification checks; including one specification where all individual controls are excluded, one replacing the baseline linear trends with separate quadratic trends on each side of the discontinuity, and, finally, one using a one-week donut around the discontinuity, which means we drop families with children born in +/- one week around the reform date.

Finally, we examine whether our results are affected by the use of local linear regression as an alternative to estimating the RD effects globally. One drawback with estimating globally, is that this method is more sensitive to outliers far away from the discontinuity.

[29]The average effect of an extra week added to the father quota can be obtained by scaling θ by the jump in the uptake at the cut-off, estimated by the first stage regression.

[30]We focus the robustness analysis on the 2009 reform, results for the results estimated on the other reforms give essentially the same picture.

Using instead a local linear regression reduces this problem.

5.3 Threats to Identification

For the RD design to be valid in this setting, it requires that parents cannot perfectly manipulate the birth date of their child, which is what determines the "treatment", or eligibility of the increased additional father-specific leave days. A potential concern would be if future parents could anticipate the reforms, and hence plan the birth on either side of the cutoff. For expectant mothers with due dates close to the cutoff date, there is a possibility that births were either induced early by caesarean sections, or postponed.[31] If parents are not able to perfectly plan births on either side of the cutoff, as a response to the reforms, the assignment variable, i.e. the birth date, should be continuous around the cutoff. Figure A1 in the Appendix plots the number of births around the cutoff dates. Although there are some seasonal changes in the number of births throughout the year, there seems to be no discontinuity around the cutoffs, i.e. no evidence of strategically timing of births around the reform dates. This is confirmed in the estimates provided in Table A1.[32]

As previously mentioned, eligibility for parental leave benefits is determined based on the parent working at least six out of ten last months before the birth, while the mother has to meet the work requirement in order to maintain eligibility for the leave days included in the father quota. If the reforms were announced so that future parents could influence their eligibility status as a response to the upcoming reform, restricting the sample to eligible parents would be a threat to the validity of the RD estimates. Since the announcements were mostly made in December the year before the reforms were introduced, that is, five to six months before the new rules came into force, this might have affected mothers decision to work the following months in order to become eligible for the new rules. However, since we predict eligibility based on earnings in the year before birth, this is not a big concern. As is evident from Figure A2 and Table A1 in the Appendix, there seems to be no discontinuity in the share of predicted eligible parents around the cutoffs.

Another potential concern in this context is that future parents may have anticipated a new reform after the introduction of the previous ones. Recall that the first additional week was added to the father quota on July 1, 2005, and the expansions were implemented on the same day in the years 2006, 2009, and 2011. The father quota's existence and length was, and still is, a highly debated topic among Norwegian politicians and in the

[31]In Norway, there must be a medical cause for carrying out a planned caesarean section. Pregnant women have no legal right to decide if the child is to be born with Caesarean section.

[32]As a robustness check we also include a "donut" design, where we drop families who give birth in the weeks immediately before and after the reform date, and show that this does not change the results.

media, and it is reasonable to believe that future parents followed this debate. To reassure the validity of our RD design, we check for discontinuities in other characteristics of the parents. In the Appendix, both a graphical presentation in Figure A2, and estimates in Table A1 show little evidence of discontinuities in these characteristics.

Only six of the 32 estimates are significant at the 10%-level. Some significant estimates would be expected by chance, and while some estimates are statistically significant, they are fairly small, e.g. fathers' education is on average less than 2% higher in families giving birth after the reform date. Nevertheless, we include parents' characteristics as controls in the regressions.

6 Results

In the following sections, we begin by looking at the first stage that shows how the reforms affected parents' leave use.[33] We then go on to look at whether more parental leave use by fathers had any effect on both parents' labor income, work time, home involvement, measured by parents' work absences due to own and the child illness, as well as the gender gap in income within the couple, up until the year when the child turns five years old (starts school). In Section 6.3 we discuss the robustness of the results. Finally, we shed light on the costs of the extensions in Section 6.4.

6.1 First Stage: Uptake and Leave Days

As shown in Table 1, the first two extensions were of one week each, whereas the 2009 extension increased the leave time reserved for fathers by four weeks, from six weeks to ten weeks. Also recall that in the 2009 extension, not all of the weeks added to the father quota were compensated by additional weeks added to the total parental leave period. In 2009, two of the four weeks were transferred from the shared period.

While the introduction of the first father quota led to a significant jump in the uptake rate, the later extensions did not alter the share of fathers taking leave substantially. Figure 1 shows fathers' uptake rate over time. As is evident from the figure, the uptake rate is not substantially affected by the expansions. In Figure 3 Panel A, we look closer at the uptake rate among fathers +/- 3 months around the reform dates, and the corresponding RD estimates are provided in the first row of Table 2. Although the increase in uptake rate is positive and statistically significant for some of the reforms, the magnitudes are small. Following all of the 2005, 2006, and 2009 reforms, the uptake rate increases by 1-4

[33] For the first stage results we include results for all the extensions where data is available (including also the 2005 and 2006 extensions), while for other outcomes our focus will lie on the 2009 reform for reasons previously discussed. Results for the earlier extensions in 2005 and 2006 give essentially the same picture, and the main results are available in the Appendix.

percentage points from an already fairly high average of about 66%.

The average leave period taken by fathers seems to increase by about the same length as the number of days added to the quota in each extension. Figure 2 shows fathers' average number of leave days over time, while Figure 3, Panel B, shows the jumps in the average number of leave days taken by fathers in a +/- 3 months window around each reform. Mothers' leave days are shown in Panel C of the same figure. The RD estimates are provided in the last two rows of Table 2. We see clear jumps in the average number of days that fathers spend on parental leave around the later reforms. In 2009, the reform that we focus on in the following sections, the average number of leave days for fathers increase by an estimated 16.9 days, just a little less than the four weeks added to the quota this year.[34] Mothers' average leave days do not seem to be altered by the reforms in 2005 and 2006. In 2009 however, when two of the weeks added to the father quota were transferred from the shared period (see Table 1), mothers' leave days are reduced by about seven compensated days, a little less than two weeks.

To further explore how the reform affected parental leave use by parents, in Table 3 we look at heterogeneity by subgroups, focusing in the 2009 reform.[35] The subgroups we look at are parents of boys or first children, and a group where the father has high education, defined by a college or a university degree. As previous studies have indicated that fathers have a preference for boys (Dahl and Moretti, 2008) and take more leave when the child is a boy or a first-born (Bartel et al., 2018), or that fathers with higher socio-economic status take more leave (Huerta et al., 2013), it is interesting to see if fathers in these subgroups react stronger to the reforms. As is seen in the table, there is no evidence of heterogeneity in the reform response depending on the gender of the child or on the birth order. However, in the last column of Table 3 we do see interesting differences among fathers with high and low education. Fathers with higher education have a stronger reform response than do fathers with low education. Here we estimate an increase in leave days of about 20 days, compared to 14.5 days for fathers with low education. In the last row, we also see that mothers reduce their leave period more for this subgroup.

6.2 Labor Market Outcomes and Gender Equality

This section presents and discusses the effects of the 2009 reform on outcomes related to each parent's labor market outcomes, our measures of home involvement, and gender equality. If parents shift time from market work to home production as previously hy-

[34]Leave days are measured in compensated days. Hence, five leave days reflect one week.

[35]To explore heterogeneity, we interact the reform indicator in Equation 1 with an indicator for the subgroup.

pothesized, we expect fathers' income and/or work time to decrease and mothers' income and/or work time to increase. As explained, as measures of home involvement we look at the number of days spent on sick leave, and the number of days absent due to taking care of a sick child. We interpret an increase in a father's work absence related to taking care of a sick child as a reflection of an increase in his involvement in raising the child. The last outcome considered in this section is the income gap between the parents, measured as the mother's share of total household income. If extended use of parental leave by fathers has an affect on gender equality, we expect to find evidence of a reduction in the gender gap in income.

