

# Welfare Reforms and the Division of Parental Leave\*

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## Abstract

We formulate a model of parents' joint parental leave use to investigate the effect of welfare reforms on the division of parental leave. We estimate the model using Danish register data on almost 200,000 births combined with sharp variation in economic incentives created by the parental leave benefit system. The estimated model reproduces the empirical distribution of leave, including bunching at kinks in household budget sets and a large share of fathers taking little or no leave at all. We provide a menu of counterfactual policy simulations showing substantial interaction effects between earmarked leave, replacement rates and the duration of leave benefits. For example, our model predicts that introducing 9 weeks of earmarked parental leave with a low replacement rate will on average increase the leave of fathers by roughly 1 week, reduce the leave of mothers by 3.5 weeks and reduce household utility by 1% of household income. Finally, we discuss the efficient policy mix if the goal is to increase leave of fathers.

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# 1 Introduction

The arrival of children is one of the main drivers of labor market gender inequality ([Angelov \*et al.\*, 2016](#); [Lundborg \*et al.\*, 2017](#); [Kleven \*et al.\*, 2019b,a](#)), and part of the reason for the slow progress towards labor market gender equality in many developed countries over the past decades ([Olivetti & Petrongolo, 2016](#); [Blau & Kahn, 2017](#)). This fact has spurred an increasing interest in welfare reforms that incentivize parents to share the burden of child rearing. Central among such policies is earmarked (non-transferable) parental leave, which has recently been mandated by law in all EU member countries ([EU, 2019](#)).<sup>1</sup> However, while earmarked parental leave may reduce labor market gender inequality, opponents of earmarked leave argue that such policies in effect restrict the choice set of parents and hence risk reducing both total parental leave and household welfare.

The arguments put forward by the opponents of earmarked leave reflect a deficiency in our understanding of how the broader design of parental leave benefits affects parents' division of parental leave and household welfare. While a sizable literature studies partial elements of the parental leave system, such as the length of benefits (e.g. [Lalive & Zweimüller, 2009](#); [Dahl \*et al.\*, 2016](#)), earmarked parental leave (see Footnote 1), and the replacement rate while on leave (e.g. [Nielsen, 2009](#); [Raute, 2019](#)), these empirical findings are hard to combine into a general framework for understanding welfare reforms combining several of these features.

We formulate and estimate a model of parents' willingness to pay for parental leave to study a wide set of counterfactual parental leave reforms. The model allows for rich heterogeneity in preferences for leave including selection of parents into more family friendly occupations and future career concerns. With the estimated model, we provide the first general analysis of the effects of a menu of counterfactual parental leave reforms with particular focus on the interaction effects between earmarked parental leave, replacement rates and the length of shared parental leave benefit rights.

We estimate the model using detailed register data and sharp variation in economic incen-

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<sup>1</sup>Earmarked parental leave has already been implemented in e.g. Canada, Germany, Austria and Scandinavia ([Ekberg \*et al.\*, 2013](#); [Dahl \*et al.\*, 2014](#); [Cools \*et al.\*, 2015](#); [Patnaik, 2019](#)).

tives created by the Danish parental leave benefit system. The Danish parental leave system combines transferable, but relatively low public benefits (average replacement rate is around 50%) with temporary and earmarked wage compensation partly provided by employers. This two-tier system creates discontinuities in the marginal cost of leave at which we find sharp bunching, consistent with a significant effect of economic incentives on the take-up of parental leave (Saez, 2010; Kleven, 2016). Carefully modeling the household-level incentives for parental leave division in Denmark allows us to back out preferences from the bunching created by these kinks in the household budget set.

The estimated model replicates the empirical distribution of parental leave well, both in terms of the observed bunching at the at kink points and in terms of the extensive margin. In particular, despite the often strong incentives for fathers to take parental leave, we find that a large share of parents choose “the gender stereotypical” allocation with zero parental leave to the father. In fact, we find that half of the parents in our sample on the margin is willing to pay at least 10% of household earnings to avoid transferring parental leave from the mother to the father.

We conduct several counterfactual policy simulations using the estimated model. First, we investigate how introducing earmarked parental leave affects parents while keeping remaining features of the Danish institutional settings fixed. We find that earmarked leave of 9 weeks only increases the leave of fathers slightly while leave taken by mothers is reduced significantly. Combined, households reduce the number of parental leave weeks with around 2 weeks and experience a utility loss worth roughly around 1% of annual household income in our model.

We find, however, important interaction effects between earmarked leave, the replacement rate when on benefits and the total length of leave benefit rights, which explain the modest response of fathers described above. A higher replacement rate increases the behavioral responses of fathers to earmarked leave, and combining earmarked parental leave with higher replacement rates may fully undo the negative effects on household utility and the total parental leave duration.

Finally, we use the model to discuss the efficiency of different policies aimed at raising

fathers' use of parental leave. The in-sample simulations suggest that if total household leave is not a concern, the most efficient way to increase the fathers *share* of leave is to construct a less generous system with significant earmarked leave. Alternative policy goals, focusing on the absolute *level* of fathers' or household's leave, are most efficiently achieved by a more generous parental leave system with an extended period of parental leave benefits and a high replacement rate. In general, we find that earmarked parental leave is an efficient way to increase the leave of fathers.

Our paper contributes to three strands of literature. First, we contribute to the empirical literature on parental leave reforms and in particular the growing literature on the effects of earmarked parental leave (Ekberg *et al.*, 2013; Kluge & Tamm, 2013; Dahl *et al.*, 2014; Cools *et al.*, 2015; Avdic & Karimi, 2018; Andersen, 2018; Druedahl *et al.*, 2019; Farré & González, 2019; Patnaik, 2019; Olafsson & Steingrimsdottir, 2020). This literature studies the effects of earmarked leave on a number of outcomes such as the division of household work, the gender wage gap, fertility and marriage stability using actual policy reforms. We complement these studies in two ways. First, we provide evidence on the effect on household utility, a key component in the assessment of the desirability of earmarked leave reforms. Second, by carefully modeling the institutional settings we can relate the observed behavioral responses to the underlying changes in incentives. Hence, our study does not just provide behavioral responses to a particular reform but can serve as guide for policy markers when designing parental leave systems more broadly.

Second, we contribute to the large literature that uses discontinuities in marginal costs (so-called kinks) to estimate behavioral responses (Saez, 2010; Kleven, 2016). Concretely, the parental leave rules create kinks in the household budget set that depend on both parent's leave, requiring a joint analysis of the behavior of both parents. Furthermore, we document significant bunching in real outcomes (parental leave), something that is relatively uncommon in the existing labor supply literature (Chetty *et al.*, 2011; Bastani & Selin, 2014; Kleven, 2016; Søgaard, 2019). Instead, sharp and significant bunching is predominately found when considering reporting responses (le Maire & Schjerning, 2013) or when considering discontinuities in average costs (so-called notches) (Kleven & Waseem, 2013; Manoli & Weber, 2016). Potential explanations for this difference include that the temporary wage

compensation creates large discontinuities in the marginal costs and that parents explicitly plan their parental leave. Both of which work to overcome the optimization frictions that mask bunching responses in other settings.

Finally, we contribute to a growing literature using estimated economic models to analyze a broad set of counterfactual policy reforms. A paper closely related to ours, both in spirit and in methodology, is [Chan \(2013\)](#) who estimates a model of individual labor supply and investigates the labor supply effects of the Earned Income Tax Credit (EITC) in the US. Similarly, [Blundell \*et al.\* \(2016\)](#) analyze the U.K. tax and welfare system through a model of female labor supply. Similar “structural” approaches has for example been used to investigate the effect of pro-fertility policies on fertility and women’s careers ([Adda \*et al.\*, 2017](#)), the effect of taxes on labor supply (see [Keane, 2011](#) for a survey), the effect of social benefits on retirement of couples ([van der Klaauw & Wolpin, 2008](#)), and the effect of divorce laws ([Voena, 2015](#)). To the best of our knowledge, we provide the first analysis of counterfactual parental leave reforms.

The rest of the paper is organized as follows. Section 2 presents a model parent’s willingness to pay for parental leave together with a general formulation of a parental leave benefit system. Section 3 describes the Danish register data and institutional settings which we use to estimate the model in Section 4. In Section 5 we use the estimated model to investigate the in-sample effects of counterfactual policies. Finally, Section 6 concludes.

## 2 Model

In this section, we formulate a discrete choice model of the division of parental leave between mothers and fathers after a childbirth. The model includes a flexible parental leave benefit system and allows for rich heterogeneity in preferences for parental leave through both observed and unobserved household characteristics.

Parents to child  $i$  choose the amount of leave of the mother,  $l_{i,m} \in \{0, 1, \dots\}$ , and the father,

$l_{i,f} \in \{0, 1, \dots\}$  that maximize household utility, given by

$$U(l_{i,m}, l_{i,f}, y_i) = y_i + \sum_{j \in m, f} \left( \alpha_{i,j} l_{i,j} + \frac{1}{2} \beta_{i,j} l_{i,j}^2 \right) + \rho l_{i,m} \cdot l_{i,f}, \quad (1)$$

where  $y_i$  is disposable income and  $\alpha_{i,j}$ ,  $\beta_{i,j}$  and  $\rho$  for  $j \in \{m, f\}$  measure preferences for leave of each parent.

This specification implies that the couple's willingness to pay for an incremental increase in leave of parent  $j$  is given by

$$MWP_{i,j} \equiv \frac{U(l_{i,j} + \Delta l_j, l_{i,-j}, y_i) - U(l_{i,j}, l_{i,-j}, y_i)}{\Delta l_j} = \alpha_{i,j} + \beta_{i,j} l_{i,j} + \rho l_{i,-j} + \frac{1}{2} \beta_{i,j} \Delta l_j, \quad (2)$$

which is linear in leave with  $\alpha_{i,j}$  as the level parameter,  $\beta_{i,j}$  as the slope in parent  $j$ 's own leave, and  $\rho$  allowing for parental leave to be complementarities or substitutes.

We allow the utility parameters to depend on parental characteristics through

$$\begin{aligned} \alpha_{i,j} &= \gamma_{\alpha,j} X_{i,j} + \varepsilon_{i,j}, \\ \beta_{i,j} &= \gamma_{\beta,j} X_{i,j}, \end{aligned} \quad (3)$$

where  $X_{i,j}$  is a set of observed individual and household-level characteristics, and  $\varepsilon_{i,m}$  and  $\varepsilon_{i,f}$  are unobserved random utility parameters, which we assume follow a bi-variate normal distribution with mean zero, variances of  $\sigma_f^2$  and  $\sigma_m^2$  and covariance  $\sigma_{mf}$ .

Disposable household income is given as

$$y_i = (1 - \tau) \left( B(l_{i,m}, l_{i,f}; Z_i, \mathcal{B}) + \sum_{j \in m, f} w_{i,j} (52 - l_{i,j}) \right), \quad (4)$$

where  $w_{i,j}$  is the weekly earnings of parent  $j$  and  $\tau$  is the income tax rate.<sup>2</sup>  $B(l_{i,m}, l_{i,f}; Z_i, \mathcal{B})$  is the parental leave benefits as a function of each parent's leave, relevant household in-

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<sup>2</sup>We focus on the incentives created by the parental leave system and model the tax system as a simple proportional tax on total income. This simplification does not have significant implications for our results, as the complexity in the tax system is largely orthogonal to the complexity in the parental leave system. In our empirical application below, we set  $\tau = 0.4$ , which corresponds to the typical marginal tax on non-capital income in Denmark.

formation ( $Z_i$ ) such as wage rates, and the institutional settings ( $\mathcal{B}$ ), described in detail below.

The model is intended to capture the main trade-offs parents face when allocating parental leave between them. For example, we want the model to be able to accurately describe the parents' *joint* allocation of parental leave. Thus, we model the amount of leave on the weekly level leading to a choice-set with  $53^2 = 2,809$  discrete alternatives for a given value of observed and unobserved household characteristics,  $Z_i$ ,  $X_{i,j}$  and  $\varepsilon_{i,j}$ , above.<sup>3</sup>

We have formulated the household decision problem as static to keep estimation computationally tractable. The model incorporates dynamic considerations of parents into parents' willingness to pay for leave. Parents may, for example, be concerned with the consequences of parental leave on their future career (Rege & Solli, 2013; Johnsen *et al.*, 2020) due to losses in human capital (Adda *et al.*, 2017) or norms and signaling effects (Tô, 2018). This will reduce their willingness to pay for a given level of leave, which is captured in  $\alpha_{i,j}$  and  $\beta_{i,j}$ . We probe the explanatory power of such extrinsic motives in Section 4, when we estimate the model including e.g. potential wage growth and firm-level parental leave information in  $X_{i,j}$ , and discuss the implications for counterfactual simulations in Section 5.

Finally, the model is unitarian in the sense that parents allocate parental leave optimally as if they were a single agreeing unit. Alternatively, household bargaining could be implemented through a collective model (see, e.g., Chiappori, 1992; Bourguignon & Chiappori, 1994) or as a non-cooperative model (e.g. Konrad & Lommerud, 2003). While such alternatives are interesting avenues for future research, we opt for the unitary model for simplicity.<sup>4</sup>

## 2.1 Parental Leave Benefit System

We formulate the parental leave benefit system in a flexible way, incorporating the key institutional details present in most developed countries, including Denmark. In particular,

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<sup>3</sup>Empirically, there is significantly heaping around integer weeks, suggesting that weekly leave is a good approximation of the decision problem.

<sup>4</sup>Gobbi *et al.* (2018) estimate a collective model of parental leave use in Germany.

we allow the parental leave benefits to be a non-linear function of the leave taken by both parents. As described in Section 3, the non-linear parental leave benefits are in the Danish setting created by a two-tier system that combines public parental leave benefits with wage compensation partly provided by firms, but the system could just as well be purely public or private.<sup>5</sup>

The parental leave benefit system consists of the following policy parameters: *i*) a statutory benefit replacement rate as a share of pre-birth earnings ( $\chi$ ), *ii*) a benefits cap ( $\kappa$ ), *iii*) leave earmarked to each parent ( $\bar{e}_j$ ), *iv*) the total number of household weeks of parental leave benefits including earmarked weeks and leave with full wage compensation ( $\bar{p}_H$ ), *v*) the number of weeks with full wage compensation for each parent ( $\bar{z}_j$ ), and *vi*) the number of weeks with full wage compensation shared between the parents ( $\bar{z}_H$ ).

