UNU-MERIT Working Paper Series

#2013-045

Male use of parental leave in Luxembourg: Empirical analysis of administrative records

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UNU-MERIT Working Papers

ISSN 1871-9872

Maastricht Economic and social Research Institute on Innovation and Technology, UNU-MERIT

Maastricht Graduate School of Governance MGSoG

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Male Use of Parental Leave in Luxembourg

Empirical Analysis of Administrative Records

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October 5, 2013

The present project is supported by the National Research Fund, Luxembourg

[1]For writing this paper, I have greatly benefitted from discussions with and comments by my PhD Promoter at Maastricht University - Professor Dr. Joan Muysken and my supervisor at the University of Geneva - Professor Dr. Gilbert Ritschard.

[2]The findings, interpretations and conclusions expressed in this paper are solely mine and do not necessarily present policies or views of UNU-MERIT/Maastricht Graduate School of Governance.

Abstract

The study investigates the decisions of fathers to use parental leave at the individual level. The focus is on the opportunity cost fathers would face for using the leave. Opportunity cost is measured in two ways: as the difference between the parental leave benefit and the salary of the father and as the mean salary growth for a period of six months. The first measure is a proxy for the direct opportunity cost, while the second aims to capture opportunity costs of being away from the workplace in terms of foregone promotion opportunities. Data for the analysis are based on anonymous administrative records of fathers working in the Grand Duchy of Luxembourg. The analysis deploys a duration model to investigate fathers' use of parental leave throughout an observation period of five years. The results of the study suggest a negative, although non-linear, relationship between foregone income and the hazard of taking parental leave. Surprisingly, however, salary growth in the six-month period prior to taking parental leave has a positive, rather than a negative effect on the hazard of taking parental leave.

JEL-Classification: J130, J160
Keywords:Parental leave, work-family reconciliation, fatherhood

Contents

1 Introduction and Literature Review

The study investigates the decisions of fathers to use parental leave at the individual level. The research topic is important as policy-makers in industrialized countries are increasingly looking for ways to increase the number of fathers using parental leave. Despite parental leave generally been conceptualized as a gender-neutral work-family reconciliation measure, the majority of leave users in industrialized countries are women(Plantenga and Remery, 2005). Increasingly policy-makers and academics are recognizing the importance of achieving a more equal distribution of paid and unpaid work between men and women. The participation of men in parental leave would mean that women would not be the sole bearers of all negative consequences associated with time spent out of the labor force. Fathers' use of parental leave has been linked to higher probability for couples to have more children in Sweden and Norway (Duvander, Lappegå rd, and Andersson, 2010). In addition, parental leave provides an important opportunity for fathers to strengthen their emotional connection with their children (O'Brien, Brandth, and Kvande, 2007). There is evidence that fathers' parental involvement is linked to positive outcomes for children (see Pattnaik and Srirarm, 2010) and for their spouses (Lamb, Pleck, and Levine, 1986). Therefore it is important to understand what factors foster or prevent the participation of men in parental leave and to concentrate policy efforts accordingly.

Previous research on male use of parental leave is reviewed in Zhelyazkova (2013). So far, it is well-established that variations in the policy design can significantly affect male take up rates of parental leave. Earmarking part of the leave for fathers on a use-it-or-lose it basis seems to have particulary pronounced effects, as has been demonstrated by a number of "natural" experiments, comparing take up rates before and after a reform (Ekberg, Eriksson, and Friebel, 2013; Duvander and Johansson, 2012; Geisler and Kreyenfeld, 2012).

Empirical research has also been carried out outside the quasi-experimental framework, linking taking parental leave (or its duration) to explanatory factors. Typically situated within the context of single countries, this stream of research has provided a deeper understanding of the factors involved in the decision-making of fathers and couples regarding use of parental leave. Some main findings from such studies are that men are more likely to take

leave for their first child, if their partner is more educated and if their partner has (relatively) higher earnings(Nielsen, 2009; Geisler and Kreyenfeld, 2011; Lappegå rd, 2008; Sundstrom and Duvander, 2002).