Labor Market Outcomes – Plots of parents' average annual labor income, work time, and sick leave for a sick child are displayed in Figures 4 and 5. In Figure 4, the first row shows the average of fathers' income (Panel A), work hours (Panel B), fraction working part time (Panel C), and absence days when a child is sick (Panel D), measured when the child is 0-1 years. The second row shows the same outcomes measured when the child is 2-3 years old, and the third row shows the outcomes measured when the child is 4-5 years old. Figure 5 shows the averages of the same outcomes for mothers. The corresponding RD estimates are provided in Table 4. The results show that extended use of parental leave by fathers had no effects on the labor market outcomes considered. When looking at the figures, there are no obvious jumps in any of the outcomes for neither fathers, nor mothers. This is confirmed by the RD estimates in Table 4. Although most of the estimates go in the direction hypothesized above, they are all small in magnitude and most of the them are not statistically significant at any conventional level. The only statistically significant estimate is a small increase in the fraction of fathers working part time when the child is 0-1 years old (a 1.9 percentage point increase from an average of about 30%). The effect disappears when the child grows older, and is probably only reflecting that fathers take more parental leave in the child's first living year, and not a more permanent shift in time from market to home.[36] Further, we find no indication that mothers spend more time in market work, neither by increased income, nor increased work time.

Gender Gap in Income – Though there seems to be no effects on the labor market outcomes considered above, we now go one step further to assess the impact of extended use of parental leave by fathers on gender equality. We run RD regressions using the income gap between the parents, measured by the mother's share of total household income as outcome variable. As in the previous section, we estimate the reduced form RD effects on the each of the outcomes when the child is 0-1 years, 2-3 years old, and

[36] Of course, the significance could also be by chance, as when estimating a large number of outcomes one would expect some of the estimates to turn up as significant, even if the true effect is zero.

4-5 years old. Panel E of Figure 5 plots average outcomes for the mothers' share of total household income. Again, as is also confirmed by the RD estimates in the last row of Table 4, extended paternity leave have no effect on this outcome.

Estimates on the labor market outcomes for the other extension reforms are shown in the Appendix Tables A2 and A3. As is seen in these tables, the results show essentially the same picture of no effects of paternity leave on parents' labor market outcomes as well as the gender gap in income. Finally, when assessing these outcomes for the same subgroups as discussed in the previous section, we find no evidence of heterogeneity in the results among any of the subgroups.[37]

6.3 Robustness

As mentioned, we run a number of robustness checks to increase the confidence in the results. As a first check we estimate the same effects using extended sample windows. Estimates in the Appendix Table A4 show the results on uptake and leave days for parents of children born 4, 5, and 6 months around the cut-off. The estimates confirm our findings of increases in uptake and leave days among fathers, and a decrease in the number of leave days used by mothers around the 2009 reform. Tables A5 and A6 in the Appendix show the results on labor market outcomes for fathers and mothers, respectively, confirming that all the estimates are small in size and most of them are not significant.[38] Although, as expected, precision increases as the window gets larger. For mothers, Table A6 shows a statistically significant increase in work hours in the child's first living year when increasing the sample window. This results is in line with the father taking more leave, and the effect disappears as the child grows older. Table A6 also includes the results on the gender gap in income, again, showing no significant effect on this measure.

Next, we check sensitivity to various specifications in Table A7 for the uptake and leave days, and in Tables A8 and A9 for the labor market outcomes (the results on the gender gap in income are included in Table A9). The first column (i) shows our baseline specification. In the remainder of the table, we re-estimate the full set of results, and exclude individual controls (col. ii), replace the baseline linear trends with separate quadratic trends on each side of the discontinuity (col. ii), and as a last specification, we use a one-week donut around the discontinuity (col. iv). Again, for the results on uptake and leave days these results give the same picture as before. There are, however, two exceptions. In the last column, where we exclude births in +/- one week around

[37]Heterogeneity tables are not included, but are available upon request.

[38]The exception is still the binary indicator for part time work by fathers when the child is 0-1 years old, which is significant for all the window widths.

the reform, we estimate a smaller and no longer significant effect on fathers' uptake of parental leave. In addition, when including quadratic trends on each side of the cutoff date, instead of linear trends, we no longer estimate a significant effect on mothers leave days. Nevertheless, our main result, that fathers increase their leave use, is significant throughout the specification checks. For the labor market outcomes, apart from a few estimates that turn up significant, as would have been expected with so many outcomes, we still find essentially no effects of extended leave use by fathers on any labor market outcomes for the parents, or on the gender gap between the parents.

Finally, we examine whether our results are affected by the use of local linear regression as an alternative to estimating the RD effects globally. Results on the uptake and number of leave days are shown in Table A10, and as before, we estimate in increase in fathers' uptake and the number of days on leave. Again we see that the mothers' number of leave days are less robust (not statistically significant when using a bandwidth of 30 days), although we still estimate a reduction in this outcome. The results from this last robustness check does not show any evidence of fathers shifting time from market work to home production, or of fathers being more involved in childcare, measured by the work absences. And finally, we find no effects on the gender gap in income. Results are shown in Tables A11 and A12 in the Appendix.

6.4 Costs of the Program

We now turn to look at the costs of the reforms. The long run costs of extending the father-exclusive leave period naturally depend on the direct costs of the program, but also on any indirect effects, e.g. any changes to parents' future tax payments or welfare benefits receipts. Recall from Table 1 that the 2009 reform added four weeks to the father quota, while only adding two weeks to the total parental leave period. In Figure 6, and the associated estimates in Table 5, we measure program costs as the average cost per child, i.e. for both parents combined. Hence, the additional program costs is interpreted as the additional costs related to the total reform, where two of the four weeks added to the father quota were transferred from the shared parental leave period, reflected by a decrease in mothers' average leave days. Estimates for all the reforms show a significant increase in the cost of the parental leave program, ranging from 4300 NOK to 5,400 NOK per child for the smaller reforms. The RD estimates for the 2009 reform show an increase in costs of almost 12,000 NOK per child, from an average of around 250,000 NOK. We further find no effects on taxes paid, nor on the benefits received by the parents when the child is 0-5 years old. This is expected as we find no effects on labor market outcomes.

7 Conclusion

The main question discussed in this paper is whether extended parental leave use by fathers induces them to shift time from market work to home production when the child grows older, measured by both parents income and work time until the child turns five years old. As a measure of home involvement, we examined the number of work absence days taken by parents to stay home and take care of a sick child. Second, we asked whether more parental leave use by fathers leads to a higher degree of gender equality elsewhere, measured by mothers share of total household income and the income gap between the parents.

Our first finding, in line with previous literature, is that reserving parental leave time for fathers is effective in increasing fathers' leave use. Importantly, we document that this holds even when the father-exclusive leave period increases to a more substantial length than has previously been studied. Reforms increasing the Norwegian father quota in 2005, 2006 and 2009 led to an increase in the average number of leave days taken by fathers by about the same amount of weeks added in each reform. Interestingly, we find evidence of heterogeneity among fathers with high and low education; fathers with a college or a university degree respond stronger to the incentives provided by the reform than do fathers with less education.

Focusing on the largest extension of the quota in 2009, which added four weeks to already six weeks long period reserved for fathers exclusively, and employing an RD design, the results do not suggest a shift in time use from market work to home production for fathers, or the opposite for mothers. Further, for our measure of involvement at home, absence from work due to the child's sickness is also not affected by the reform. Finally, we find no evidence that extended use of paternity leave by fathers affects the within-couple pay gap.

Our results also show that extending the non-transferable father quota comes at a non-negligible cost to the society. Taken together, as we do not find any evidence suggesting that a more equal share of the parental leave period affects parents' future behavior and time allocation, this lead us to conclude that other arguments should be used for justifying the increased costs to society by continuing extensions of the father quota.