Before discussing these economic incentives created by the parental leave system, we formally describe the institutional settings captured in  $B(l_m, l_f; Z, \mathcal{B})$ .<sup>6</sup> We assume throughout that parents maximize the amount of benefits they can receive for a given combination of leave. This implies that in situations where parents exhaust the shared leave components, they will allocate leave with benefits to the parent with the highest benefit level.

Denoting parent  $k$  as the parent with the highest weekly earnings,  $w_k > w_{-k}$ , we allocate any shared weeks with wage compensation ( $\bar{z}_H$ ) between the parents and compute the used weeks with wage compensation for each parent as

$$z_k = \min(\bar{z}_k + \bar{z}_H, l_k), \quad (5)$$

$$z_{-k} = \min(\bar{z}_{-k} + r_z, l_{-k}), \quad (6)$$

where  $r_z = \min(\bar{z}_k + \bar{z}_H - z_k, \bar{z}_H)$  is the shared weeks with wage compensation unused by the highest earning parent.

Similarly, we allocate the total parental leave benefits ( $\bar{p}_H$ ) (net of earmarked leave and leave with wage compensation) to the parent  $k$  with the highest weekly benefits, defined

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<sup>5</sup>The two-tier system created by the combination of public benefits and firm paid wage compensation is similar to the setting in many other countries, including some of US states (Goldin *et al.*, 2020).

<sup>6</sup>We drop child subscript  $i$  throughout this exposition to ease notation.



as

$$b_j = \min(\chi w_j, \kappa), \quad (7)$$

and compute the weeks with benefits for each parent as

$$p_k = \min(r_{p,k}, l_k - z_k), \quad (8)$$

where  $r_{p,k} = \bar{p}_H - z_k - \max(\bar{e}_{-k}, z_{-k})$  is the unused shared parental leave remaining for parent  $k$  after deducting leave with wage compensation and leave earmarked to parent  $-k$ . Leave with parental benefits to the parent  $-k$  is then given by

$$p_{-k} = \min(r_{p,-k}, l_{-k} - z_{-k}), \quad (9)$$

where  $r_{p,-k} = \bar{p}_H - z_{-k} - \max(\bar{e}_{-k}, z_{-k} + p_k)$  is the remaining parental leave benefits for use by parent  $-k$ .

Combining the above, we calculate total parental leave benefits as

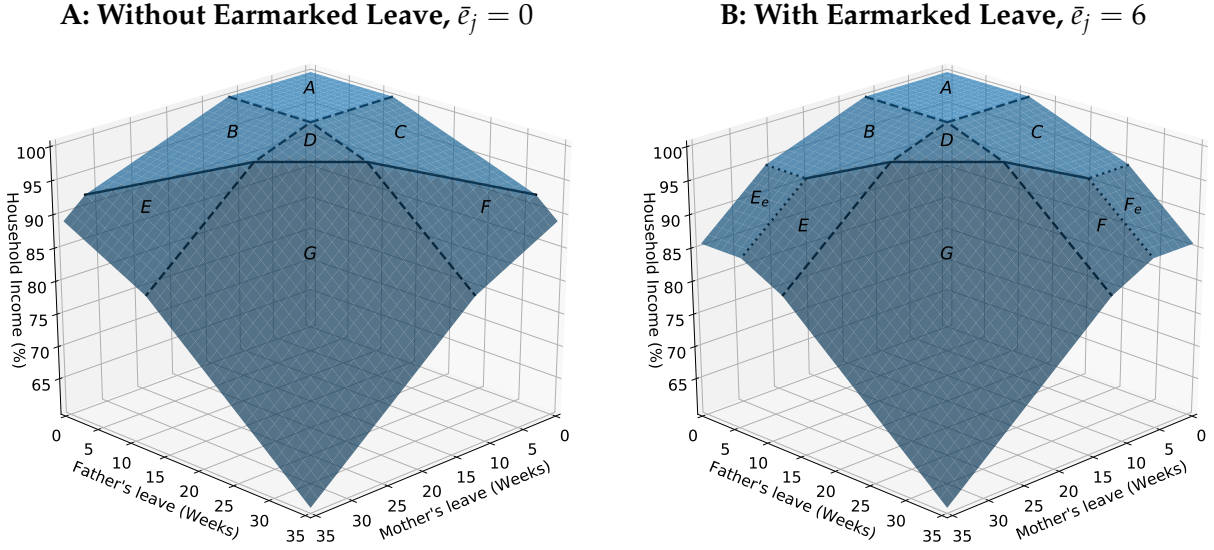
$$B = \sum_{j \in \{m, f\}} z_j w_j + p_j b_j. \quad (10)$$

We illustrate the resulting household budget sets in Figure 1 for  $w_j = 1000$ ,  $\bar{z}_j = 12$ ,  $\bar{z}_H = 0$ ,  $\bar{p}_H = 32$ ,  $\chi = 1$ ,  $\kappa = 580$  and  $\bar{e}_j \in \{0, 6\}$ . Thus, while the setup allows for general asymmetry in the parent-specific parameters, the example presented here is completely symmetric with respect to the mother and father. We plot household income,  $y(l_m, l_f)$ , relative to the no-leave income,  $y(0, 0)$ .

In Figure 1 Panel A, we divide the budget set into 7 segments depending on the economic incentives parents face. In segment A, where  $(l_m, l_f) \in \{0, \dots, 12\}^2$ , household disposable income is unaffected by the number of weeks on leave since both parents receive full wage compensation in 12 weeks in this example. Hence, in this segment, the cost of an incremental increase in leave for both parents is  $\Delta y / \Delta l_j = 0$ .

Moving outside this plateau, the slopes of the budget set change discretely in multiple places. These kinks in the budget set are key to the identification of the model, as dis-

Figure 1: Examples of Household Budget Sets



Notes: The figure illustrates the household budget set,  $y(l_m, l_f)$ , as a function of leave of both parents. We report the budget set in percent relative to taking no leave,  $y(0, 0)$ . The budget sets are illustrated for a situation with  $w_j = 1000$ ,  $\bar{z}_j = 12$ ,  $\bar{z}_H = 0$ ,  $\bar{p}_H = 32$ ,  $\chi = 1$ ,  $\kappa = 580$  and  $\bar{e}_j \in \{0, 6\}$ . Panel A has no earmarked parental leave,  $\bar{e}_j = 0$ , while Panel B include 6 weeks of earmarked leave to both parents,  $\bar{e}_j = 6$ .

cussed in Section 4. In the segments C and D, the father has exhausted his wage compensation without the couple having exhausted their total public parental leave. Hence, in these segments the father will only be eligible for the lower parental leave benefits ( $b_f = \min(\chi w_f, \kappa)$ ) and incremental increases in leave will reduce household income by the difference between his wage and the benefits net of taxes,  $\Delta y / \Delta l_f = (1 - \tau)(b_f - w_f)$ . Similarly, the incremental cost of parental leave for the mother in segments B and D is given by  $\Delta y / \Delta l_m = (1 - \tau)(b_m - w_m)$ .<sup>7</sup>

The third kink arises due to the exhaustion of the parental leave benefits of  $\bar{p}_H = 32$  weeks, indicated by the solid line in Figure 1. In segment G, the parents are no longer eligible for benefits, and hence, the incremental cost of leave for both parents is given by their full wage net of taxes,  $\Delta y / \Delta l_j = -(1 - \tau)w_j$ .

The exhaustion of the public leave also creates kinks between segments B-E and C-F, but with slightly different changes in slopes. For example, in segment E the father have not ex-

<sup>7</sup>Without the symmetry we would still have a jump in the marginal cost of leave for the mother when moving from A to C or B to D, but the size and position of these kinks would differ from those of the father.

hausted his wage compensation despite the parents having exhausted their shared leave. Hence, when the father takes more leave he will use parental leave benefits at the expense of the mother in order to take advantage of his wage compensation. This creates an incremental cost of leave for the father of  $\Delta y / \Delta l_f = -(1 - \tau)b_m$ , and similarly, for the mother in segment G.

In addition to the isolated marginal cost of leave of each parent, consider the marginal cost of reallocating leave from one parent to the other holding fixed total household leave. These costs are given by the difference between their marginal cost of leave. Consider, for example, segment B, where the father is still covered by wage compensation, while the mother receives lower parental benefits. Hence, reallocating leave from the mother to the father in this segment will *increase* household income by  $\Delta y / \Delta l_f - \Delta y / \Delta l_m = (1 - \tau)(w_m - b_m)$ , and as we show in Section 4, this is a common situation for Danish parents to be in.

In Figure 1 Panel B we illustrate a budget set with all parameters as in Panel A, except that  $\bar{e}_j = 6$  weeks of leave is now earmarked each parent. This creates two additional segments,  $E_e$  and  $F_e$ , where the mother or the father take less than 7 weeks, respectively. These segments provide lower income than in the previous setting without earmarked leave and arise from the fact that total parental leave benefits,  $\bar{p}_H$ , no longer can be fully shared between parents.

In addition to the reduction in household income in segment  $E_e$  and  $F_e$ , the earmarked leave also changes the incremental cost of leave in two ways: First, in segment  $E_e$  the cost for the mother is now her full wage net of taxes,  $\Delta y / \Delta l_m = -(1 - \tau)w_m$ , and similarly for the father in segment  $F_e$ . Second, in segment  $E_e$ , the leave of the father is no longer rivaling the leave of the mother, as she cannot use the leave with benefits even if he does not. This implies that the incremental cost of leave for the father is 0 in segment  $E_e$ , and similarly for the mother in segment  $F_e$ .

As discussed above, the parental leave system creates a number of segments in which parents could increase their leave without reducing household income, or could even reallocate leave and *increase* household income. These segments are informative about par-

ents' willingness to pay for parental leave to the extent we observe empirically (as we do) that parents are willing to forego contemporaneous income by allocating leave in a way that leaves money on the table. We use this information in the identification of the model parameters below.

## 3 Danish Data and Institutional Setting

### 3.1 Institutional Settings

During our sample period the Danish parental leave system provides a total of 52 weeks of leave divided into four parts: *i*) 4 weeks of pregnancy leave before estimated date of delivery, *ii*) 14 weeks of maternity leave after birth, *iii*) 2 weeks of paternity leave within the first 14 weeks after birth, and *iv*) 32 weeks of shared parental leave of which none are earmarked.<sup>8</sup>

We focus on the division of the final 32 weeks of shared parental leave between mothers and fathers. As we show below, parents typically allocate most leave to the mother, and the marginal decision to transfer leave between parents is thus in the last half of the shared parental leave. Hence, we are effectively studying the allocation of parental leave when the child is typically 8–12 months old, when the relative biological advantage of mothers in child rearing (e.g. due to breastfeeding) is less pronounced.

Parents have wide flexibility in when and how to use the 32 weeks of shared parental leave: They can take leave together, return to work fully or part time, postpone a proportion of the leave until the child is up to 8 years old and extend the leave by either 8 or 14 weeks.<sup>9</sup> However, parents must inform their employer about their planned leave well in advance and thus cannot take leave on a day to day basis.

While on any of the four types of leave, parents who are employed pre-birth are eligible

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<sup>8</sup>The public leave is assigned to parents per birth regardless of the number of children born. Hence, twin births do not trigger additional leave. See, e.g., [Andersen \(2018\)](#) for additional details of the Danish parental leave system.

<sup>9</sup>Extensions do not trigger more benefits but parents can choose to smooth their benefits over the total duration of leave.

for public benefits equivalent to unemployment benefits.<sup>10</sup> For a full-time employee (37 hours per week) benefits replace 100% of pre-birth earnings up to a benefit cap of EUR 580 per week (2019-level, EUR 1  $\approx$  DKK 7.5).<sup>11</sup> Hence, the public benefits only replace hourly wages up to EUR 15.7, which is close to the effective minimum wage in the Danish labor market. Compared to an average hourly wage rate of EUR 30, the benefits offer an effective replacement rate of only 53%, which is low by European standards (OECD, 2019).

The low public replacement rate is partly offset by firm-provided wage compensation, which cover the gap between public benefits and the parent’s former wage.<sup>12</sup> The wage compensation does in most cases not cover the entire period of potential leave and cannot be transferred between parents. Hence, combined with the public parental leave benefits the wage compensation creates budget sets similar to the ones presented in Section 2. In the notation of the general parental leave system presented in that section, the division of the shared parental leave benefits in the Danish system is characterized by  $\chi = 1$ ,  $\kappa = 580$ ,  $\bar{e}_j = 0$ ,  $\bar{p}_H = 32$  and  $\bar{z}_j$  and  $\bar{z}_H$  varying across parents. We will discuss the individual and shared wage,  $\bar{z}_j$  and  $\bar{z}_H$ , compensation in detail below.

## 3.2 Data

We use administrative data for the full population in Denmark. The data combine several administrative registers (linked at the individual level via personal identification numbers) and contain detailed information on earnings and benefits received as well as demographic information. The data allow us to link individuals over time, to other family members and

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<sup>10</sup>The employment criteria is roughly that the parent was working at least three out of four months. Employees are also covered by extended job protection during pregnancy and (all types of) parental leave, which implies that the employer must prove that a firing was fully motivated by other factors than the pregnancy or leave.

<sup>11</sup>For employees working less than full-time the cap is scaled down proportionally. Parents on unemployment benefits pre-birth are also eligible for parental leave benefits, while parents, who have children while being on other types of benefits such as cash or student benefits typically will stay on these benefits.

<sup>12</sup>In practice, firms pay out the entire wage to employees when providing wage compensation and receive the public parental leave benefits as reimbursement from the state. For firms in the private sector, the wage compensation (the difference between the wages paid out and the public benefits) is to a large extent covered by parental leave funds organized by either the state or employer organizations, and hence, private firms are largely unaffected financially by having workers on parental leave (Brenøe *et al.*, 2020). During the period we consider, it is mandatory for firms to be a member and to contribute to a parental leave fund, but it is not mandatory for firms to actually provide wage compensation.

workers to firms.