Within the workplace, there is evidence that fathers' working in the public sector are more likely to use parental leave (Lappegå rd, 2012; Nielsen, 2009). Organizational size also matters, as for smaller organizations it is expected to be harder to accommodate prolonged leaves of their employees (Anxo, Fagan, Smith, Letablier, and Perraudin, 2007; Whitehouse, Diamond, and Baird, 2007). In addition, research has pointed out the importance of the sector of employment, scheduling of the work, age and gender-composition of the company, etc.(Anxo et al., 2007). The study of Haas, Allard, and Hwang (2010) further extends the analysis to company-level factors, which are harder to measure, such as organizational culture and the extent to which management was supportive of parenting values.

From a purely economic point of view, one could expect that the opportunity cost of fathers to take parental leave, in terms of their foregone earnings while on leave, would also be among the key predictors for use of leave. Interestingly, however, previous empirical findings tend to suggest a rather non-linear association between earnings level and probability of taking parental leave. For example, in the study of

The present study positions the opportunity cost of every individual father at the center of the analysis in order to extend previous understanding of the role of income-levels for parental leave further. Opportunity cost is measured in terms of two main components: direct foregone income and promotion opportunities, conceptualized as the average growth in each previous six-month period. The analysis benefits from the opportunity to use anonymous administrative records from the Grand-Duchy of Luxembourg, which provide information about the income and growth of salary at every time point during the whole period when a father is eligible to use parental leave on a monthly basis. The longitudinal nature of the data makes it possible for the effects of covariates to be traced even if they change over time, as information from the entire period of observation can be used,as opposed to relying on values at fixed points of time (typically before the birth). Furthermore, the administrative records provide the rare opportunity to analyze parental leave via knowledge of actual leave-taking as from the records, as opposed to inferring parental leave based on general leave of absence from work or self-reported data. Finally, researching the Luxembourg data, extends the

knowledge of male use of parental leave to a new, previously unexplored context. Although Luxembourg is a rather small country, its size and composition its workforce make it comparable to the workforce in a number of European regions, especially around large cities (Brosius and Ray, 2012).

2 Background: Parental Leave in Luxembourg

The present research is situated in Luxembourg where parental leave take up has not been researched before with the exception of a report for the European Commission prepared by Plasman and Sissoko (2005) and an evaluation performed by KPMG Assurance Advisory Luxembourg (2002). The Luxembourg context is interesting because still in 2004 (only five years after the introduction of parental leave in Luxembourg) men already constituted 17% of parental leave users, which is amongst the higher figures for European Union countries. In their report for the European Commission Plantenga and Remery (2005) mention Luxembourg, amongst the Netherlands, Sweden, Iceland and Norway as the only countries where fathers' take up rates are above 10 per cent. Recent figures published in the report by the Luxembourg Ministry of Family and Equality (2012) indicate a steeply increasing rate of the share of male users of parental leave. For example, when the scheme was first introduced in 1999, only 90 or 6.3 percent of the 1433 parents using parental leave were men. In 2001, the share of men using parental leave more than doubled to 13.7 percent of the 2297 total users, and in 2012 the share of male users was as high as 23.4 per cent out of a total number of 4025 parental leave users. In terms of take up rates, computed as users of parental leave as a fraction of all who are eligible, the first available figure is the one provided by

It is possible, that the policy design of the leave in Luxembourg could explain this relatively high rate of male participation. In a comparative assessment De Henau, Meulders, and O'Dorchai (2007) classified the parental leave system in Luxembourg as being the best one (amongst the countries in the analysis) in terms of its potential to achieve gender equality. The leave is paid (although on a flat-rate basis) and equally divided between the two parents. That is, each parent in Luxembourg has the individual and non-transferable right to paid parental leave, which can be taken in a block of six months full-time or twelve months part-time. This means that fathers'

who take parental leave, take at for a minimum duration of six months. In comparison, data on fathers' take up of leave in Sweden show that on average fathers took leave of duration equal to the minimum earmarked period of about two months (Plantenga and Remery, 2005).