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Figures

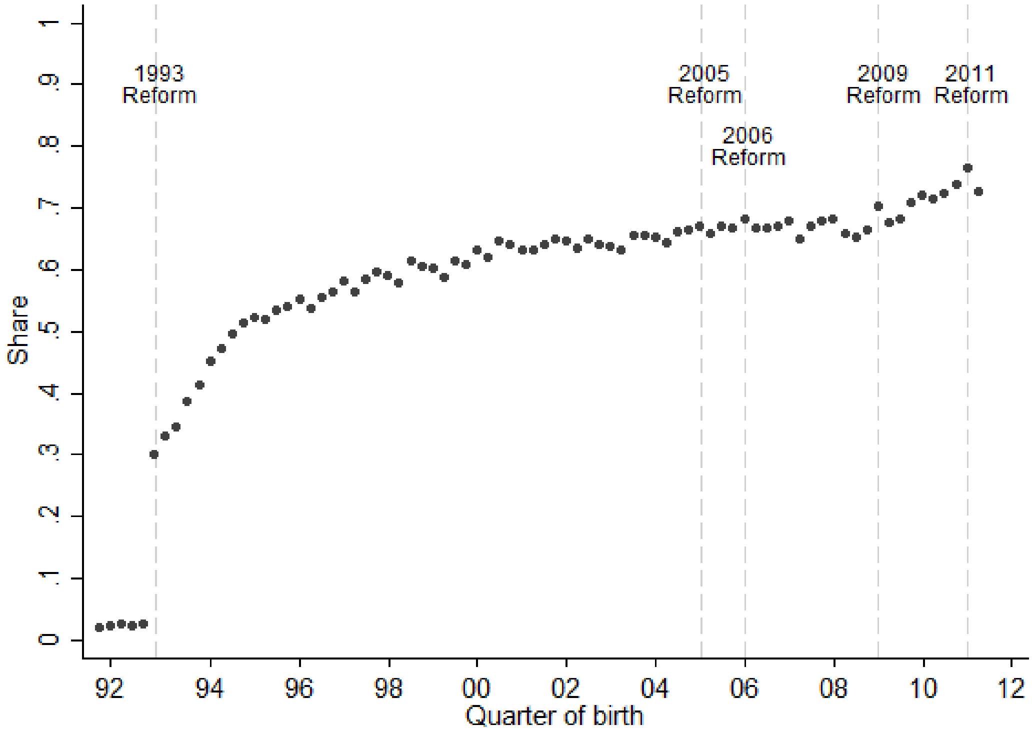


Figure 1: Fathers' Parental Leave Use: Uptake Rate.

Note: Each dot represents the average uptake rate for fathers in one quarter of the year. The dashed lines denote the reforms' cutoff dates (April 1st for the 1993 reform, July 1st for the later reforms).

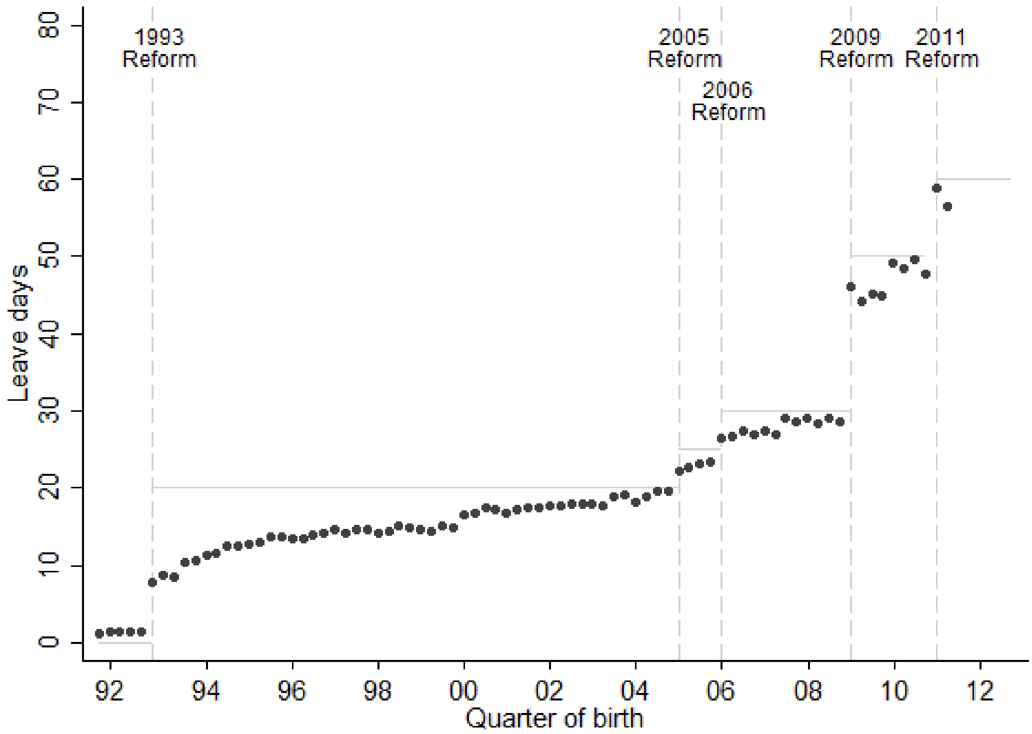


Figure 2: Fathers' Parental Leave Use: Average Number of Leave Days.
Note: Each dot represents the average number of leave days for fathers in one quarter of the year. The dashed lines denote the reforms' cutoff dates (April 1st for the 1993 reform, July 1st for the later reforms), and the gray horizontal lines indicate the number of leave days stated by the quota.

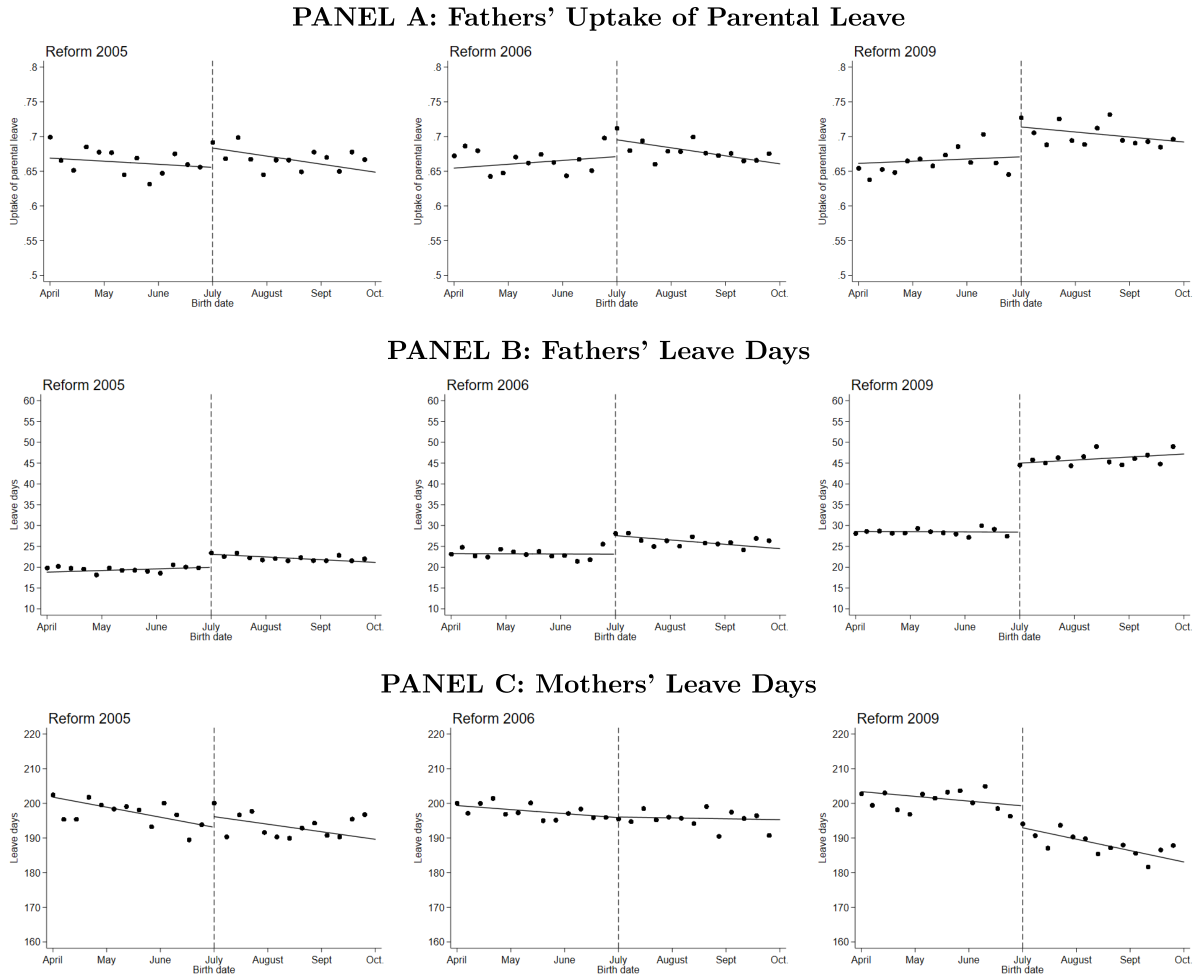


Figure 3: Parents' Number of Leave Days

Note: Each dot represents the average outcome for fathers (Panel A and B) and mothers (Panel C) in a one-week bin based on the birth date of the child. The dashed lines denote the reforms' cutoff date (July 1st for all the reforms). The solid lines are estimated by linear regressions, using daily individual-level data and employing triangular weights.