Our two main data sources are spell data on the use of parental leave available for parents to children born 2008-2015 and monthly earnings data for the universe of Danish employees starting in 2008. The spell data has information on the amount of leave benefits received by each parent-child observation, including whether the benefits has been paid out to the parent or to the employer. Benefits are paid to the employer when the employer provides wage compensation, as employers in practice pay the entire wage to employees when providing wage compensation and receive the public parental leave benefits as reimbursements from the state.

We compute the total number of parental leave weeks from the start and end dates of the spell and use the total benefits paid out to calculate individual replacement rates. With these replacement rates, we calculate the number of weeks with full wage compensation from the amount of benefits paid to the employer. Our measure of parental leave includes all full-time leave taken at most three years after childbirth.

We restrict our attention to parents who are in stable employment and not on public benefits in the 3 months leading up to the birth, except pregnancy related benefits. We consider each birth a separate observation, but we exclude births of parents who have a subsequent child within 15 months. These restrictions leave us with just below 190,000 births as shown in Table 1.

Table 1: Sample Selection.

	<b>Mothers</b>	<b>Fathers</b>	<b>Births</b>
All Births 2008-2015	414,248	414,248	414,248
+ No Close Births	404,860	404,860	404,860
+ Parents in Stable Employed Pre-birth	266,367	296,847	215,935
+ Parents not on Benefits Pre-birth	254,260	276,653	196,578
+ Parents in Parental Leave Data	243,843	213,571	189,974
<b>Final Sample</b>			<b>189,974</b>

*Notes:* Close births are defined as parents having subsequent children within 15 months. Stable employment is defined as being continuously employed in the same firm in the 3 months prior to birth. Similarly, we exclude parents who are on non-birth related public benefits at some point during the 3 months prior to birth. Our sample is not significantly affected by considering a longer (e.g. 9 months) pre-birth period. Each observation is a parent(s)-child combination, and hence, parents may enter multiple times if they have more children and in each case fulfill the selection criteria.

Table 2 provides descriptive statistics for our final sample. Half of the parents are married, and fathers are on average 2 years older than mothers. Additionally, mothers are positively selected into the public sector, larger firms, and industries, in which both fathers and mothers take longer parental leave. Mothers have lower pre-birth weekly earnings on average, but is on a steeper part of their career trajectory, measured by the potential earnings growth. The potential earnings growth is computed from a Mincer regression of log earnings on education level, field of study and labor market experience, as described in the table notes.

Table 2: Descriptive Statistics

	Fathers			Mothers		
	P25	Mean	P75	P25	Mean	P75
Child Generation	2,009.00	2,011.38	2,013.00	2,009.00	2,011.38	2,013.00
Total Number of Children	1.00	1.80	2.00	1.00	1.80	2.00
Married	0.00	0.51	1.00	0.00	0.51	1.00
Age	30.00	33.22	36.00	28.00	31.09	34.00
<i>Earnings</i>						
Weekly Earnings (EUR)	955.22	1,273.33	1,424.42	795.19	993.30	1,127.37
Potential Earnings Growth	0.00	0.12	0.18	0.06	0.16	0.23
Replacement Rate	0.41	0.51	0.61	0.50	0.60	0.69
Earnings Share in Couple	0.50	0.55	0.61	0.39	0.45	0.50
<i>Sector, Firm and Industry Characteristics</i>						
Private Sector	1.00	0.79	1.00	0.00	0.46	1.00
Local Government	0.00	0.11	0.00	0.00	0.44	1.00
Central Government	0.00	0.10	0.00	0.00	0.10	0.00
Firm Size (Employees)	25.38	3,853.94	2,428.63	124.92	8,478.68	10,697.13
Median Weekly Earnings in Firm (EUR)	869.19	1,027.28	1,186.90	825.67	925.93	1,041.55
Median Male Leave in Industry	0.00	1.58	3.00	0.00	3.02	6.00
Median Female Leave in Industry	26.00	27.84	32.00	26.00	28.75	32.00

*Notes:* The table provides descriptive statistics for each parent-child observed. All variables are measured pre-birth and all monetary amounts are scaled to 2019 levels. We compute individuals' potential earnings growth as follows: First, we estimate a Mincer equation of log earnings on education level, field of study and labor market experience on a sample of only men. Second, using the estimated coefficients, we predict the log earnings for all parents in two situations: A) given their pre-birth education and experience, and B) given their pre-birth education and experience plus 5 years. The difference between A and B is our estimate of potential increase in log earnings over the next 5 years. Median leave is measured within 6-digit industry (740 Groups).



### 3.3 Individual Rights to Wage Compensation

We do not observe the individual rights to wage compensation directly in the data, and hence, we need to impute these.

#### The Public Sector

For the public sector, the collective labor market agreements stipulate a common set of rules for all employees. These rules give both parents the right to 6 weeks of full wage compensation with an additional 6 weeks shared between them (the so-called 6-6-6 model). However, the latter 6 weeks of wage compensation are only shared between parents if they are both employed in the same public sub-sector (either the central or local government). If instead, for example, the father is employed in the central government (state) and the mother in the local government (e.g. municipalities) or private sector, the father can use the 6 shared weeks uncontested. Hence, in this case, he has an individual right to 12 weeks of wage compensation.<sup>13</sup> We use these rules directly to impute the rights to wage compensation of publicly employed parents based on register data on the employment sector of both parents.

#### The Private Sector

Compared to the public sector, there is significant variation in the individual rights to wage compensation among private sector employees. The variation is created by three overall factors: *i*) Differences in collective agreements applying to different employees, *ii*) Firms not covered by collective agreements, and *iii*) Employees that negotiate additional individual rights to wage compensation. Hence, we impute each individual's rights to wage compensation in two steps for private sector employees.

First, we assume that parents whom we observe taking some leave without wage compensation must have first exhausted their individual right to wage compensation. For these

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<sup>13</sup>The 6-6-6 model was in effect between April 1st, 2008 and April 1st, 2015, which covers the bulk of our sample period. Starting April 1st 2015, the 6-6-6 model was replaced by a 6-7-6 model providing fathers with an additional week of wage compensation.

parents, we assume that the observed leave with wage compensation in the data is equal to their individual rights. Formally, let  $l_i$  denote the leave taken,  $\bar{z}_i$  the (unobserved) individual right to wage compensation, and  $z_i$  the observed weeks of leave with wage compensation for individual  $i$ . We then impose the natural assumption that  $\bar{z}_i = z_i$  if  $l_i > z_i$ . We impute the individual right to wage compensation through individual exhaustion for around 35 percent of parents working in the private sector (see Table 3).

Second, for parents who do not exhaust their wage compensation ( $l_i = z_i$ ), we know that  $\bar{z}_i \geq z_i$ . For these parents we impute  $\bar{z}_i$  as the mode wage compensation among the coworker parents, who we observe with wage compensation weakly above parent  $i$ , and who exhaust their wage compensation.<sup>14</sup> Formally, that is

$$\bar{z}_i = \begin{cases} z_i & \text{if } l_i > z_i \\ \arg \max_{\bar{z}} f(\bar{z} | \underbrace{j \subset G_i}_{\text{Coworkers}}, \underbrace{l_j > z_j}_{\text{who exhaust with}}, \underbrace{z_j \geq z_i}_{\text{weakly more compensation}}) & \text{else} \end{cases} \quad (11)$$

where  $f(\bar{z}|\cdot)$  is the empirical conditional probability function of weeks with wage compensation of coworkers in the same group,  $G_i$ , as individual  $i$ .<sup>15</sup>

Our preferred imputation of  $\bar{z}_i$  is based on groups of coworkers defined as firm-year cells. However, as our imputation requires at least two coworkers who exhaust their wage compensation, there are a set of predominately smaller firms for whom we cannot obtain an imputation at this dis-aggregated level. For the parents in this subset of firms, we define the coworker group as industry-year cells. In Table 3 we split the private sector sample according to the definition of coworker group used to impute their individual right to wage compensation. For a third of fathers, who do not exhaust their benefits, we impute the right to wage compensation from within firm-year cells, while the remaining is identified from industry-year cells. The vast majority of mothers exhaust their benefits, and thus, we are able to identify their right to wage compensation directly from their observed amount of wage compensation.

<sup>14</sup>We allow for misclassified reimbursement claims by scaling down the mass with zero wage compensation by 50% when computing the mode.

<sup>15</sup>We illustrate our estimation strategy in Appendix Figure A.I.

Table 3: Definition of Coworkers Used in the Private Sector Imputation

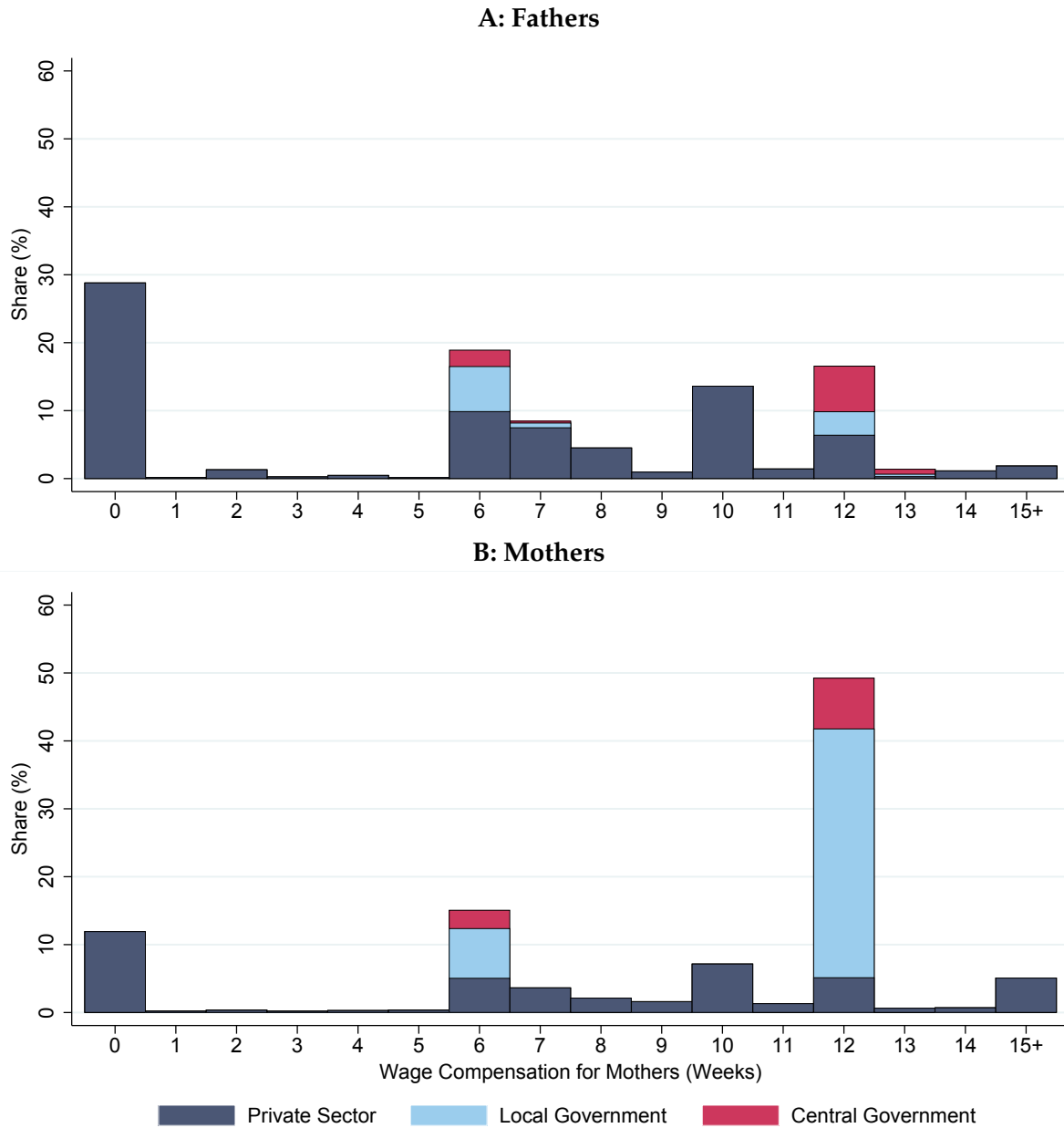
Share of Parents (%)	Fathers	Mothers	Total
Individual <sup>†</sup>	5.3	29.12	34.42
Within Firm	19.13	1.72	20.85
Within 6-Digit Industry (740 Groups)	36.12	1.58	37.7
Within 5-Digit Industry (127 Groups)	4.95	2.09	7.04
<b>Total</b>	<b>65.49</b>	<b>34.51</b>	<b>100.00</b>

*Notes:* The table shows the definition of coworkers used to impute the individual rights to wage compensation in the private sector. In all case we define coworker groups as within year.

<sup>†</sup> Parents who exhaust their parental leave benefits.

In Figure 2 we show the distribution of individual rights to wage compensation based on the procedure described above. The figure reveals a marked difference in rights to wage compensation between fathers and mothers with the distribution for mothers shifted significantly towards more weeks with wage compensation. Part of this difference is driven by the fact that mothers to a larger extent is employed in the public sector, but even within the private sector mothers are more likely to work in firms offering more generous wage compensation.

Figure 2: Imputed Individual Rights to Wage Compensation



*Notes:* The figure shows the distribution of individual rights to wage compensation based on the imputation procedure described in Section 3.3. In the private sector we impute individual rights to wage compensation based on observed coworker behavior, while we in the public sector base it on the sub-sectors in which the parents are employed. If parents are employed in the same public sub-sector (central or local government), they have 6 weeks of individual wage compensation and 6 weeks shared. The shared wage compensation are not shown in the figure, but we incorporate them in our analysis in Section 4 as explained in Section 2.