Parental leave in Luxembourg was introduced for the first time in 1999 following European Union requirements set out in European Directive of 96/34/EC of 3 June 1996. Updated information on leave policies in Luxembourg is published on an annual basis by the International Leave Network (refer to Zhelyazkova and Loutsch, 2012). Presently, the parental leave scheme gives working parents in Luxembourg the right to take either a block of six months full-time parental leave or a block of twelve months part-time leave for the purposes of caring for a young child at home. The leave can be used up to the fifth birthday of the child and is an individual entitlement: both parents have to right of leave (if they meet the eligibility conditions), however, they cannot transfer it to each other. In addition, there is the requirement that the first leave in a two-parent family must be taken immediately after the maternity leave (the period immediately before and after birth, which in Luxembourg is equal to four or five months fully compensated from the national health care fund). If a parental leave is not taken immediately after the maternity leave the right of the leave is forfeited, however, the second leave (in a case of family of two parents) can still be used until the child turns five.

Parents who take parental leave are compensated on a flat-rate basis, meaning that everyone receives the same compensation regardless of their previous income. In 1999 the rate of compensation started out at 1496.11 EUR for the full-time leave and half of the amount for the part-time leave. There was an annual adjustment for inflation until 2007, when the compensation rate was frozen at 1778.31 EUR and it has remained at this rate until the time of writing this paper portail des statistiques (see 2013). The eligibility requirements for the leave are a minimum of one year employment with the same employer prior to the start of the leave and a reduction of at least 50% of working hours in the case of taking the leave part-time. In accordance with the European Directive of 96/34/EC of 3 June 1996, the leave is fully job-protected and parents are guaranteed the right to return to the same or an equivalent working position at the end of the leave.

3 Conceptual Framework and Research Hypotheses

According to the parental leave legislation in Luxembourg described in section 2, fathers who work in Luxembourg can decide at any point of time between the birth or adoption of their child until his or her fifth birthday whether to use parental leave or not[3]. If the father does not use the leave it is "lost", as it is not possible that the mother uses it instead. The fundamental premise I base my analysis on, is that parental leave is an individual entitlement and each father decides whether to use it or not during the five period for which it is possible to use it. Thus I consider fathers within a classical economic framework where they are rational agents who act to maximize utility. Therefore fathers decide whether to take leave or not based on comparing their utility of taking the leave and remaining at home with their child to the opportunity cost in terms of salary-related income or career opportunities.

Due to the availability of detailed, accurate longitudinal earnings-related data, the present study can contribute to the current understanding of how men make decisions on taking parental leave by incorporating two measures of opportunity cost. The first measure is the directly measurable cost in terms of foregone earnings, which is equal to the pre-leave wage minus the amount of the benefit. The second measure is conceptualized as a proxy for foregone career development opportunities. It is measured through the average rate of salary growth over the previous six months for each father. The main hypothesis is that, for both measures of opportunity cost, higher opportunity cost would be associated with lower likelihood of using parental leave.

The analysis controls for family-related and workplace-related characteristics of the fathers, which are available in the data and which have been demonstrated to be important in previous studies. Within the family, I control for the parity of the birth, the presence of other children, the marital

[3]In principle, fathers face several constraints in this decision: that their partner cannot be on parental leave during this time, that the earliest possibility to take the leave is immediately after the end of the maternity(adoption) leave and that they will lose their eligibility rights if they become unemployed or seize to be employed for a minimum of 20 hours. However, for simplicity, I ignore these constraints, as it is very difficult to incorporate them into an estimation model.

status of the father, the gender of the child and whether multiple births occurred. In terms of work-related variables, I am able to incorporate information on the size of the enterprize and the monthly hours of employment. I also control for nationality and age, as they can also reveal some differences in fathers' labor market positions. For example, immigrants' position on the labor market could be less advantageous than that of natives

Unfortunately, the use of administrative records makes it impossible to use education in the analysis. This is an important omission, as higher-educated fathers are considered more likely to hold gender-egalitarian beliefs (Bolzendahl and Myers, 2004) and, thus to share in household tasks (Nordenmark and Nyman, 2003) or see Davis and Greenstein (2009) for an overview. At the same time, however, education bears a direct relationship to fathers' work situation, as higher education is associated with higher earnings (Brunello and Comi, 2004), which could suggest a higher opportunity cost of using parental leave.

Finally a few words on the decision to analyze men individually and not within the family unit. Positioning the analysis at the individual level is somewhat different from the general trend in previous research, where male use of parental leave is usually analyzed at the family level. Academic research based on the life-course perspective(Elder Jr., 1994), has highlighted the fact that lives of individuals are "linked"(Elder Jr., 1994) and decisions concerning work and family are often made inter-dependently.