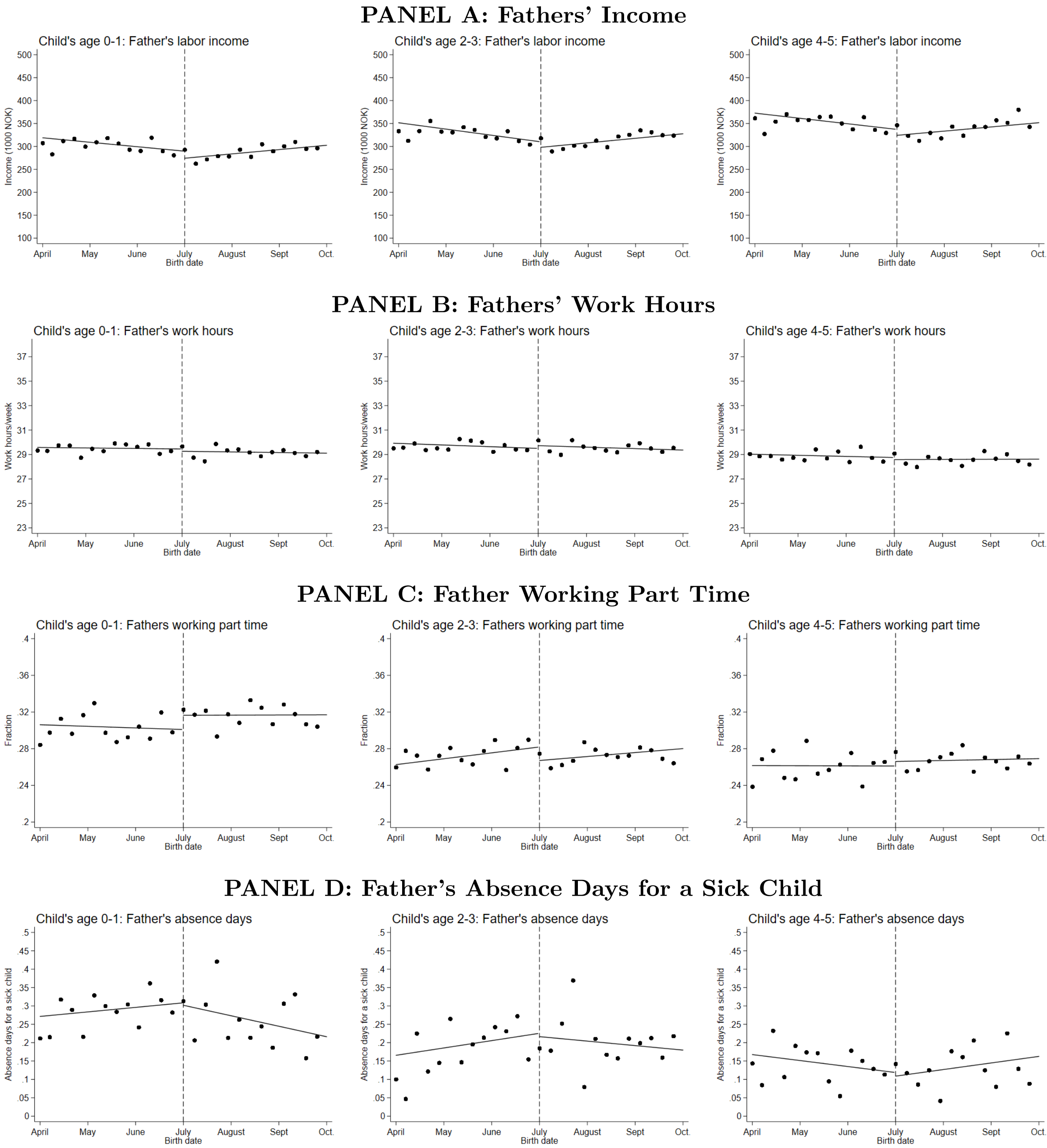
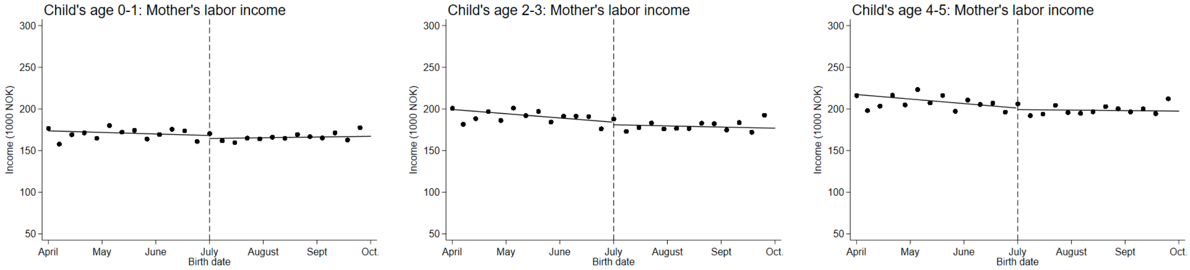


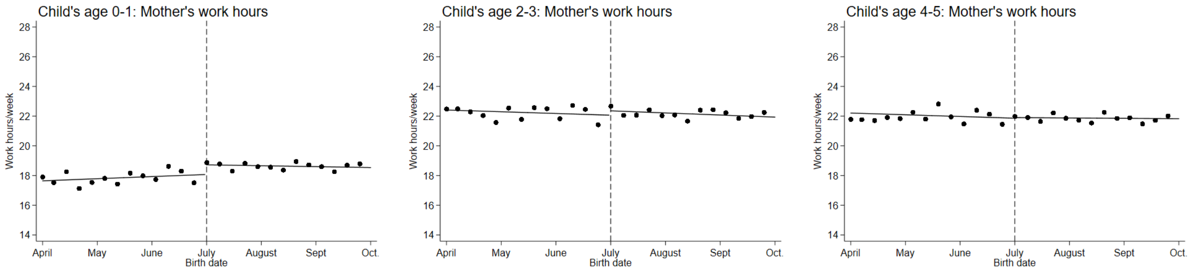
Figure 4: Labor Market Outcomes: Fathers

Note: Each dot represents the average outcome for fathers in a one-week bin based on the birth date of the child. The dashed lines denote the reform's cutoff date (July 1st). The solid lines are estimated by linear regressions, using daily individual-level data and employing triangular weights.