The imputation method provides accurate measures for publicly employed parents. In Figure A.II in the Appendix, we apply our imputation method designed for privately em-

ployed parents to parents in the public sector. For these parents, we know their actual rights through the collective labor market agreements and can compare the imputed rights to those. We find estimates consistent with the collective agreement rules for more than 90% of fathers and 70% of mothers. The larger fraction of measurement error for women is less of a problem in the empirical analysis, as women in most cases take more leave than typically covered by wage compensation, and hence, the marginal incentives to take leave is largely unaffected by differences in their wage compensation.

## 4 Results

We estimate the model outlined in Section 2 through Maximum Likelihood in a Mixed Multinomial Logit Framework (MMNL) (McFadden & Train, 2000). Concretely, we assume that on top of the economic model outlined in Section 2, parents receive a leave-specific random taste shock,  $\epsilon(l_{i,m}, l_{i,f})$ . That, in turn, yields an associated value of choice as

$$v(l_{i,m}, l_{i,f}) = U(l_{i,m}, l_{i,f}; Z_i, X_i, \epsilon_{i,m}, \epsilon_{i,f}) + \epsilon(l_{i,m}, l_{i,f}),$$

where we assume that  $\epsilon(l_{i,m}, l_{i,f})$  follows an Extreme Value Type I distribution.

With this assumption, the likelihood of observing a leave bundle given  $Z_i, X_i, \epsilon_{i,m}, \epsilon_{i,f}$  is equal to the standard multinomial logit probabilities

$$P(l_{i,m}, l_{i,f} | Z_i, X_i, \epsilon_{i,m}, \epsilon_{i,f}) = \frac{\exp(U(l_{i,m}, l_{i,f}; Z_i, X_i, \epsilon_{i,m}, \epsilon_{i,f}))}{\sum_{k=0}^{52} \sum_{n=0}^{52} \exp(U(k, n; Z_i, X_i, \epsilon_{i,m}, \epsilon_{i,f}))}.$$

Integrating out the unobserved preference parameters  $(\epsilon_{i,m}, \epsilon_{i,f})$  we obtain

$$P(l_{i,m}, l_{i,f} | Z_i, X_i) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} P(l_{i,m}, l_{i,f} | Z_i, X_i, \epsilon_{i,m}, \epsilon_{i,f}) \phi(\epsilon_{i,m}, \epsilon_{i,f}; \Omega) d\epsilon_{i,m} d\epsilon_{i,f},$$

where  $\phi(\epsilon_m, \epsilon_f; \Omega)$  is the bi-variate Normal probability density function with mean zero and covariance  $\Omega$ .<sup>16</sup> We parameterize the covariance matrix as  $\Omega = TT'$  where  $T =$

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<sup>16</sup>We use in total 49 Gaussian quadrature nodes/weights to approximate the integrals numerically.

$\begin{pmatrix} \tilde{\sigma}_f & 0 \\ \tilde{\sigma}_{mf} & \tilde{\sigma}_m \end{pmatrix}$  to ensure that the covariance matrix is always positive definite and report standard errors of the elements of  $\Omega$  using the Delta method.

We estimate the parameters  $\theta = (\gamma_{\alpha,m}, \gamma_{\alpha,f}, \gamma_{\beta,m}, \gamma_{\beta,f}, \rho, \sigma_m, \sigma_f, \sigma_{mf})$  with data on  $i = 1, \dots, n$  births as

$$\hat{\theta} = \arg \max_{\theta} \frac{1}{n} \sum_{i=1}^n \log (P(l_{i,m}, l_{i,f} | Z_i, X_i)).$$

## 4.1 Identification

The key parameters governing how parents respond to changes in the budget set are the slope parameters,  $\beta_j$ , and the interaction effect between the leave of the parents,  $\rho$ . We identify these parameters through an assumption on the underlying distribution of the preference shocks  $(\varepsilon_m, \varepsilon_f)$  in  $\alpha_j$ . The key assumption is that the distribution of  $\varepsilon_m, \varepsilon_f$  is smooth. With this assumption, the overall distribution of parents' willingness to pay for parental leave is smooth, which translates into a smooth distribution of parental leave use in the absence of discontinuities in the parental leave benefit system,  $B(\cdot)$ . In contrast, kink points in the household budget set through  $B(\cdot)$  will create mass points in the leave distribution (bunching) to the extent that parents responds to the changes in the marginal cost of leave. Hence, these mass points identify  $\beta_j$  and  $\rho$ . Specifically, we can think of  $\beta_j$  as being identified from the kinks created by the exhaustion of each parents' wage compensation, while kinks created by the shared parental leave identifies  $\rho$ . The fact that we allow  $\beta_j$  to vary with the characteristics of parents ( $X_j$ ) captures heterogeneity in the responsiveness through the parameters  $\gamma_{\beta,m}, \gamma_{\beta,f}$ .

In turn, we identify the parameters related to the covariance matrix of the preference shocks,  $\sigma_m, \sigma_f, \sigma_{mf}$  as well as the heterogeneity in  $\alpha_j$  captured by  $\gamma_{\alpha,m}, \gamma_{\alpha,f}$  from variation in the joint parental leave use away from the individual and household level kinks in the budget set together with the joint normality assumption.

In summary, identification in our model rests on the same key assumptions as in traditional bunching studies (Saez, 2010; Kleven, 2016). However, our structural approach allows us to handle the complexity of the parental leave system in terms of both of the location and

magnitude of the discontinuities created by parents' wage compensation and the rivaling nature of the 32 weeks of shared parental leave.

## 4.2 Parameter Estimates and Model Fit

In Table 4 we list the covariates included in the estimation and report the estimated parameters. All variables except the dummies for sector and wage compensation, graduate school and child generation are standardized.

The first 3 rows control for selection into occupations with more or less wage compensation. The reference group, included in the constant, is the public sector. Conditional on the other covariates, being employed in the private sector with relatively few weeks of wage compensation implies a high level of willingness to pay for parental leave (positive effect on  $\alpha$ ), but also a steeper downward slope (negative effect on  $\beta$ ), relative to the public sector. In contrast, privately employed parents with more than five weeks of wage compensation generally have a relatively lower level of willingness to pay for leave, but slightly less negative slope implying a higher responsiveness to changes in the marginal cost of leave.

Table 4: Estimation Results

	$\alpha_f$	$\alpha_m$	$\beta_f$	$\beta_m$
Constant	3.978 (0.123)	7.343 (0.141)	-0.369 (0.011)	-0.167 (0.005)
Privately employed, <6 weeks compensation	1.232 (0.050)	1.289 (0.059)	-0.033 (0.005)	-0.036 (0.002)
Privately employed, 6-9 weeks compensation	-1.075 (0.051)	0.330 (0.055)	0.045 (0.006)	-0.012 (0.002)
Privately employed, >9 weeks compensation	-0.216 (0.045)	-0.631 (0.054)	0.000 (0.004)	0.011 (0.002)
Age	-0.010 (0.003)	-0.044 (0.004)	0.004 (0.000)	0.002 (0.000)
Child generation	-0.000 (0.006)	0.077 (0.009)	-0.004 (0.001)	-0.003 (0.000)
Weekly earnings	0.008 (0.017)	0.988 (0.037)	0.031 (0.003)	0.005 (0.001)
Potential earnings growth	-0.031 (0.016)	-0.047 (0.020)	0.005 (0.002)	-0.000 (0.001)
Graduate school	1.133 (0.034)	0.261 (0.047)	-0.018 (0.004)	-0.013 (0.001)
Relative earnings share of mother	0.069 (0.020)	-0.164 (0.025)	-0.001 (0.002)	0.004 (0.001)
Median parental leave of fathers in industry	0.824 (0.023)	0.127 (0.020)	-0.023 (0.002)	-0.001 (0.001)
Median parental leave of mothers in industry	-0.022 (0.010)	0.278 (0.022)	0.006 (0.002)	0.001 (0.001)
$\sigma_j^2$	6.884 (0.092)	2.911 (0.021)		
$\rho$		-0.114 (0.002)		
$\sigma_{fm}$		2.816 (0.053)		
Number of births: 189975				

Notes: Variables are defined in Table 2. All variables except the dummies for sector and wage compensation, graduate school and child generation are standardized to have mean 0 and standard deviation 1. Child generation measured relative to 2008. Robust asymptotic standard errors in brackets.

As the identification is based on the variation in the contemporary marginal cost of parental



leave, our estimates capture both intrinsic preferences for parental leave as well as extrinsic motives such as career concerns and norms. We probe the significance of such extrinsic motives by including two sets of controls in the estimation.

First, as proxies for career concerns, we find a small negative, but significant effects on  $\alpha$  of potential earnings growth for both fathers and mothers, while higher weekly earnings is correlated with a higher  $\alpha$  for mothers. Both of these variables only have limited effects on the  $\beta$ s. Similarly, we find that a higher relative wage rate of the mother is correlated with a higher  $\alpha$  for the father and lower for the mother. However, overall we find limited preference heterogeneity between parents with different earnings potentials.

Second, we include the median weeks of leave of fathers and mothers, respectively, in the 6-digit industry in which each parent works. These controls are intended to proxy for industry or firm norms, but may also reflect selection. We estimate positive and relatively large own-sex effect on  $\alpha$  implying that parents working in a sector with a relatively high median leave take-up of employees of the same sex tend to take longer leave. The industry median leave use of opposite sex employees have a much smaller effect and is negative for the father.

Finally, we estimate a significant positive covariance between fathers and mothers, consistent with assortative matching on preferences for parental leave, and a negative  $\rho$  implying that the leave of the two parents are substitutes.

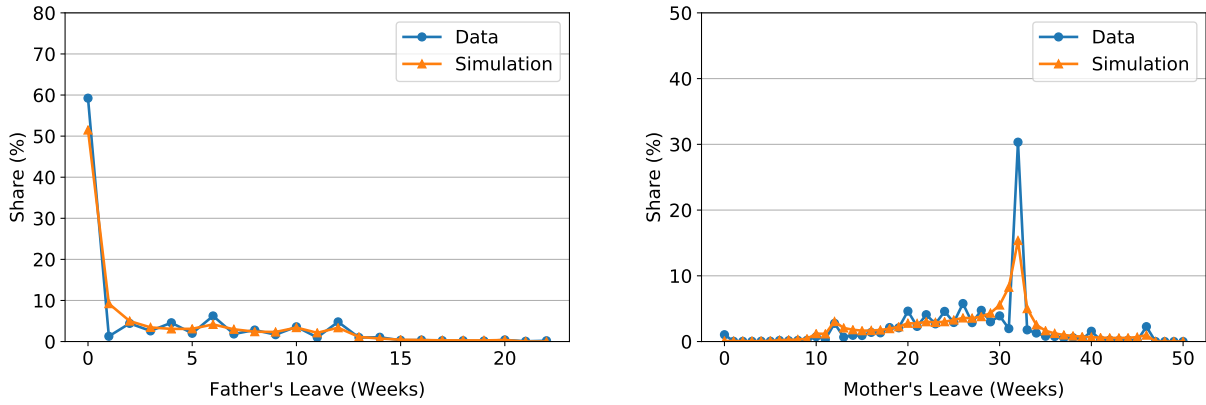
In Figure 3 and Appendix Figure A.III, we compare the simulated parental leave from our model to the observed distributions of parental leave in the data. The estimated model reproduces the distributions very well. In particular, the model matches well two salient features of the distributions. First, we reproduce the clear bunching at the exhaustion of wage compensation for both fathers (left figures) and mothers (right figures) and at the exhaustion of the 32 weeks of shared benefits.<sup>17</sup> The excess mass varies considerably across subsamples, and we match this heterogeneity as well.

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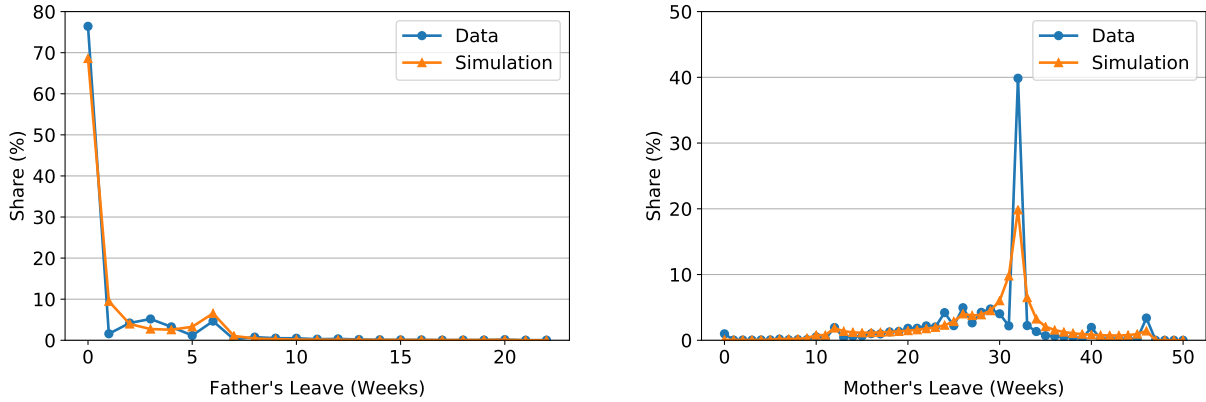
<sup>17</sup>The discrete choice model creates a small degree of smoothing in the leave distribution, which is why some of the excess mass is located on the weeks adjacent to the kink points.