Economic frameworks used for analyzing male use of parental leave also tend to analyze the decisions of fathers within the couple (see Zhelyazkova, 2013). Many economic studies base their theoretical analysis economic frameworks derived from Becker's (1981) New Home Economics (Reich, Boll, and Leppin, 2012) and bargaining theories (for example see: Amilon (2007)). In both of these frameworks tasks related to the home production would be performed by the spouse who earns less on the labor market. In the New Home Economics reasoning this is due to the fact that this would allow the couple as a unit to be more productive, while in the bargaining theories the partner who has a higher earning power has a more favorable position in the negotiation process of task distribution.

Generally approaches based on negotiations within the couple have been applied for Germany (Geisler and Kreyenfeld, 2011) or in Sweden (Sundstrom and Duvander, 2002), where parental leave is a family-based right. In con-

trast, in Luxembourg, parents are given an individual and non-transferable right to leave, meaning that parents do not need to negotiate on sharing the leave per se. Therefore, an individual approach to the analysis might be more appropriate for the case of Luxembourg.

4 Data and Methods

4.1 Data

Data for the analysis are provided in the form of anonymous administrative records from the *Inspection générale de la sécurité sociale (IGSS)* Luxembourg. When working with administrative data, it is important to consider that not everyone in the population has an administrative record. In the case of the data used for this analysis, administrative records are available only for persons working in Luxembourg or persons who have a relation with the Luxembourg social security system. This means that naturally excluded from the sample are Luxembourgish nationals who live or work outside of Luxembourg, Luxembourg residents who are employed at the European Union institutions in Luxembourg (as they are not included in the national social security system). At the same time, however, information is available for cross-border workers. In short, cross-border workers are persons who are employed in Luxembourg, however, they commute daily to their workplace from one of the neighboring countries where they live.

The analysis is based on a selected sample from the available administrative records. The population of interest for the analysis is working parents, as parental leave is a measure available to working parents only. For the analysis, I selected all male employees in Luxembourg who:

- had a social security record for at least part of the period $2000 - 2007$
- had a child born in their fiscal household[4] in 2003

[4]The fiscal households are artificially reconstructed households based on tax-related documents. In rare cases it is possible that children in the fiscal household are not biological children, but children from a prior marriage of a spouse, grandchildren, nieces or nephews.

- were working in Luxembourg and eligible to take parental leave at the time when the child was born[5]

After applying the selections mentioned above the data set used for the analysis contains the employment histories of 5827 men, who all had a child born in their household in 2003[6].The year 2003 was chosen as pivotal time-frame for the analysis, as data are available for the period $2000 - 2008$ and focusing on parents who had a child in 2003 allows for sufficient time periods of observation both before and after the event of arrival of a new child in the family. Focusing on parents who all had their child born in the same year, makes comparison somewhat easier, as potential confounding factors, such as other policy measures or the overall economic climate are held constant.

The administrative records contain socio-demographic, work and social security related information for the entire period of observation. For each father in the sample, there is information on his age, nationality and country of residence. In addition, his marital status is known, as well as, the number and ages of any other children in the household. There is also a detailed record of the fathers' labor force participation. For any given time point, it is known what is his salary-related income, his employment status, number of hours worked, the size of his enterprize and the some information about the sector of his employment.

4.2 Analytical Approach

For the analysis, I apply event history modeling methods[7], as they are designed for questions related to the timing of occurrence of one or more events of interest (for a recent overview see Mills, 2011). In event history analysis models the dependent variable is either the duration until an event occurs or the "hazard" rate (the probability that a particular event occurs at a given time point, conditional on that that is has not already occurred). For event history analysis one needs longitudinal data, a clearly defined event of

[5]Eligibility for the leave was defined according to the parental leave eligibility rules of Luxembourg. Fathers who worked for the same employer for a minimum of one year and for over 20 hour per week were considered eligible for taking parental leave

[6]The total number of fathers exceeds the number of children born in Luxembourg in 2003 because the data set contains also the career trajectories of cross-border workers.

[7]also called survival, duration or transition methods

interest (or multiple events[8]) and a clearly defined starting point at which everyone in the sample starts to be "at risk" of experiencing the event. The data available in the monthly social security records of fathers in Luxembourg allows for setting up an event history model as they are longitudinal. For the model, I consider as the event of interest whether or not a father takes parental leave. I consider fathers to be "at risk" for taking parental leave from the month when the child is born in 2003.