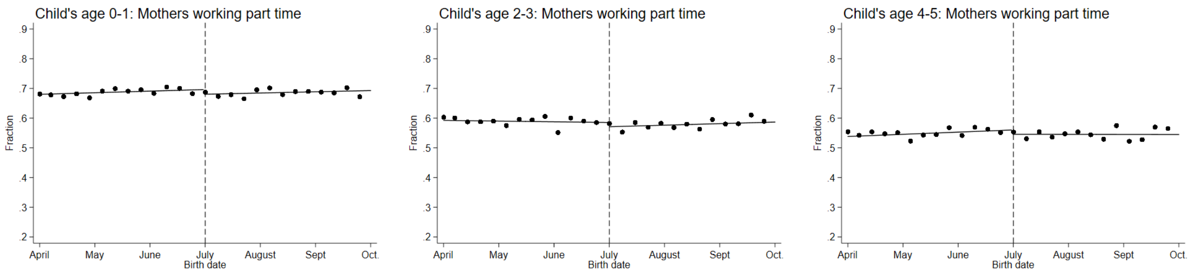
PANEL A: Mothers' Income



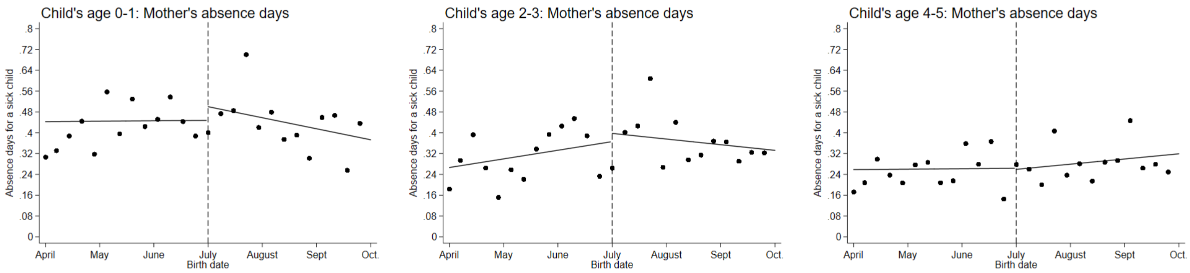
PANEL B: Mothers' Work Hours



PANEL C: Mother Working Part Time



PANEL D: Mother's Absence Days for a Sick Child



PANEL E: Mother's Share of Total Household Income

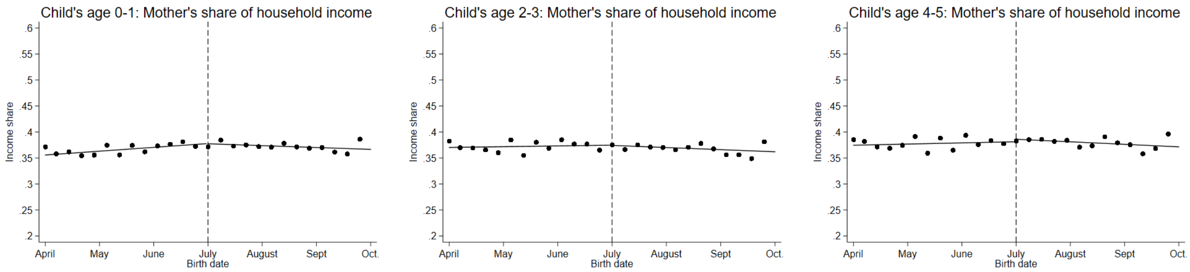


Figure 5: Labor Market Outcomes: Mothers

Note: Each dot represents the average outcome for mothers in a one-week bin based on the birth date of the child. The dashed lines denote the reform's cutoff date (July 1st). The solid lines are estimated by linear regressions, using daily individual-level data and employing triangular weights.

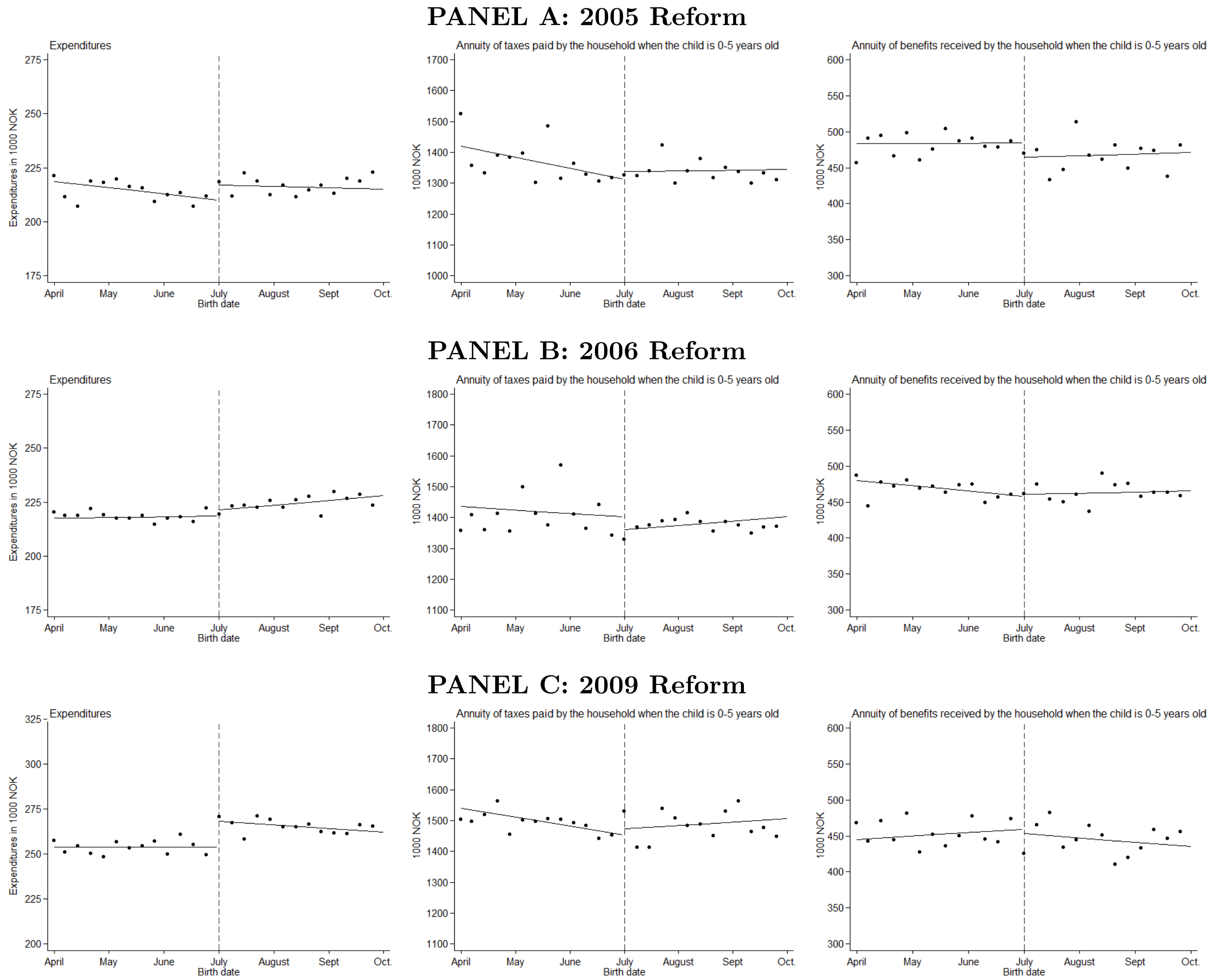


Figure 6: Program Costs

Note: Each dot represents the average outcome for parents in a one-week bin based on the birth date of the child. The dashed line denote the reform cutoff date (July 1st for all the reforms). The solid lines are estimated by linear regressions, using daily individual-level data and employing triangular weights.

Tables

Table 1: Parental leave and father quota in Norway

Date	**Father's quota**	total weeks	**Total leave period**	total weeks
April 1st **1991**				32
April 1st **1992**	0	0	+3	35
April 1st **1993**	+4	4	+7	42
July 1st **2005**	+1	5	+1	43
July 1st **2006**	+1	6	+1	44
July 1st **2009**	+4	10	+2	46
July 1st **2011**	+2	12	+1	47
July 1st **2013**	+2	14	+2	49
July 1st **2014**	-4	10	0	49

Note: Total weeks reflect parental leave time with full wage compensation. Parents may choose a longer leave period with reduced (80%) compensation.

Table 2: First stage RD estimates on uptake and leave days.

	2005 reform	2006 reform	2009 reform
Fathers			
- Uptake	.0169	.0316***	.0404***
	(.0103)	(.0113)	(.0139)
	[.664]	[.666]	[.663]
- Number of leave days	2.99***	5.06***	16.9***
	(.712)	(1.02)	(1.03)
	[19.6]	[23.3]	[28.5]
Mothers			
- Number of leave days	1.11	.762	-6.53***
	(2.27)	(2.3)	(1.95)
	[197]	[198]	[201]
Obs.	23098	23554	25267

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, robust standard errors in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table 3: Heterogeneity: Uptake and leave days

	Interaction term		
	Boy	First child	Father w. high educ.
Fathers			
- Uptake	0.033**	0.038***	0.035**
	(0.016)	(0.014)	(0.017)
Interaction	0.014	0.006	0.017
	(0.014)	(0.013)	(0.014)
Joint p-value	0.008	0.015	0.000
- Number of leave days	16.422***	17.364***	14.575***
	(1.197)	(1.252)	(1.131)
Interaction	0.903	-1.047	6.101***
	(1.267)	(1.239)	(1.418)
Joint p-value	0.000	0.000	0.000
Mothers			
- Number of leave days	-6.043**	-8.022***	-4.088*
	(2.441)	(2.040)	(2.314)
Interaction	-0.925	3.348	-5.605***
	(2.278)	(2.093)	(1.957)
Joint p-value	0.003	0.001	0.000

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, robust standard errors in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table 4: RD reduced form estimates: Labor Market Outcomes