Figure 3: Model Fit: Parental Leave Use

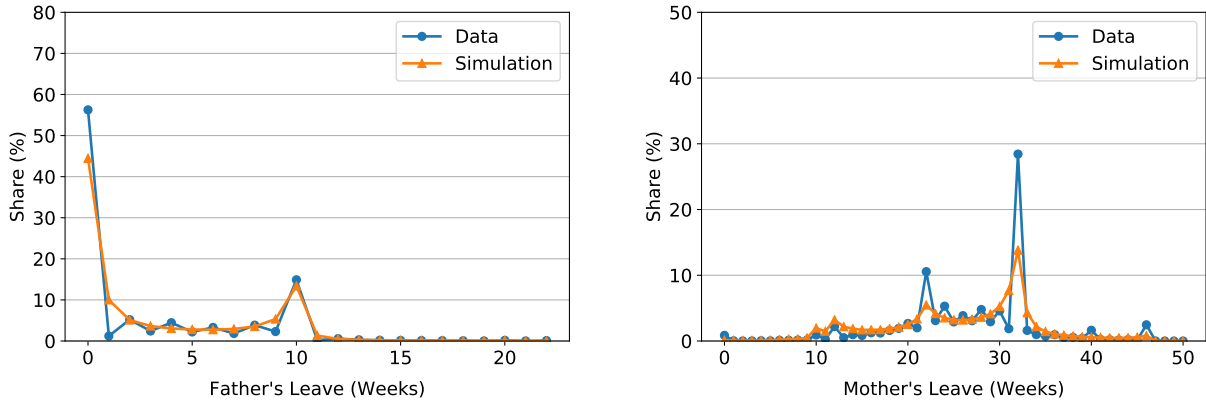
**A: All Births**



**B: Father in Private Sector with 6 Weeks Compensation**



**C: Father in Private Sector 10 with Weeks Compensation**



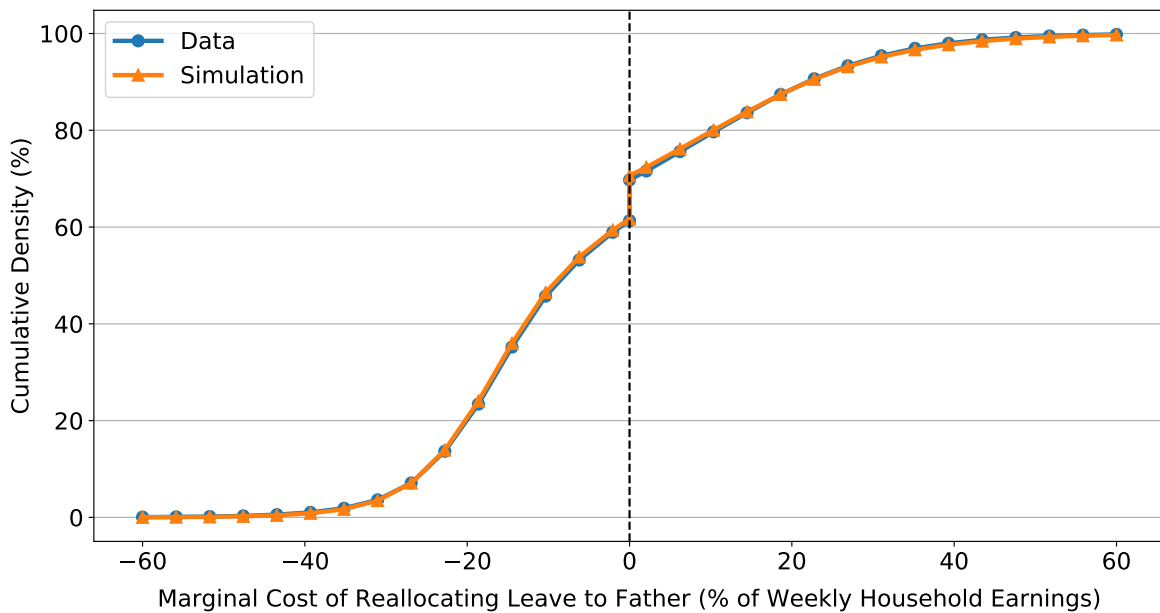
*Notes:* The figure shows the distributions of fathers' and mothers' parental leave split by the father's rights to wage compensation and sector. The simulated leave distributions are based on 200 random draws. We show the model fit for additional combinations of fathers' wage compensation and sector in Appendix Figure A.III.

Second, we reproduce the large share of fathers taking very little or no leave. As described

in Section 2, parents can in many cases increase contemporaneous household income by reallocating parental leave from the mother to the father, when the father initially takes less leave than covered by individual wage compensation. Hence, while there may be many idiosyncratic motives for parents to allocate all parental leave to the mother, they might reveal a strong willingness to pay for this specific allocation.

We highlight this point in Figure 4, which shows the marginal cost of shifting one week of leave from the mother to the father. More than 60% of parents could increase household income by reallocating parental leave from the mother to the father. Furthermore, for the median household, reallocating parental leave to the father would on the margin increase household income by 10% of household earnings.<sup>18</sup>

Figure 4: Model Fit: Marginal Cost of Father’s Leave.



*Notes:* The figure illustrates the marginal household cost of transferring one week of leave from the mother to the father in the data and simulated from the model. The marginal cost is calculated using the Danish benefit rules described in Section 2 and 3, and expressed relative to the weekly household pre-birth earnings.

<sup>18</sup>The mass of parents with marginal costs of zero reflects two things. First, mothers with earnings at or below the benefits cap, and second, parents with shared wage compensation (parents working in the same public sub-sector). In both of these cases household income is typically unaffected by reallocating leave from the mother to the father.

## 5 Counterfactual Policy Simulations

In this section, we use the model to simulate and evaluate the introduction of earmarked leave. We perform these in-sample simulations to make two points. First, we want to highlight the importance of the broader set of economic incentives facing parents when implementing earmarked parental leave. Second, we want to probe the efficiency of different parental leave reforms.

We define the efficiency of a reform as

$$\text{Efficiency} = (\bar{U}_{CF} - \bar{U}_B) - (\bar{C}_{CF} - \bar{C}_B), \quad (12)$$

where  $\bar{U}_B$  and  $\bar{U}_{CF}$  is the average household utility in the baseline and counterfactual simulations, respectively, and  $\bar{C}$  is the cost of the parental leave system, given by the net transfers paid to parents.<sup>19</sup> Because the utility function is quasi-linear in income, we can directly interpret changes in household utility in a money-metric measure similar to the costs ( $\bar{C}$ ). Hence, one way to interpret equation (12) is the change in household utility following a reform if we were to finance the parental leave system by lump sum taxation.<sup>20</sup>

Our model contains no explicit motive for governments to provide parental leave benefits. Hence, the aim of our policy simulations is to study the behavioral effects and *efficiency* of a particular policy and not to rationalize the policy itself. The optimal policy design can then be achieved by balancing societal preferences for a particular allocation of parental leave with the efficiency costs implied by our model. This is similar to the welfare analyses in other policy settings (Saez & Stantcheva, 2016; Goldin & Reck, 2020).

As also discussed in Section 2, our estimated willingness to pay includes both the intrinsic and extrinsic motives for parental leave, which we implicitly assume fixed. However, we could imagine that in particular the extrinsic motives depend on the overall policy

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<sup>19</sup>See, e.g., Chan (2013) for a similar definition of the efficiency of a reform.

<sup>20</sup>We would arrive at a similar measure of efficiency in more realistic settings with distributional concerns, distortionary taxation and income effects (see, e.g., Kaplow, 2004). The intuition for this result is that once policy makers have set the available tax instruments to balance efficiency and distributional concerns, they will at the margin be indifferent between the different tax instruments, including lump sum taxes. By assuming quasi-linear utility and lump sum taxation we avoid conflating our analysis with arbitrary distortions in other parts of the economy.

environment, and hence, we might expect that parents respond more in the long run to reforms that changes the overall policy environment, than predicted by our model.

Pulling in the other direction is the extent to which the wage compensation acts as reference points for parents' leave use. Such reference point effects would be captured in our empirical strategy and imply that we would overestimate parents' responsiveness to isolated changes in economic incentives. Further assuming that reference points change slowly, our model would overestimate the short run effects of parental leave reforms. One way to judge the "time horizon" of our model is to compare our model simulations to the effect of past earmarked leave reforms. As we show in Appendix B, our model does a fair job in predicting the medium-run effects of reforms in several countries.

## 5.1 Earmarked Leave in the Current Danish Policy Setting

To illustrate how the introduction of earmarked leave changes the behavior of parents in our model, we start by presenting simulations of two earmarked leave reforms. More concretely, we simulate the effects of introducing either 1 week or 9 weeks of earmarked leave, while keeping all other policy parameters fixed. The latter of these reforms are interesting in its own right as it corresponds to the recently passed [EU \(2019\)](#) directive, which stipulates that all EU member states must implement 2 months of earmarked, non-transferable, parental leave to each parent no later than August 1, 2022. We implement earmarked leave by changing the household budget sets as illustrated in Section 2.

We present the effects of the two reforms in Figure 5. Considering first the small reform of 1 week earmarked leave, we see in Panel A that 7pp of fathers shift from taking 0 to 1 week of parental leave. The response of mothers in Panel B are larger, where the model predicts an almost complete shift to the left of the mass round 32 weeks. The net effect of these changes is a reduction in total household leave as shown in Panel C. Considering the larger reform of 9 weeks earmarked leave we find similar but more pronounced responses: Modest positive responses for men and larger negative responses for women, resulting in a reduction in total household leave.

However, as we show below this result depends critically on the replacement rates that

parents face. In our baseline setting, these replacement rates are often only around 50% once a parent have exhausted the wage compensation, and with longer periods of earmarked leave an increasing number of fathers would exhaust their wage compensation if they wanted to utilize all the earmarked leave.

In Table 5 we show the simulated changes in average parental leave and labor earnings of mothers and father together with changes in household income, utility and efficiency from the two reforms. For each reform we break up the total effect into a mechanical effect, where we hold leave and labor supply fixed, and a behavioral effect. Panel A shows the effects of introducing 1 week of earmarked leave and Panel B the effect of 9 weeks of earmarked leave.

The mechanical effects of both reforms are reductions in the (net) transfers reflecting the reductions in parental leave benefits. Due to quasi-linear preferences, these reductions carry over directly to household utility. In contrast, the mechanical effect on efficiency is zero as the reduction in household utility is offset by the lower net transfers paid out by the government.

The behavioral responses of parents partly mitigate the mechanical effects by shifting leave from the mother to the father. For both reforms, fathers increase their leave by less than half of the reduction in the leave of mothers, and hence, the reforms lead to a reduction in household leave as also illustrated in Figure 5. The mirror image of the reduction in leave is an increase in household labor supply.<sup>21</sup> In addition, the change in behavior also increases net transfers due to the shift from the (post-reform) unpaid leave of mothers to fathers, who either receive wage compensation or public benefits. For both reforms, these effects more than counter the mechanical reduction in household income.

Turning to household utility, the behavioral responses only have a second order effect and for small reforms the behavioral effect on household utility would to a first approximation be zero. Hence, the mitigating effect on household utility is generally smaller than the effect on household income. However, as the reforms we consider become larger, the behavioral effects become non-negligible: The relative size of the behavioral effect increases

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<sup>21</sup>The effect of the change in labor supply on household labor earnings is muted by the higher average weekly earnings of fathers, who now work slightly less.

from 25% of the mechanical effect in Panel A to 40% in Panel B. Combining the mechanical and behavioral effects, we estimate a reduction in household utility corresponding to around EUR 800 or 1.2% of the baseline household income from the introduction of 9 weeks of earmarked leave.

Finally, we find that both reforms have small positive effects on efficiency. This reflects that both reforms push parents' use of parental leave closer to what they would choose without parental leave subsidies (i.e., reduce household leave), and increase their labor supply.

## 5.2 Interaction Effects with Replacement Rates and Total Leave

Above we considered the effects of introducing earmarked leave, keeping fixed the replacement rates and total leave duration in the parental leave system. Next, we consider a menu of different combinations of these policy parameters..

We show in Figure 6 the simulated average outcomes as a function of the number of earmarked weeks under 4 different policy settings: Either low (50%) or high (100%) replacement rates combined with earmarked leave either taken from the initial 32 weeks of shared leave (referred to as "fixed total leave") or added to the total leave (referred to as "fixed shared leave"). Considering the (red) scenario with low replacement rate with fixed total leave, we find effects similar to the ones presented above. The effect on fathers' leave-taking is modest both on the extensive margin (Panel A) and on the average number of weeks on parental leave (Panel B), while total household leave (Panel D) and utility (Panel E) decreases.

However, these results depend critically on the replacement rates in the parental leave system. Considering the (green) scenario with a 100% replacement rate, the effect of 12 weeks earmarked leave is an increase in the share of fathers taking leave to around 75%. More than twice the change in fathers' take-up of parental leave in the low replacement rate scenario. Similarly, we find a much stronger increase in fathers' average number of weeks on parental leave, and thus, their share of total household leave (Panel C). Total household leave and utility still decreases in this scenario but from higher levels.

Next, we consider the (orange and blue) scenarios where the earmarked leave to fathers is added on top of the existing shared leave of 32 weeks. This expansion of total parental leave has two effects. First, it loosens the rivaling nature of the shared parental leave, and hence, fathers who use all of the earmarked leave will be more likely to also use some of the shared leave as it is now more abundant. However, the second and here dominating effect is a reduction in fathers' willingness to pay for parental leave through the substitutability with the leave of the mother.

We can compare these changes in outcomes to the effects on household utility and social welfare. Naturally more generous parental leave systems raise household utility, while earmarked leave reduces household utility when it is not accompanied with expansions in total leave.<sup>22</sup> Efficiency is reduced to the extent to which parents respond to the larger subsidies for parental leave.

### 5.3 Probing the Efficiency of Parental Leave Reforms

Finally, we can use the model to find the efficient set of policy parameters for a particular set of policy objectives, and compare the trade-off between different objectives.

To illustrate, we show in Table 6 four examples of efficient policies. In each example, we select the combination of *i*) weeks of earmarked *ii*) replacement rates, and *iii*) total benefit weeks, that minimize the efficiency loss of the parental leave system while achieving a particular division of parental leave.<sup>23</sup> In columns A and C, we consider a case in which the policy objective is to incentivize fathers to take a least 15% of the household leave, while the objective in columns B and D is a minimum of 6 weeks leave of fathers. In Columns C and D, we add the additional constraint that household leave must not fall below 30 weeks. This additional restriction could be motivated by e.g. child care availability or other considerations.

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<sup>22</sup>The reduction in household utility could alternatively be countered by making the parental leave system more generous in other dimensions.

<sup>23</sup>For simplicity, we restrict the set of policy parameters to the sub-set also considered in Section 5.2. In a full policy analysis, we could allow for any joint non-linear replacement rate schedule and benefit cap for men and women.