With event history multivariate modeling, it is possible to investigate what factors contribute to whether a father takes parental leave or not. In addition, if time-varying effects are incorporated, it is also possible to trace how the rate of taking leave varies over time. The possibility to incorporate time-varying covariates makes the analysis more precise, as the observation period for five years is a substantial time span during which a number of important factors in one's family or employment status can change (for example, more children can be born, or salary levels can increase, etc.). Event-history analysis methods are common in the literature related to maternity leave, parental leave or, in general, family-related career breaks. A number of studies have examined how soon after birth mothers return to work and the role or parental leave and institutional or individual-level factors in this process.

Event-history analysis models make different assumptions about the shape of the hazard function and its relationship with explanatory factors. There are non-parametric, semi-parametric and parametric methods. In this analysis, it would be difficult to apply a parametric method, as there is very limited information on the timing of parental leaves used by men in Luxembourg. The report by the Luxembourg Ministry of Family and Integration (2012) shows that, on average, women are more likely to use the "first" leave available for the two parents, while men were much more likely to use the "second" parental leave. For example, in 2012, men represented only 12.3 per cent of the users of the "first" parental leave and 87.7 per cent of the users of the "second" parental. The Luxembourg parental leave scheme also requires that the "first" leave in the family must be taken immediately after the maternity leave, which continues for two or three months (three months if the mother breastfeeds). Thus if the male partner of the couple is less likely to be using the "first" leave, it could be expected that the slope of the hazard rate will be relatively flat in the beginning and will be getting steeper at the point after the period of the "first" parental leave, which if

[8]Multiple events of interest can be analyzed via competing risk models.

taken full-time would be around the 8th or 9th month of the birth of child. However, it is difficult to imagine how it will be distritbuted after this point or to make any assumptions about the relationship of covariates and the shape of the hazard function over time. Therefore, it would be a safe choice to use a non-parametric or a semi-parametric model for the analysis.

The analysis in this study is broken into two parts. The first part is an exploratory analysis, where the survival rate of all fathers in the sample is estimated using the Kaplan-Meier estimation technique (explained in more detail in the next section). In short, the Kaplan-Meier estimation technique can be used to measure the duration until the event of interest(in this case until the father takes parental leave) takes place. It is an especially appealing technique for the explorative part of the analysis, as it makes absolutely no assumptions about either the shape of the hazard function or a potential relationship with covariates. As a first explanatory step, the survival functions based on the Kaplan-Meier estimator are comparable across the different levels of the main covariates of interest for the analysis: the two measures of opportunity cost. Next, the analysis is extended to a multivariate level by applying a Cox proportional hazard model(Cox, 1972), a semi-parametric method, which allows the inclusion of multiple covariates (including time-varying covariates and time effects) at the same time.

Equation 1 displays one of the generic ways of writing the formula for the Kaplan-Meier estimator. In this formula $\hat{S}(t)$ represent the estimated cumulative probability of survival beyond time point t, n_i denotes the total number of observations who are "at risk" of experiencing the event (in the first period these are all observations and in subsequent periods observations which already experienced the event in the previous period and censored observations are subtracted) and d_i stands for the number of data points experiencing the event in period t_i. Therefore $\hat{S}(t)$ is equal to the product of the ratios of the number of observations who have not yet experienced the event $n_i - d_i$ and the total number of observations at risk n_i, whereby censored cases are subtracted at the time period when they are censored.

$$\hat{S}(t) = \prod_{t_i<t} \frac{n_i - d_i}{n_i} \tag{1}$$

The Kaplan-Meier estimator can be used to model the survival probability

of the entire sample and to explore the relationship with categorical covariates (one at a time), whereby the survival curves are plotted for groups with different levels of the predictor variable. In this paper, I am using this technique to explore the relationship between the two explanatory variables relating to the opportunity cost of taking parental leave for the fathers. The statistical significance of the difference between the survival probabilities of the groups can be assessed via the log-rank test. Briefly said, the log-rank test works by comparing the difference between observed and expected number of events at each event time for the different levels of the predictor variables (see Cleves, 2008, p.123). The log-rank test can be considered equivalent to the score test from a semiparametric model under the assumption of proportional hazards(see Harrell, 2001; Dalgaard, 2008, p.474,p.255). This is the approach used in this study because the log-rank test is difficult to estimate with time-varying covariates in the Survival Library (Therneau, 2012) in R (R Core Team, 2012).