	Fathers			**Mothers**		
	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years
Labor income (NOK)	-4748	-1115	-3895	1419	3214	4972
	(6829)	(6919)	(8570)	(2833)	(3320)	(3918)
	[302145]	[328156]	[352033]	[170176]	[190698]	[207938]
Weekly work hours	-.151	.241	-.245	.516	.247	-.0608
	(.35)	(.349)	(.343)	(.318)	(.3)	(.345)
	[29.5]	[29.7]	[28.9]	[17.9]	[22.2]	[22]
Employed	.00341	.00375	-.00119	.00417	-.00238	-.00942
	(.0061)	(.00599)	(.00575)	(.00647)	(.00614)	(.00687)
	[.917]	[.92]	[.91]	[.885]	[.912]	[.884]
Part time work	.0191**	-.0151	.00655	-.0119	-.013	-.00992
	(.00949)	(.0107)	(.0112)	(.0125)	(.0119)	(.0126)
	[.303]	[.273]	[.261]	[.688]	[.59]	[.551]
Sickness absence days	-.326	.807	-.718	.0276	-1.91	-.884
	(.828)	(.836)	(.614)	(1.09)	(1.36)	(.872)
	[11.8]	[11.1]	[7.67]	[36.5]	[28]	[15.2]
Absence days for child	.0172	.0179	-.0049	.0324	.0377	.0105
	(.0766)	(.0491)	(.0498)	(.0851)	(.0901)	(.0747)
	[.284]	[.184]	[.141]	[.427]	[.311]	[.253]
Mothers share of total household income				-.00126	.00122	.00332
				(.00556)	(.00594)	(.00614)
				[.367]	[.373]	[.378]
Obs.	25267	25267	25267	25267	25267	25267

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

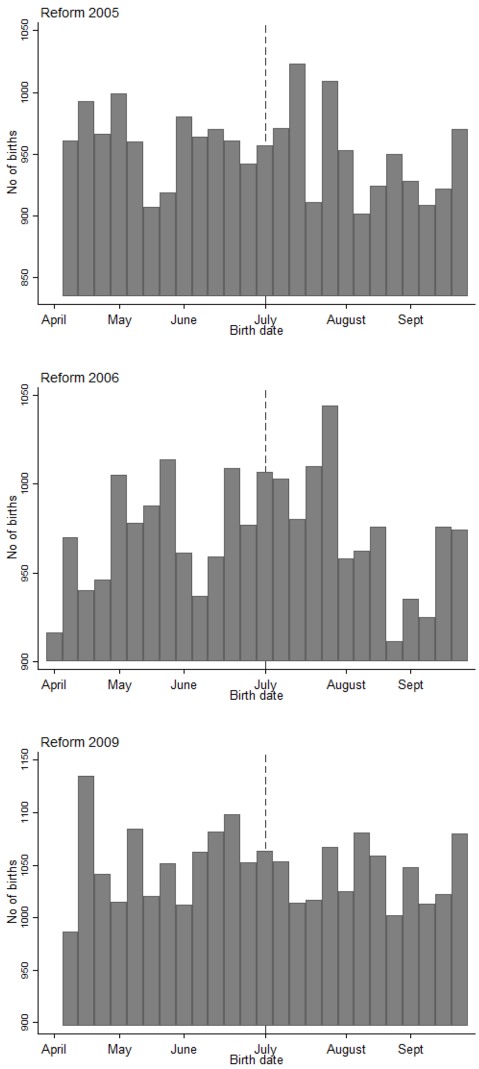
Table 5: RD reduced form estimates: Program costs

	2005 reform	2006 reform	2009 reform
Program expenditures	4282*	5393*	11963***
(NOK per child)	(2514)	(2580)	(2686)
	[213961]	[218517]	[253732]
Total taxes paid	12377	-15134	-8699
by parents	(28679)	(27734)	(27475)
when child is 0-5 years	[1367556]	[1408837]	[1493315]
Total amount of welfare	-9535	-6393	2808
benefits received by parents	(12476)	(12891)	(12706)
when child is 0-5 years	[482838]	[467698]	[454888]
N	23098	23554	25267

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Appendix

Figure A1: Number of births



Note: Each bar represents the average number of births in a one-week bin based on the birth date of the child. The dashed lines denote the reform's cut-off dates (July 1st for all the reforms). The solid lines are estimated by linear regressions, using daily individual-level data and employing triangular weights.

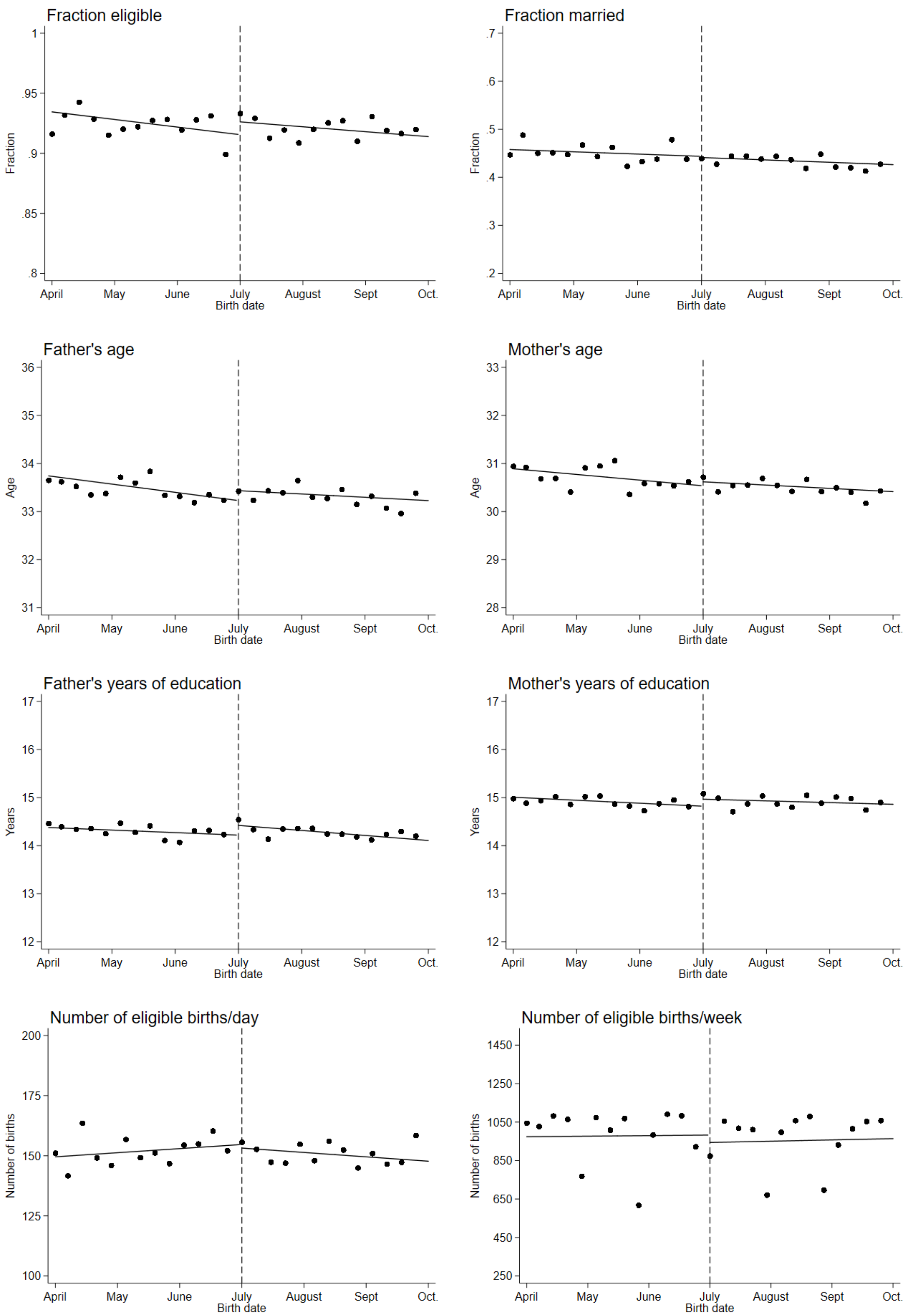


Figure A2: Balance plots (2009 Reform)

Note: Each dot represents the average outcome for parents in a one-week bin based on the birth date of the child. The dashed lines denote the reform's cutoff date (July 1st). The solid lines are estimated by linear regressions, using daily individual-level data and employing triangular weights.

Table A1: Balance tests.