Increasing the *relative* share of leave to fathers (in column A) can be achieved both by increasing the leave of fathers and by decreasing the leave of mothers, and the efficiency-maximizing policy parameters in column A reflect these two channels. Concretely, we find that the efficient policy mix is to earmark a significant part of the parental leave and to reduce the general generosity of the system (few weeks of benefits with a low replacement rate).

The intuition for this result is that a higher number of earmarked weeks incentivize fathers to take more leave. The effect of earmarked leave on fathers leave use is increasing in the replacement rate (see Figure 6). However, as a higher replacement also increases the leave of mothers (thus reducing the relative share of leave taken by fathers), the policy goal can be achieved most efficiently with the maximum number of earmarked weeks and a lower replacement rate.<sup>24</sup>

An absolute goal of fathers taking at least 6 weeks of leave (in column B) removes part of the motivation for a lower replacement rate because this cannot be achieved through a reduction in the leave of mothers. Therefore, the efficient policy mix includes a significantly higher replacement rate compared to column A. In terms of efficiency, the change in the policy objective creates an additional loss of approximately EUR 3,000 per birth on average.

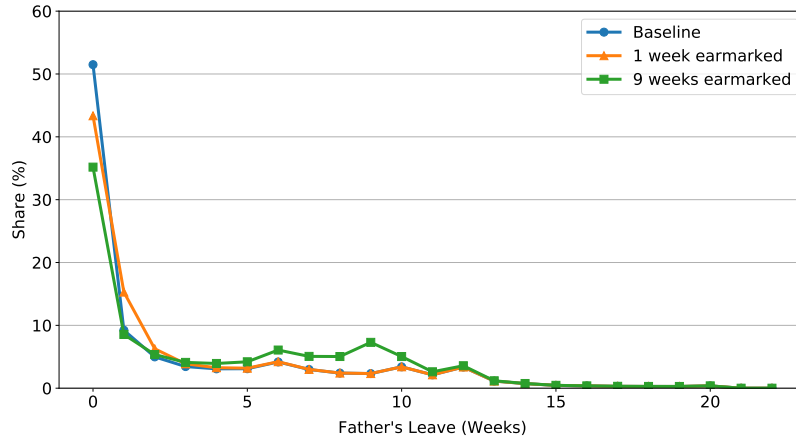
Finally, adding a requirement that average household leave must not fall below 30 weeks (columns C and D), the optimal policy features additional incentives for households to increase total leave. In columns B and D, this is most efficiently achieved by raising both the replacement rate and the number of total benefit weeks together with a significant part of leave earmarked to each parent.

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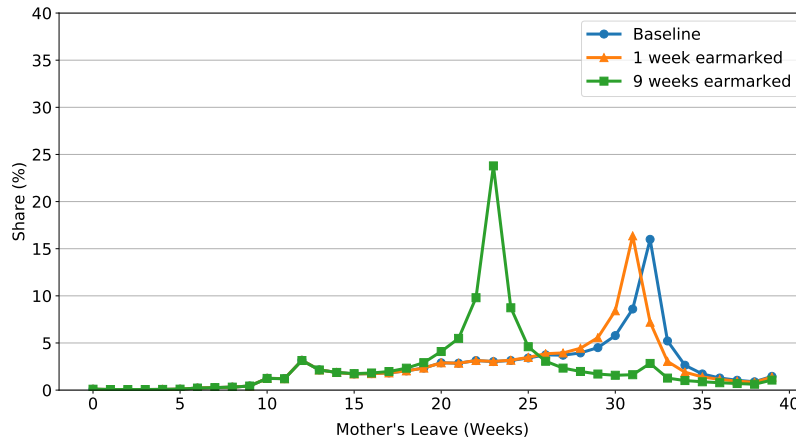
<sup>24</sup>With 26 benefit weeks, the maximum number of earmarked leave to each parent is 13.

Figure 5: Policy Simulations: Implementing Earmarked Leave

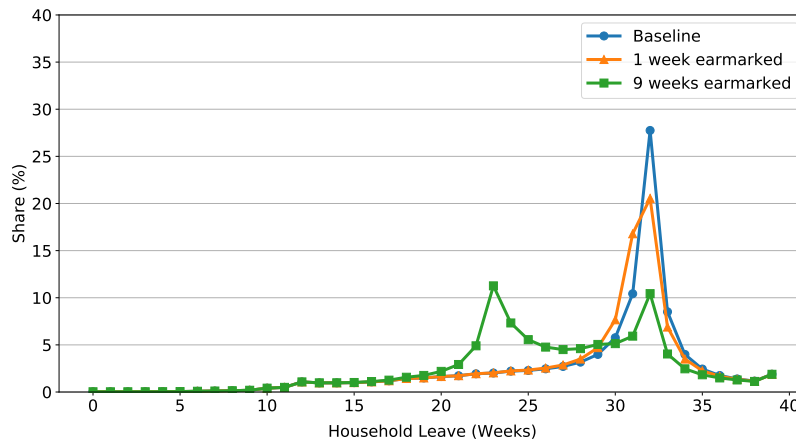
**A: Fathers' Parental Leave**



**B: Mothers' Parental Leave**

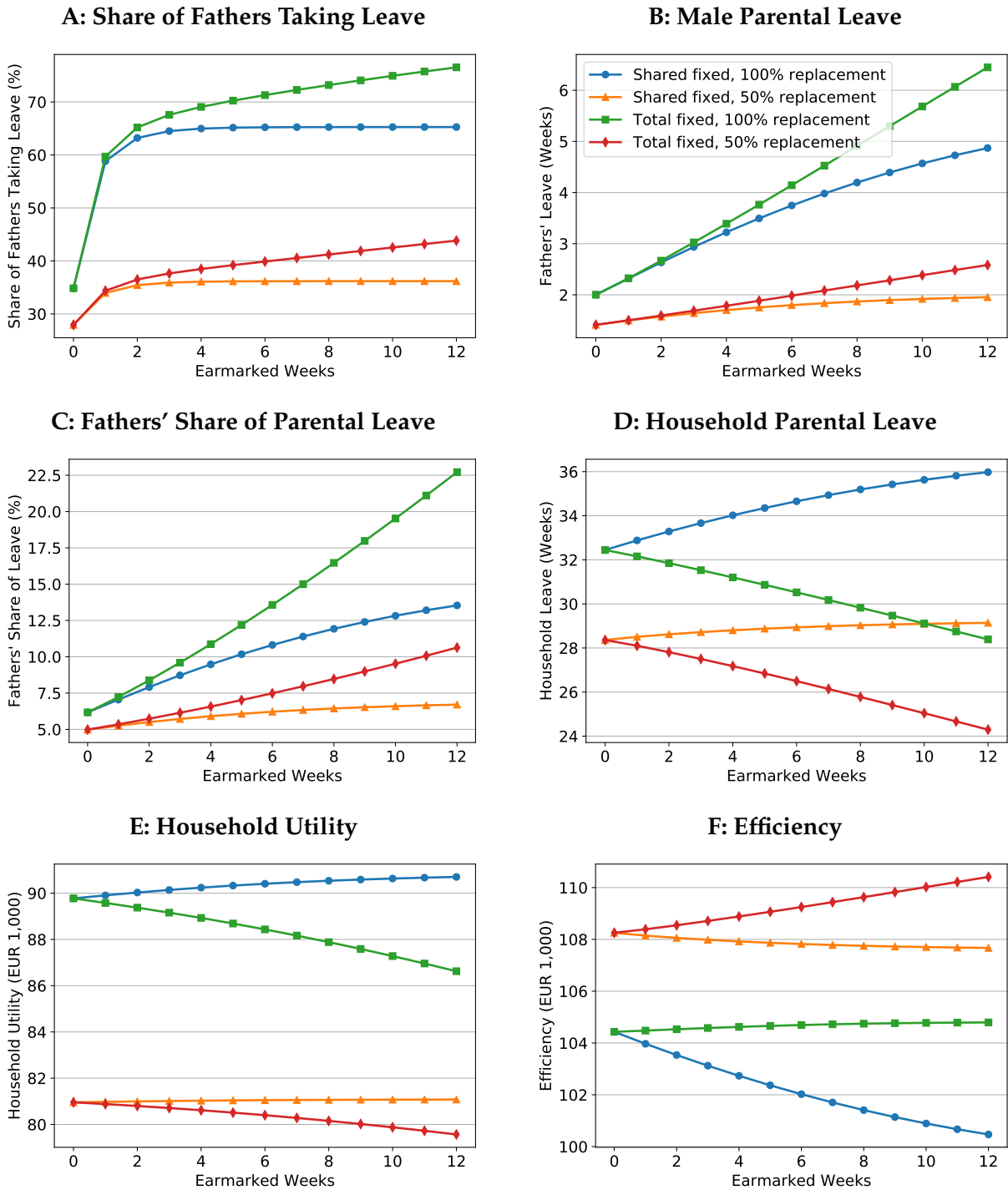


**C: Household Parental Leave**



Notes: The figure shows the simulated leave distributions in three different policy setting: 1) with no earmarked leave (baseline), 2) 1 week earmarked leave to both parents 3) 9 weeks of earmarked leave. In all simulations we keep the 32 weeks of public parental and individual wage compensation fixed. The simulations are based on 200 random draws.

Figure 6: The Effects of Earmarked Leave under Different Policy Settings



Notes: The figure shows the simulated outcomes of different parental leave policies. In these simulations we remove the heterogeneity in individual replacement rates and implement a uniform replacement rate for both parents and for the entire duration of public parental leave. In the simulations with fixed total leave we keep the total leave at 32 weeks and let the earmarked leave reduce the shared leave. In the simulations with fixed shared leave we expand the total leave with the number of earmarked weeks provided to the father.

Table 5: Policy Simulations: Welfare Effects of Earmarked Leave

	A: 1 Week Earmarked Leave				B: 9 Weeks Earmarked Leave		
	<i>Changes from Baseline</i>						
	Baseline	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total
<b>Parental Leave (Weeks)</b>							
(1) Total	29.713	0.000	-0.174	-0.174	0.000	-2.208	-2.208
(1a) Fathers	3.015	0.000	0.116	0.116	0.000	1.281	1.281
(1b) Mothers	26.698	0.000	-0.290	-0.290	0.000	-3.489	-3.489
<b>Labor Earnings (EUR 1,000)</b>							
(2) Total	87.603	0.000	0.126	0.126	0.000	1.723	1.723
(2a) Fathers	61.826	0.000	-0.138	-0.138	0.000	-1.530	-1.530
(2b) Mothers	25.777	0.000	0.264	0.264	0.000	3.253	3.253
<b>Household Income, Utility and Welfare (EUR 1,000)</b>							
(3) Net transfers	-21.576	-0.083	-0.011	-0.095	-1.404	0.042	-1.362
(3a) Transfers	22.442	-0.139	0.065	-0.074	-2.340	1.219	-1.122
(3b) Taxes	44.018	-0.056	0.077	0.021	-0.936	1.177	0.241
(4) Income (2+3)	66.027	-0.083	0.115	0.032	-1.404	1.765	0.361
(5) Utility	85.052	-0.083	0.020	-0.064	-1.404	0.568	-0.836
(6) Efficiency	106.628	0.000	0.031	0.031	0.000	0.527	0.527

*Notes:* The table shows simulated average effects from two hypothetical reforms. Panel A shows the effect of introducing 1 weeks of earmarked parental leave to each parent, while we in Panel B increase the earmarked leave to 9 weeks. The mechanical effect is calculated as the effect from changing the parental leave system while keeping the labor supply and parental leave of parents fixed at the baseline levels. The total effect is calculated by letting households re-optimize under the new regimes, and the behavioral effect is the difference between the mechanical and total effects. Transfers include both public transfers and the wage compensation formally pay for by firms. The assumption of quasi-linear preferences implies that we can directly interpret the effect on household utility as a money-metric effect.

Table 6: Examples of Optimal Parental Leave Settings under Different Objectives.

	A	B	C	D
<b>Objectives:</b>	Fathers' share of leave: $\geq 15\%$	Fathers' leave: $\geq 6$ weeks Household leave:	Fathers' share of leave: $\geq 15\%$ $\geq 30$ weeks	Fathers' leave: $\geq 6$ weeks Household leave: $\geq 30$ weeks
<b>Optimal Policy Parameters:</b>				
Earmarked Weeks	13	14	14	14
Replacement Rate	0.61	0.86	0.89	0.96
Total Benefits Weeks	26	28	38	37
<b>Outcomes:</b>				
Fathers' Leave (Weeks)	3.70	6.03	5.22	6.09
Fathers' Share of Leave (%)	15.18	22.36	15.19	17.81
Household Leave (Weeks)	22.33	24.49	30.13	30.24
Household Utility (EUR 1,000)	79.22	82.29	86.32	87.24
Efficiency (EUR 1,000)	111.06	108.12	104.83	103.92

*Notes:* The table shows the combination of *i*) weeks of earmarked *ii*) replacement rates, and *iii*) total benefit weeks that maximize the efficiency of the parental leave system, subject to satisfying the policy objectives in each column. We find the efficiency-maximizing combination by a grid-search over total benefit weeks from 26 to 44 weeks, earmarked weeks from 5 to 16, and 15 replacement rates from 50% to 100%.

## 6 Conclusion

In this paper, we estimate a novel model of parents' division of parental leave to advance our understanding of how the broader design of parental leave benefits affects the behavior of parents and household welfare. We estimate the model using detailed Danish register data and multiple kinks in the household budget set created by the parental leave benefit system. The estimated model replicates several key features of the distribution of parental leave division. In particular, the model matches that a substantial share of fathers take no parental leave and the substantial bunching around kinks in the household budget created by Danish parental leave benefits system.

Counterfactual policy simulations reveal several interesting results. First, we find that implementing the EU directive of 9 weeks earmarked parental leave to each parent leads to a reduction in the total household leave and household utility. This result reflects that the direct effect of earmarked leave is reductions in parental leave benefits to households and in the incentives for mothers to take parental leave. In contrast, the incentives for fathers to take up the earmarked are primarily driven by the removal of the rivaling nature of the shared parental leave, and with low replacement rates (as in the current Danish system) we find that the incentives are insufficient to outweigh the reduction in parental leave taken by mothers.