For the multivariate analysis, I use the Cox proportional-hazards regression model Joesch (]Cox1972. An overview of this model and a step-by-step guide to its application with the free statistical and programming environment R (R Core Team, 2012) is available in Mills (2011, chap. 5). The most important feature of this method is that it does not make any assumption about the shape of the hazard function, which makes it suitable for the analysis of events whose distribution cannot be derived theoretically

Different notations are used in the literature for writing the formula for the Cox proportional hazard model. In Fox (2002), the following formula is presented, where i is the subscript denoting the different observations and covariates are denoted as $x's$:

$$h_i(t) = h_0(t)exp(\beta_1 x_{i1} + \beta_2 x_{ik} + ... + \beta_k x_{ik}) \tag{2}$$

To make the model easier to understand Fox (2002) presents step by step how the hazard ratios of two individuals can be presented. The hazard for observation i is shown in Equation 3, while the hazard for observation i' is in Equation 4. Equation 5 shows how the hazard ratio for these observations would look like, whereby one can observe that it is independent of time t.

$$\eta_i = \beta_1 x_{i1} + \beta_2 x_{ik} + ... + \beta_k x_{ik} \tag{3}$$

$$\eta_{i'} = \beta_1 x_{i'1} + \beta_2 x_{i'k} + ... + \beta_k x_{i'k} \tag{4}$$

$$\frac{h_i(t)}{h_{i'}(t)} = \frac{h_0(t)e^{\eta_i}}{h_0(t)e^{\eta_{i'}}} =$$

One potential problem with this estimation technique is that it makes a strong assumption that the hazard functions of groups defined by the explanatory factors (e.g. low and high levels of the same covariate) remain parallel over time. In other words, the ratio of the hazards of any two individuals from the data set is assumed to not vary over time. To test this assumption, I use the Schoenfeld residuals (Schoenfeld, 1982) test, as suggested in Mills (2011, chap.7). Schoenfeld residuals are described in Schoenfeld (1982). Schoenfeld residuals are not residuals for the whole model, but are computed for each individual for each covariate. When residuals are plotted against time, their slope should be equal to zero if the assumption of proportionality holds. The Schoenfeld residuals test is equivalent to testing whether the slope of a regression of the scaled residuals on time would be equal to 0 (UCLA: Statistical Consulting Group, 2013). The results of the test are presented in Appendix D.

The results of the model estimated in this study suggest that a number of the covariates in the analysis do not meet the proportional hazards assumption. To correct this, I follow Joesch (1997) and include interactions between the covariates and time in the model. In addition to this method, Mills and Begall (2010) suggests that an alternative solution would be stratifying the data. However, interactions with time have the advantage of allowing the researcher to trace how the effect of the covariates changes over time.

Another potential problem with the analysis is whether the censored observations are random. Censoring means that there are incomplete records in the data where information is missing either in the beginning (left-censoring) or at the end of the observation period (right-censoring). With right-censored observations, the problem is that it is not possible to know at what time period (and if) they experience the event of interest, as their complete records

are not available. In this analysis, I treat as censored observations these cases that interrupt their social security record during the five-year period of observation. Interrupting the social security record means that these persons "disappear" from the data set. This could mean that they either stop working or they start working in another country or in one of European institutions in Luxembourg. Technically, these persons also lose the right the parental leave in Luxembourg, as they interrupt their employment relationship. However, they could, in principle transfer the right to parental leave in another country or re-gain it based on their future employment with another employer. A potential problem with this analysis is that it is difficult to say whether persons interrupting their employment in Luxembourg do so "at random". Therefore there is the risk that the assumption that censoring is random may be violated.