	2005 reform	2006 reform	2009 reform
Fraction predicted eligible	-.00207	-.00139	.0107
	(.00651)	(.00716)	(.00668)
	[.911]	[.909]	[.924]
Fraction of parents married	.0228*	-.0187	-.00248
	(.013)	(.0128)	(.0131)
	[.482]	[.472]	[.448]
Age of father	.137	.0415	.205
	(.117)	(.143)	(.139)
	[33.3]	[33.2]	[33.3]
Age of mother	-.0221	-.13	.082
	(.102)	(.139)	(.129)
	[30.5]	[30.5]	[30.5]
Father's education	.0579	-.219**	.201**
	(.0818)	(.091)	(.0798)
	[14.1]	[14.2]	[14.2]
Mother's education	.0926	-.159*	.147*
	(.0781)	(.0931)	(.082)
	[14.6]	[14.6]	[14.8]
Number of eligible births per day	3.13	3.44	-1.48
	(5.25)	(4.81)	(6.53)
	[139]	[142]	[152]
Number of eligible births per week	36.5	44.4	-38.5
	(64.4)	(58.1)	(73.3)
	[897]	[916]	[990]
Obs.	24686	25261	27079

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A2: RD reduced form estimates: Labor Market Outcomes (2005 reform)

	Fathers			**Mothers**		
	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years
Labor income (NOK)	-2035	5698	-3616	-1028	-277	385
	(7184)	(10949)	(7225)	(2442)	(3023)	(3620)
	[273294]	[314941]	[325777]	[141956]	[167383]	[186848]
Weekly work hours	.0959	.358	.0318	-.553*	-.161	.212
	(.374)	(.325)	(.346)	(.29)	(.309)	(.36)
	[28.4]	[28.9]	[29]	[16.6]	[20.6]	[22.4]
Employed	.00573	.0137**	.00421	-.00444	.00253	-.00895
	(.00611)	(.00614)	(.00642)	(.00812)	(.00721)	(.00734)
	[.906]	[.91]	[.911]	[.852]	[.891]	[.918]
Part time work	.0145	-.00274	.0092	.011	-.00333	.000667
	(.0122)	(.0132)	(.0123)	(.0132)	(.0131)	(.0116)
	[.283]	[.257]	[.239]	[.667]	[.6]	[.579]
Sickness absence days	-1.41	.567	1.57	-.964	-1.26	-.342
	(.916)	(.959)	(1.16)	(1.04)	(1.17)	(1.41)
	[11.1]	[11.5]	[13.7]	[32]	[26.4]	[23.5]
Absence days for child	.0898	.0352	.00312	-.0314	.158**	.0535
	(.0611)	(.0634)	(.0727)	(.0766)	(.0754)	(.095)
	[.208]	[.154]	[.17]	[.443]	[.271]	[.281]
Mothers share of total household income				-.00436	-.00367	.00149
				(.00712)	(.00622)	(.0066)
				[.349]	[.356]	[.374]
Obs.	23098	23098	23098	23098	23098	23098

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A3: RD reduced form estimates: Labor Market Outcomes (2006 reform)

	Fathers			**Mothers**		
	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years
Labor income (NOK)	4736	6523	7583	1754	4285	2030
	(7947)	(8125)	(7768)	(2763)	(3159)	(3947)
	[294257]	[318701]	[333630]	[151273]	[177702]	[193153]
Weekly work hours	.633*	.792***	.178	.226	.0422	-.0199
	(.345)	(.302)	(.266)	(.251)	(.332)	(.33)
	[28.7]	[29.4]	[29.3]	[16.8]	[21.4]	[22.7]
Employed	.00412	.00882	-.00324	.00702	-.00684	-.00226
	(.00676)	(.00611)	(.00566)	(.00956)	(.00705)	(.0063)
	[.912]	[.915]	[.915]	[.856]	[.899]	[.919]
Part time work	.00332	.0153	.024**	.009	-.00533	.00159
	(.0115)	(.0102)	(.0114)	(.0108)	(.00966)	(.0102)
	[.296]	[.255]	[.246]	[.675]	[.594]	[.579]
Sickness absence days	-.627	.242	-1.12	-.128	-.839	1.02
	(.869)	(.982)	(1.06)	(1.1)	(1.29)	(1.11)
	[10.9]	[12.6]	[12.7]	[34.3]	[28.4]	[22.9]
Absence days for child	.059	.0219	.114*	.0827	.0164	.156
	(.0687)	(.0603)	(.0638)	(.0956)	(.0842)	(.0955)
	[.261]	[.201]	[.154]	[.436]	[.358]	[.273]
Mothers share of total household income				-.00515	-.00113	.000987
				(.00551)	(.00599)	(.00773)
				[.348]	[.363]	[.373]
Obs.	23554	23554	23554	23554	23554	23554

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A4: Robustness checks varying the sample window: First stage (2009 reform)

	Window width (number of moths around the reform date)		
	4	5	6
Fathers			
- Uptake	.0388***	.0429***	.0468***
	(.0122)	(.0109)	(.01)
- Number of leave days	17.4***	18.3***	18.6***
	(.942)	(.891)	(.838)
Mothers			
- Number of leave days	-7.44***	-8.24***	-8.72***
	(1.73)	(1.56)	(1.44)
Obs.	32964	40608	47825

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 4, 5, and 6 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A5: Robustness checks varying the sample window: Fathers' labor market outcomes (2009 reform)

	0-1 years			2-3 years			4-5 years		
	4	5	6	4	5	6	4	5	6
Labor income (NOK)	-4515	-3096	-2855	-1254	-399	-892	-3135	-1884	-3082
	(6050)	(5424)	(4976)	(6049)	(5413)	(5007)	(7399)	(6615)	(6090)
Weekly work hours	-.21	-.171	-.133	.189	.153	.122	-.166	-.124	-.132
	(.313)	(.283)	(.259)	(.309)	(.278)	(.254)	(.306)	(.276)	(.253)
Employed	.000832	.0000446	.000939	.00312	.00265	.00286	.00138	.00238	.0027
	(.00526)	(.00472)	(.00433)	(.00525)	(.00478)	(.00445)	(.00531)	(.00498)	(.00473)
Part time work	.0164*	.0151*	.0146**	-.0136	-.012	-.0113	.00636	.00655	.00403
	(.00858)	(.00784)	(.00722)	(.00959)	(.00874)	(.00805)	(.00967)	(.00864)	(.00786)
Sickness absence days	-.288	-.108	.0752	.768	.784	.74	-.442	-.396	-.438
	(.736)	(.669)	(.618)	(.728)	(.654)	(.598)	(.542)	(.49)	(.455)
Absence days for child	-.00085	-.00662	-.00274	.016	.024	.0236	-.00485	-.0137	-.0188
	(.0662)	(.0586)	(.0529)	(.0444)	(.0403)	(.037)	(.0435)	(.0391)	(.0358)
Obs.	32964	40608	47825	32964	40608	47825	32964	40608	47825

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 4, 5, and 6 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A6: Robustness checks varying the sample window: Mothers' labor market outcomes (2009 reform)

	0-1 years			2-3 years			4-5 years		
	4	5	6	4	5	6	4	5	6
Labor income (NOK)	991	837	1051	1804	895	389	3874	3082	2831
	(2508)	(2260)	(2076)	(2987)	(2725)	(2515)	(3584)	(3299)	(3063)
Weekly work hours	.487*	.481*	.499**	.203	.246	.252	-.0718	.0316	.128
	(.283)	(.257)	(.238)	(.271)	(.251)	(.234)	(.311)	(.283)	(.261)
Employed	.00157	.000143	-.0016	-.00254	-.00198	-.00126	-.00872	-.00744	-.00562
	(.00573)	(.00522)	(.0049)	(.00532)	(.00481)	(.00446)	(.00611)	(.00552)	(.00509)
Part time work	-.0114	-.00825	-.00638	-.0124	-.00966	-.00757	-.00778	-.00695	-.00591
	(.011)	(.00994)	(.00918)	(.0105)	(.00945)	(.00866)	(.0111)	(.01)	(.0092)
Sickness absence days	-.122	-.405	-.757	-1.95	-1.71	-1.54	-.596	-.178	.213
	(.95)	(.848)	(.777)	(1.18)	(1.07)	(.98)	(.783)	(.721)	(.669)
Absence days for child	-.00609	.00177	.0236	.0371	.0528	.0575	.00678	.00408	.0119
	(.0735)	(.0652)	(.0591)	(.0782)	(.0693)	(.0626)	(.0657)	(.059)	(.0539)
Mothers share of total household income	-.000636	-.000613	.000505	.000529	-.000551	-.000106	.00295	.00241	.00411
	(.00494)	(.00444)	(.00411)	(.00531)	(.00485)	(.00449)	(.00544)	(.00498)	(.00463)
Obs.	32964	40608	47825	32964	40608	47825	32964	40608	47825

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 4, 5, and 6 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A7: Specification checks: First stage (2009 reform)