Second, we find important interaction effects between earmarked leave, the replacement rate when on benefits and the total length of leave benefit rights. A higher replacement rates increases the behavioral responses of fathers to earmarked leave, and combining earmarked parental leave with higher replacement rates may fully undo the negative effects on household utility and total leave taken.

Finally, we use the model to probe the efficient parental leave system, given various policy objectives. We find that a policy objective of incentivizing fathers to take 15% of the household parental leave is most efficiently achieved with a relatively large number of earmarked weeks and less generous replacement rate and total leave. Alternative policy objectives focusing on the level of fathers' (or household leave) lead to policy mixes with higher replacement rates and and longer parental leave benefit periods with a significant

share earmarked to each parent.

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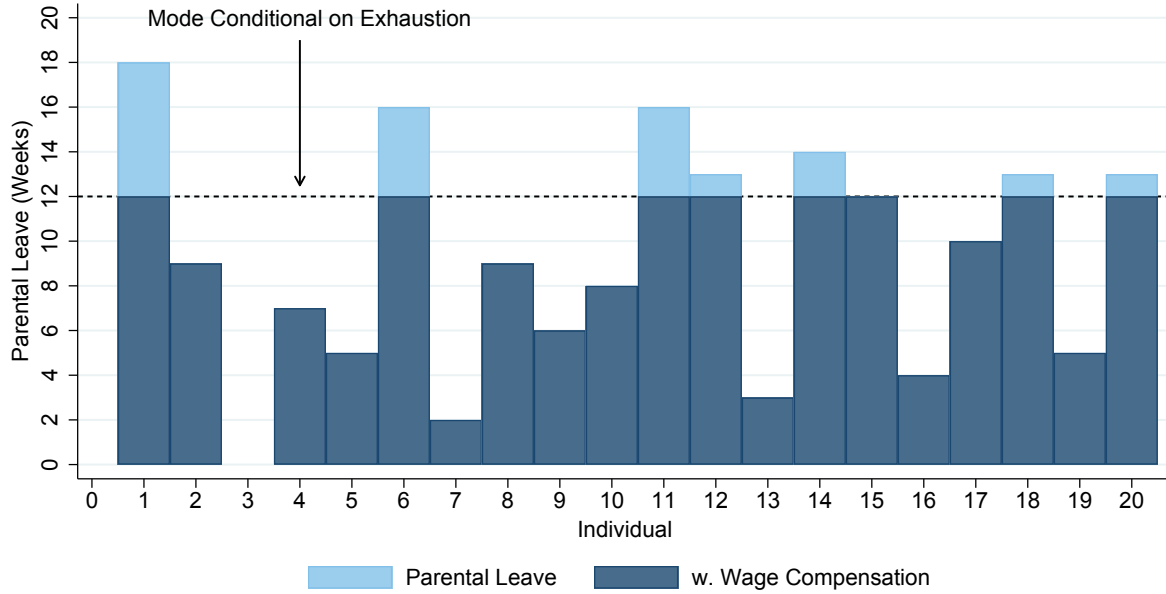
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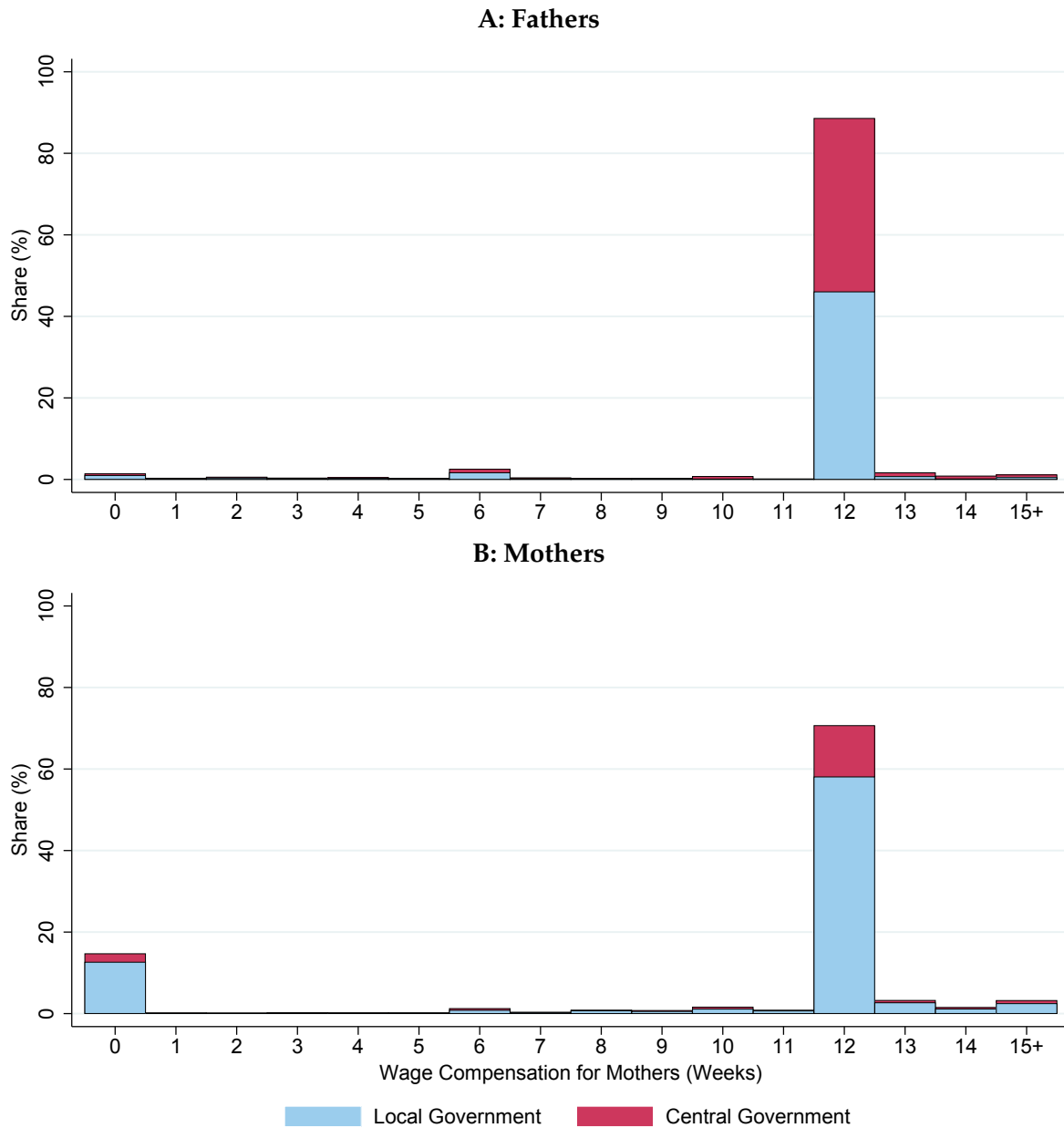
# A Supplementary Figures

Figure A.I: Illustration of the Imputation of Individual Wage Compensation



Notes: The figure illustrates our imputation procedure for individual rights to wage compensation during parental leave ( $\bar{z}_i$ ) in a hypothetically group of 20 coworkers, who get a child in a given year. In the illustration, we assume that all coworkers have the right to 12 weeks of wage compensation and our goal is to estimate this number based on the coworkers' observe leave taking  $l_i$  and wage compensation  $z_i \leq l_i$ . As we do not observe the fully right to wage compensation ( $l_i = z_i$ ), we estimate  $\bar{z}_i$  as the mode of  $z_i$  for the parents who exhaust ( $l_i > z_i$ ) as described in equation (11).

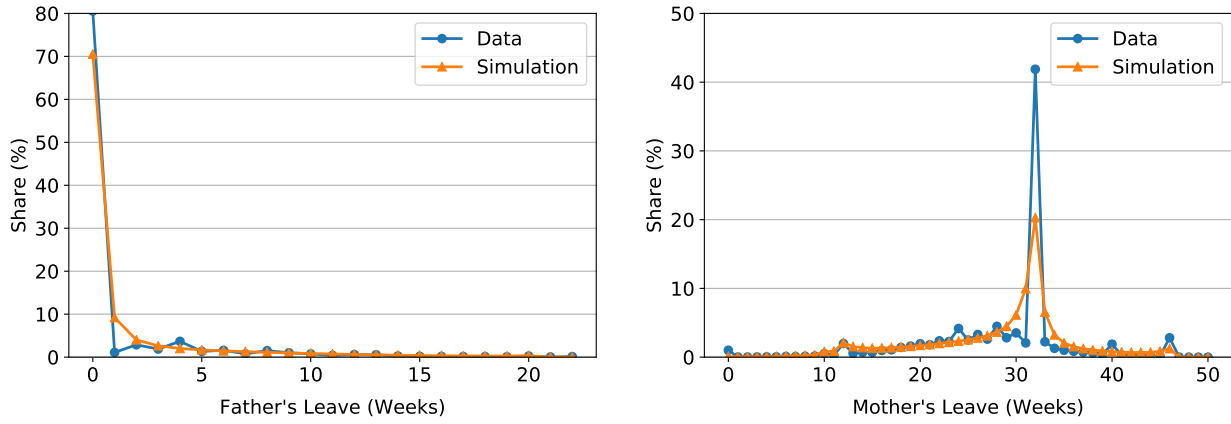
Figure A.II: Applying Our Private Sector Imputation to the Public Sector



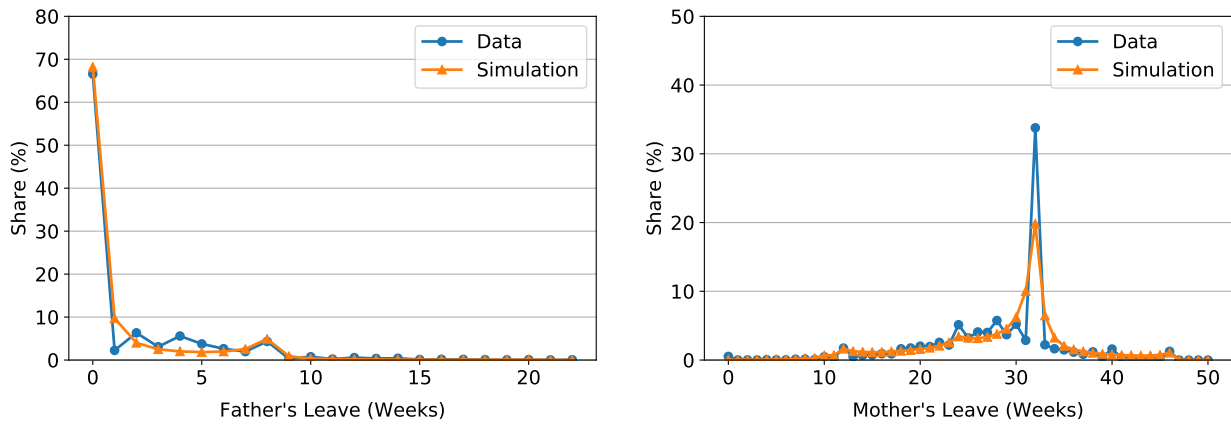
*Notes:* The figure shows the results from applying our procedure for imputing individual rights to wage compensation to the public. Estimates consistent with the public sector collective agreements are 6/12 for mothers and fathers before April 1, 2015 and 7/13 for fathers after April 1, 2015. Our private sector estimation procedure will never identify the exact 6/12 and 7/13 split as it depends on the sub-sector in which the partner is employed as described in section 3, and because we do not use spousal information in the imputation.

Figure A.III: Model Fit: Actual and Simulated Parental Leave Use

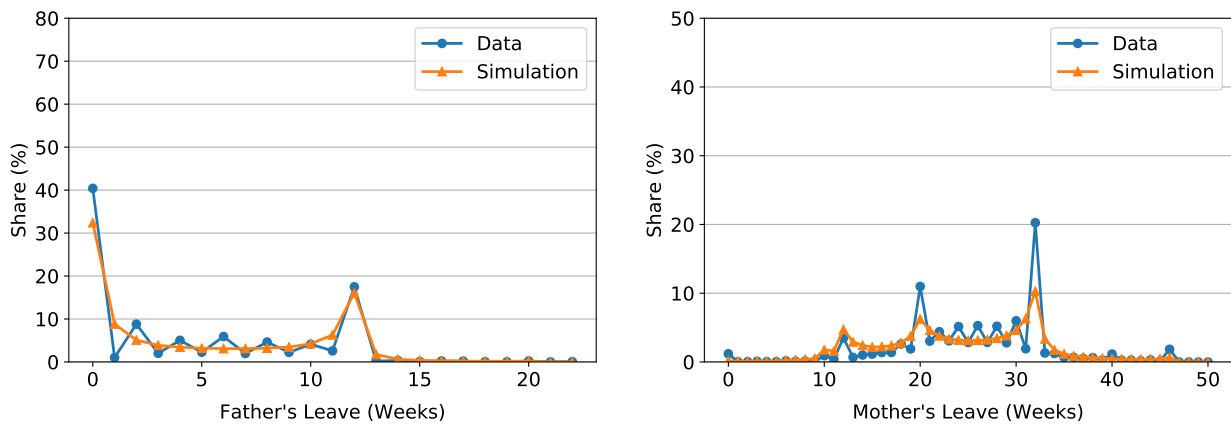
**A: Father in Private Sector with 0 Weeks Compensation**



**B: Father in Private Sector with 8 Weeks Compensation**



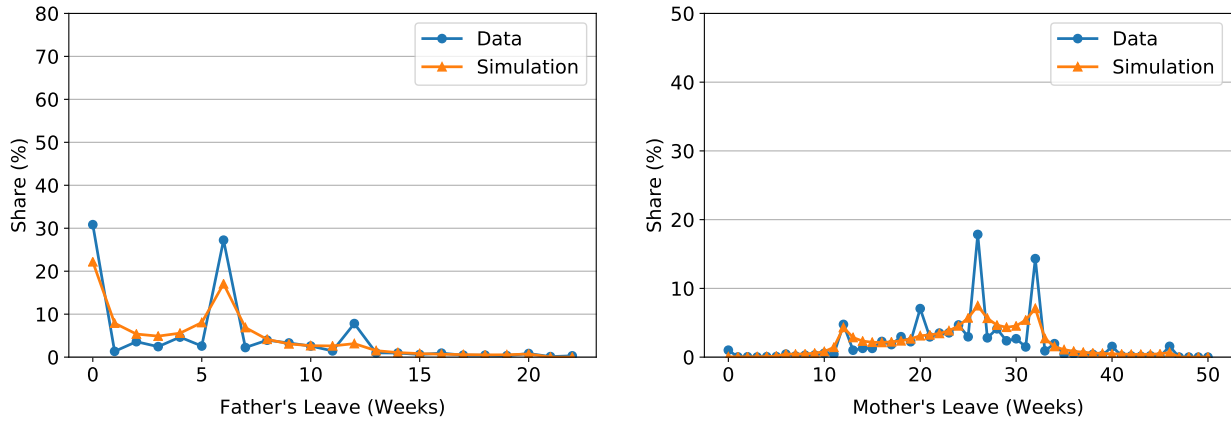
**C: Father in Private Sector 12 with Weeks Compensation**



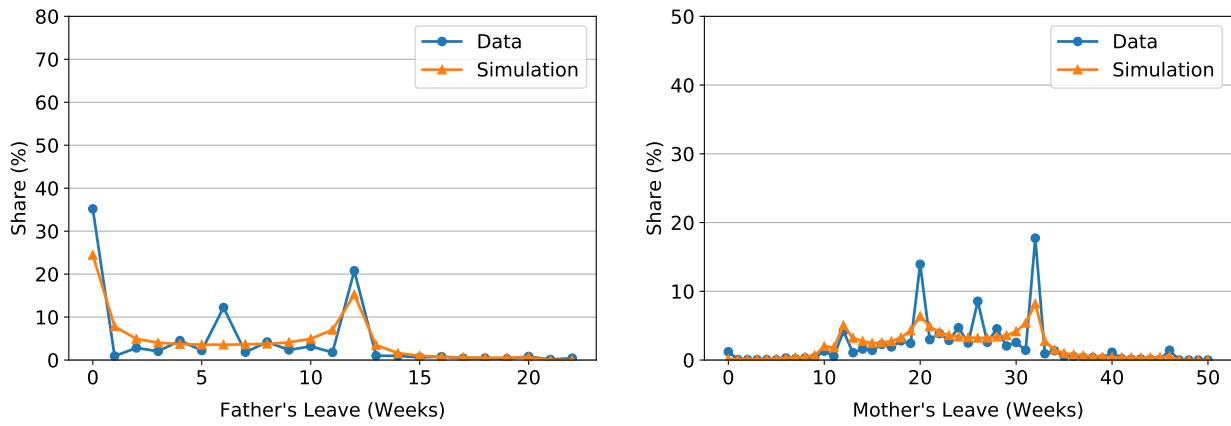
Notes: The leave distributions simulated from the model is based on 200 random draws of  $(\varepsilon_w, \varepsilon_m)$  together with a uniform draw to determine the optimal leave from the choice-probabilities.

Figure A.III: Model Fit: Actual and Simulated Parental Leave Use - Cont.

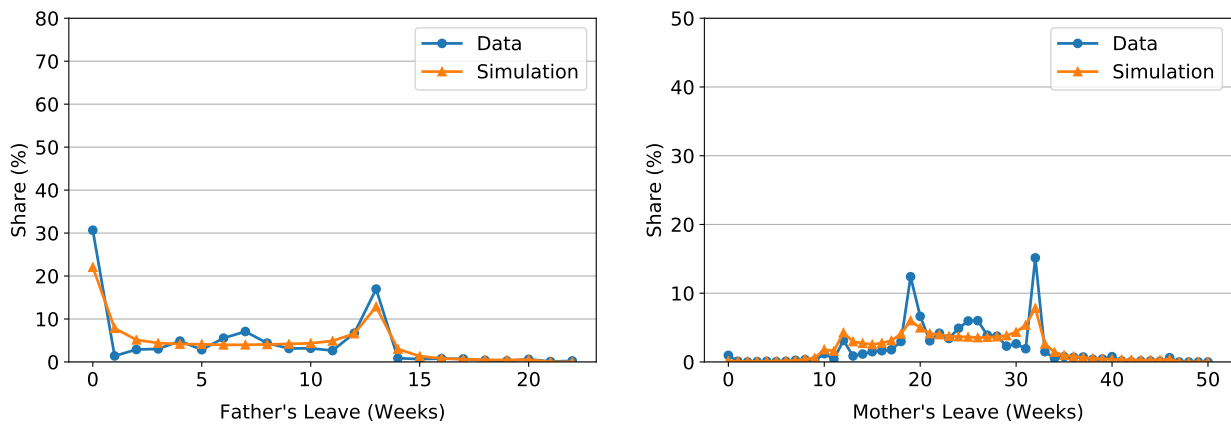
**D: Father in Public Sector with 6 Weeks Compensation**



**E: Father in Public Sector with 12 Weeks Compensation**



**F: Father in Public Sector with 13 Weeks Compensation**



Notes: The leave distributions simulated from the model is based on 200 random draws of  $(\varepsilon_w, \varepsilon_m)$  together with a uniform draw to determine the optimal leave from the choice-probabilities.



## B Comparing Our Simulations with Past Earmarked Leave Reforms

In this appendix we compare our model simulations to the past reforms that introduced earmarked parental leave in other countries. Specifically, we simulate the Norwegian 1993-reform, the Swedish 1995-reform and the Germany 2007-reform and compare our model predictions for fathers' take-up of parental leave to the observed behavioral changes after the reform.

For each reform we implement the key elements of the policy setting before and after the reform. These include leave duration, replacement rate and benefit cap. However, it is important to note the formal policy setting only partly shapes the incentives that face. In particular, the incentives facing parents are also formed by earnings distributions of men and women, which we keep fixed in our data.<sup>25</sup> For this reason, and differences in sample selection and measurement of parental leave, we should not expect our model to match observed behavior in countries. That said, our model does a fair of predicting the changes in behavior following the introduction of earmarked leave (see Table A.I).

### The Norwegian 1993-Reform

The Norwegian 1993-reform increased total parental leave from 35 to 42 weeks and earmarked leave from 0 to 4 weeks, while keeping fixed the replacement rate of 100% and benefit cap of NOK593,000 per year or €1,110 per week (2019-level). However, most public and private employers top up benefits so that income is fully compensated (Dahl *et al.*, 2014), and hence, we treat the cap as non-binding. The total parental is measured from the birth of the child, and hence, we subtract 14 weeks to make it comparable with our model.

The Norwegian 1993-reform is studied by Rege & Solli (2013), Dahl *et al.* (2014) and Cools *et al.* (2015). Cools *et al.* (2015) report a pre-reform share of fathers taking parental leave of around 5%, which jumps to around around 25% immediately after the reform. In the

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<sup>25</sup>As we note in Table A.I, we scale the benefit caps for Germany and Sweden to reflect lower earnings levels in these countries.

following 3 years there is relatively sharp increase that brings the share up to 40%, and from there more modest increase to just below 60% 10 years after the reform. Of course, the longer run changes in fathers take-up of parental leave could also reflect gradual changes in preferences and not necessarily driven solely by reform.

In [Rege & Solli \(2013\)](#) and [Dahl \*et al.\* \(2014\)](#) the long run effects are larger as they report a take-up share that is around 10pp higher in year 3 and 10. The difference is likely due to stricter sample selection in [Rege & Solli \(2013\)](#) and [Dahl \*et al.\* \(2014\)](#), who only include full-time workers in their analysis. Our sample selection lie somewhere between that of [Rege & Solli \(2013\)](#) and [Dahl \*et al.\* \(2014\)](#) and that of [Cools \*et al.\* \(2015\)](#).

Our model predict 34pp increase in the share of fathers taking parental leave from a pre-reform level of 40% to 74% post-reform. Hence, our model accurately predicts the 3-year reform effect and the level of take-up measured closer to our data window (2008-2015). Based on our model we would interpret the observed 3-year change in fathers' take-up of parental leave as the pure reform effect, while the more gradual subsequent development is due to other factors, which is also present in our data.

Turning to the change in the average length of male parental leave, [Cools \*et al.\* \(2015\)](#) report an increase of 8 days from a pre-reform level of 2 days. We estimate a significantly larger effect of 1.9 weeks, which partly can be explained by the higher pre-reform level of take-up in our model. The higher level of take-up implies that more fathers respond on the intensive margin, driving a larger changes in the average length of parental leave.

## **The Swedish 1995-Reform**

The Swedish 1995-reform introduced 4 weeks of earmarked leave and reduced the replacement rate from 90% to 80%, while keeping the total leave fixed at 360 days (corresponds to 37 in our setting).<sup>26</sup> Parental leave benefits were capped at SEK1,006 per day or €690 per week (2019-level). However, the earnings levels in Sweden is significantly lower than in Norway and Denmark (partly due to higher social security contributions). According

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<sup>26</sup>In addition, parents can take 90 days of parental leave with flat rate of 60 SEK/day.

to Eurostat the median gross hourly earnings is about 2/3 of the level in Denmark and Norway, and therefore, we scale the benefit cap by 3/2 to €1,035.<sup>27</sup>

The Swedish 1995-reform is studied by [Ekberg \*et al.\* \(2013\)](#) and [Avdic & Karimi \(2018\)](#). [Ekberg \*et al.\* \(2013\)](#) report an increase in the average length of male parental leave of 14 days, from 30 days pre-reform to 44 days after. The same increase is found in [Avdic & Karimi \(2018\)](#), but from a pre-reform level of 35 days. [Ekberg \*et al.\* \(2013\)](#) also report an increase in the share of fathers taking leave from 46.3% to 82.3%.

Compared to the observed changes in male parental leave use, our model simulations predict significant smaller reform effects. We predict an increase in the average length of 0.6 week from a pre-reform level of 2.7 weeks, and a 19pp increase in the share of fathers taking leave from 28% pre-reform. Hence, our model produces effects are essentially half size of the actual changes. However, part of this difference can be explained by the fact that both [Ekberg \*et al.\* \(2013\)](#) and [Avdic & Karimi \(2018\)](#) measure parental leave taking up to 8 years after birth, while we as in the Norwegian studies only measure up to 3 years after birth. As reported in [Ekberg \*et al.\* \(2013\)](#), a significant share of the effect is due to larger male take-up after the 3rd year and in particular during holidays.

### **The German 2007-Reform**

The German 2007-reform was significant in the sense that it almost halved total parental leave from 24 to 14 months of which 2 were earmarked to the father, while benefits were increased from means-tested €300 per month to 67% replacement of past earnings capped at €1,800 per month or €415 per week (2019-level). Similar to the Swedish reform, we scale the benefit cap by 3/2 to account for the lower earnings level in Germany.

The German 2007-reform is studied by [Kluve & Tamm \(2013\)](#) and [Bünning \(2015\)](#), but neither of them provide their own number on the changes in fathers take-up of parental leave. [Kluve & Tamm \(2013\)](#) find no significant changes in fathers involvement in childcare or employment within the first 2 years after the birth of the child, but [Bünning \(2015\)](#) cite numbers from the German Statistisches Bundesamt that the share of fathers who took

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<sup>27</sup>[https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Earnings\\_statistics](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Earnings_statistics)

parental leave increased from 3.5% in 2006 to 21% in 2008, and is currently close to 30% in 2012.

Compared to the numbers cited by [Bünning \(2015\)](#) our model has difficulties in matching the very low pre-reform take-up by fathers. We predict a 24% share compared to the 3.5% cited above. Our interpretation of this discrepancy is that the Germany pre-reform setting with very long total leave and low benefit is too far from the variation we used to identify our model. In contrast, the post-reform is closer to the baseline setting in our model and here we predict a level of take-up (40%) that is closer to numbers cited by [Bünning \(2015\)](#).

Table A.I: Comparing Our Simulations with Past Earmarked Leave Reforms

Reform	Pre-Reform Setting <sup>1)</sup>	Post-Reform Setting <sup>1)</sup>	Simulated Change	Observed Change
<b>Norway 1993</b>	100% replacement	100% replacement	34pp increase in the share of fathers taking leave from 40% pre-reform.	22pp increase year 1, 37pp year 3, and 55pp year 10 from 3% pre-reform.
	No benefit cap <sup>2)</sup>	No benefit cap <sup>2)</sup>		
	21 weeks total leave	28 weeks total leave	1.9 week increase in the avg. length of male parental leave from 4.3 weeks pre-reform.	8 days (1.15 week) increase year 1 from 2 days pre-reform.
	0 weeks earmarked	4 weeks earmarked		
<b>Sweden 1995</b>	90% replacement	80% replacement	19pp increase in the share of fathers taking leave from 28% pre-reform.	36pp increase year 1 from 46% pre-reform.
	€1,035 benefit cap <sup>3)</sup>	€1,035 benefit cap <sup>3)</sup>		
	37 weeks total leave	37 weeks total leave	0.6 week increase in the avg. length of male parental leave from 2.7 weeks pre-reform.	14 days (2 weeks) increase year 1 from 30 days pre-reform.
	0 weeks earmarked	4 weeks earmarked		
<b>Germany 2007</b>	100% replacement	80% replacement	16pp increase in the share of fathers taking leave from 24% pre-reform.	18pp increase year 1 and 26pp year 3 from 3.5% pre-reform.
	€100 benefit cap <sup>3)</sup>	€625 benefit cap <sup>3)</sup>		
	90 weeks shared leave	47 weeks total leave	1.0 week increase in the avg. length of male parental leave from 1.4 weeks pre-reform.	
	0 weeks earmarked	9 weeks earmarked		

Notes: 1) As our model focus on the shared parental leave that follows the 14 weeks of maternity leave, we subtract 14 weeks from the available parental leave in the other countries. 2) Norway has an official cap of €1,070 per week. However, most public and private employers top up benefits so that income is fully compensated (Dahl *et al.*, 2014). Hence we treat the cap as non-binding. 3) We scale the benefit caps in Sweden and Germany by 3/2 to adjust for the lower earnings levels in these countries. The 3/2 scaling reflects the relative median gross hourly earnings in 2019 between the countries measured by Eurostat.