	Baseline	No ind. controls	Quadratic trends	One week donut
Fathers				
- Uptake	.0404***	.043***	.0577***	.0216
	(.0139)	(.0137)	(.0185)	(.018)
- Number of leave days	16.9***	16.6***	16.2***	17.3***
	(1.03)	(.987)	(1.42)	(1.44)
Mothers				
- Number of leave days	-6.53***	-6.33***	-3.22	-10.2***
	(1.95)	(2.22)	(2.71)	(2.44)
Obs.	25267	27079	25267	23160

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A8: Specification checks: Fathers' labor market outcomes (2009 reform)

	Baseline			No ind. controls			Quadratic trends			One week donut		
	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years
Labor income (NOK)	-4748	-1115	-3895	-15351*	-12010	-12960	3349	10297	9200	-13611	-8310	-12597
	(6829)	(6919)	(8570)	(9172)	(9656)	(11246)	(9010)	(9568)	(11996)	(8575)	(7867)	(9794)
Weekly work hours	-.151	.241	-.245	-.191	.224	-.172	.163	.721	.157	-.346	.00129	-.743*
	(.35)	(.349)	(.343)	(.365)	(.365)	(.364)	(.45)	(.457)	(.444)	(.459)	(.46)	(.449)
Employed	.00341	.00375	-.00119	.00362	.00456	-.00237	.00654	.0108	-.00158	.00381	.00192	.000949
	(.0061)	(.00599)	(.00575)	(.00589)	(.00594)	(.00579)	(.00872)	(.00847)	(.00756)	(.00667)	(.00718)	(.00803)
Part time work	.0191**	-.0151	.00655	.0155	-.0148	.00491	.0158	-.0244	.00455	.0161	-.0128	.00518
	(.00949)	(.0107)	(.0112)	(.00985)	(.0102)	(.0109)	(.0123)	(.0155)	(.0169)	(.0129)	(.0134)	(.0129)
Sickness absence days	-.326	.807	-.718	-.785	.572	-1.06*	-1.31	1.05	-.954	-.386	1.44	-.343
	(.828)	(.836)	(.614)	(.792)	(.836)	(.631)	(1.09)	(1.27)	(.825)	(1.04)	(.929)	(.785)
Absence days for child	.0172	.0179	-.0049	-.00661	-.00906	-.00978	.0124	.0626	.00328	.0258	-.0243	-.0388
	(.0766)	(.0491)	(.0498)	(.0718)	(.0456)	(.0469)	(.108)	(.0599)	(.0663)	(.0962)	(.0698)	(.0624)
Obs.	25267	25267	25267	27079	27079	27079	25267	25267	25267	23160	23160	23160

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A9: Specification checks: Mothers' labor market outcomes (2009 reform)

	Baseline			No ind. controls			Quadratic trends			One week donut		
	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years
Labor income (NOK)	1419	3214	4972	-3591	-3072	-1812	4248	7961*	7964	-1909	-519	4001
	(2833)	(3320)	(3918)	(4821)	(5769)	(6226)	(3698)	(4206)	(5025)	(3821)	(4489)	(5664)
Weekly work hours	.516	.247	-.0608	.65**	.295	.0402	.647	.521	.0273	.174	-.18	-.107
	(.318)	(.3)	(.345)	(.326)	(.355)	(.342)	(.42)	(.403)	(.443)	(.414)	(.371)	(.445)
Employed	.00417	-.00238	-.00942	.00784	-.00164	-.00947	.00855	-.00256	-.0152*	.000144	-.00387	-.00789
	(.00647)	(.00614)	(.00687)	(.00583)	(.00593)	(.00654)	(.00941)	(.00947)	(.00893)	(.00738)	(.00631)	(.00916)
Part time work	-.0119	-.013	-.00992	-.0158	-.0144	-.0145	-.0038	-.007	-.00754	-.0276*	-.0192	-.0151
	(.0125)	(.0119)	(.0126)	(.0118)	(.0118)	(.0116)	(.0182)	(.0169)	(.018)	(.015)	(.014)	(.0136)
Sickness absence days	.0276	-1.91	-.884	-.428	-1.46	-1.13	.652	-1.26	-2.37**	-.7	-2.74	.187
	(1.09)	(1.36)	(.872)	(1.05)	(1.3)	(.865)	(1.49)	(1.95)	(1.17)	(1.49)	(1.67)	(1.23)
Absence days for child	.0324	.0377	.0105	.0525	.0316	-.00395	.0574	.0358	.0528	.0966	.0503	-.0811
	(.0851)	(.0901)	(.0747)	(.0817)	(.0832)	(.0693)	(.119)	(.119)	(.103)	(.0947)	(.122)	(.0923)
Mothers share of total household income	-.00126	.00122	.00332	-.000392	-.000484	.00477	-.000579	.00322	.00149	-.00128	-.00424	.0041
	(.00556)	(.00594)	(.00614)	(.00703)	(.00643)	(.00648)	(.00826)	(.00872)	(.00946)	(.00612)	(.00668)	(.0067)
Obs.	25267	25267	25267	27079	27079	27079	25267	25267	25267	23160	23160	23160

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * $p<0.1$, ** $p<0.05$, *** $p<0.001$.

Table A10: Local Linear Regression: First stage (2009 reform)

	Bandwidth 30 days	Bandwidth 60 days
Fathers		
- Uptake	.0625***	.0413***
	(.0199)	(.0129)
- Number of leave days	16***	16.7***
	(1.74)	(1.25)
Mothers		
- Number of leave days	-2.56	-5.67**
	(3.53)	(2.44)

Note: All coefficients are estimated using a linear RD model with triangular weights. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A11: Local Linear Regression: Fathers' labor market outcomes (2009 reform)

	Bandwidth 30 days			Bandwidth 60 days		
	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years
Labor income (NOK)	-1463	5312	5548	-14475	-11855	-9017
	(15277)	(15543)	(16536)	(10866)	(11154)	(12429)
Weekly work hours	.0675	.395	.0307	-.217	.356	-.143
	(.594)	(.502)	(.574)	(.362)	(.384)	(.388)
Employed	.00318	.00806	-.00685	.00566	.00831	-.00114
	(.0107)	(.00981)	(.0108)	(.00725)	(.00657)	(.00686)
Part time work	.0195	-.0141	.00997	.0185	-.0138	.00814
	(.0174)	(.0168)	(.0165)	(.0134)	(.0121)	(.0128)
Sickness absence days	-1.5	1.13	-.95	-.791	.799	-1.5*
	(1.41)	(1.41)	(1.12)	(1.01)	(1.02)	(.863)
Absence days for child	.00197	.0331	.0254	.00611	.021	-.021
	(.0979)	(.0836)	(.0708)	(.072)	(.0638)	(.0525)

Note: All coefficients are estimated using a local linear regression. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

Table A12: Local Linear Regression: Mothers' labor market outcomes (2009 reform)

	Bandwidth 30 days			Bandwidth 60 days		
	0-1 years	2-3 years	4-5 years	0-1 years	2-3 years	4-5 years
Labor income (NOK)	3889	5285	4509	-3039	-2797	-1522
	(8466)	(9908)	(10357)	(5544)	(6736)	(7670)
Weekly work hours	.841	.579	-.0836	.498	.177	-.0444
	(.543)	(.581)	(.6)	(.375)	(.419)	(.453)
Employed	.0141	-.00323	-.0112	.00522	-.00385	-.0142*
	(.0111)	(.0102)	(.0116)	(.0076)	(.00728)	(.00778)
Part time work	-.00818	-.0293	-.0107	-.0133	-.0134	-.0196
	(.0188)	(.0179)	(.0207)	(.014)	(.0129)	(.014)
Sickness absence days	-.564	-2.33	-2.38	-.282	-1.05	-1.26
	(1.81)	(2.03)	(1.51)	(1.31)	(1.38)	(1.05)
Absence days for child	.0561	.0506	.0787	.104	.04	.0109
	(.121)	(.116)	(.107)	(.0925)	(.0891)	(.0765)
Mothers share of total household income	.00555	.0072	.0104	-.00126	-.00202	.00194
	(.0105)	(.011)	(.0122)	(.00739)	(.00837)	(.00806)

Note: All coefficients are estimated using a local linear regression model. The sample include all eligible parents aged 20-50 years, with children born +/- 3 months around reforms. Additional controls included are age of both parents measured at birth, age squared, both parents' years of education measured in the year prior to birth, an indicator for child's gender, and an indicator for first-borns. Comparison mean in brackets, standard errors clustered at date of birth in parenthesis. * p<0.1, ** p<0.05, *** p<0.001.

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