A further note must be made about what observations are considered censored in this analysis. There are two types of cases: fathers who leave the data set (and presumably their employment in Luxembourg) and do not return and fathers who re-appear after some time. For this analysis the second type of censoring (middle censoring) poses a problem, however, these cases cannot be fully incorporated into the Cox model[9]. To begin with, there does not really exist an easily implemented solution on middle censoring. Second, for middle-censored cases most of the information on covariates will be missing also for earlier and subsequent time-periods, as the time-varying covariates are recorded on an annul basis as of December the previous year. Therefore, I decided to treat middle-censored observations as right-censored and to use their information only until the first time they leave the data set. In this way, I am analyzing their decision to take or not to take parental leave until the point for which I have the full available information for them.

I must also note that I am making certain simplifications of the actual decision of the father for this modeling. The first one is that I ignore the fact that fathers can take more than one period of parental leave in the observation period (for example, if they have one more child). To address this question, one could go into recurrent events modeling (see Mills, 2011, chap. 8). Second, I do not distinguish between full-time or part-time leave. This distinction could be addressed via competing risk modeling (see Mills, 2011,

[9]There are some solutions already proposed in the literature conserving middle censoring in parametric models. The interested reader is referred to Iyer, Jammalamadaka, and Kundu (2008); Davarzani and Parsian (2011)

chap. 10). Third, the Luxembourg legislation explicitly states that both parents in a family cannot be on parental leave at the same time. With the available data it would be possible to match only a small fraction of the men to their spouses as long as their spouse also works in Luxembourg. Therefore, although including information on the behavior of the spouse would have been very interesting, it proved not to be feasible in this case, as it results in a selected sample where single men, men whose spouses do not work or work in another country would be excluded. Finally, it must be noted that this model does not make any corrections for non-observed heterogeneity. Therefore, it is possible that there is a bias in the estimation of the coefficients, if leave-taking behavior is correlated with other characteristics, which also are related to the explanatory factors in the model. I hope that future investigations of this question could extend the analysis beyond these limitations.

All computations were performed using the Free Statistical and Programming Environment R (R Core Team, 2012). For estimating the Cox proportional hazards model, the Survival Library developed by Therneau (2012) was used. Finally results were presented through the use of the Xtable package, developed by

5 Measuring Opportunity Cost

5.1 Foregone Income

Opportunity cost in terms of foregone income was computed by subtracting the benefit rate for each time-period from the total salary-related income of each father in the analysis. Information on the salary-related income was obtained from the IGSS records, while benefit rates were obtained from the online information provided by the Luxembourg Statistical Portal (2013). Both the salary and benefit figures were converted to 2005 EUR values using the monthly *Harmonized Consumer Price Indices (HCIP)* provided by Eurostat[10] for Luxembourg.

All values of the opportunity cost were lagged six months. Using lagged

[10] http://epp.eurostat.ec.europa.eu/

variables is commonly advised in event-history modeling with time-varying variables. The reason is that without using lagged values causality can be obscured. For example, parents' salary-related income will naturally drop in the month they take parental leave, as they will not receive their salary any more. However, without using a lagged value of the variable, one can incorrectly infer that lower salary-levels lead to a higher probability of taking parental leave. In this analysis, I take the same reasoning a step further and work with six-month lags, because in Luxembourg parental leave must be applied for with the employer a minimum of six months before the desired start date. While there is no way to know exactly when parents apply for the leave, one can safely assume that both the parent and the employer will be aware of a forthcoming parental leave period six month prior to its start. As a result of the planned parental leave, the labor participation of the parent can be affected, for example, they can be less likely to involved in new projects with a foreseen longer time-frame, etc. Figure 1 displays the distribution of the measure of opportunity cost described above. The distribution is visibly not normal and rather skewed to the left. There were many outliers in the data and in order to make the main body of the distribution more visible and easier to interpret the top 5 per cent of the values have been trimmed off.

For the multivariate analysis this variable was categorized for two main reasons. First, there were many outliers in the data, representing fathers with very high incomes. In 281254 of the person-months the recorded monthly opportunity cost was higher than two standard deviations 2*6816 EUR above the mean 2812 EUR. This is not surprising for a high-income context like Luxembourg, however, a large number of extreme values are known to pose significant threats for the validity of results. To avoid the potentially confounding effects of these extreme values, I chose to put them together in the highest-earning category. Second categorizing the variable allows for the detection of non-linear effects. Logarithmic transformation of the variable was also considered as an option to resolve the two issues mentioned before, however dummy variables were chosen due to their more powerful ability to detect non-linearity. The distribution of the categorized variable is displayed in Appendix A.

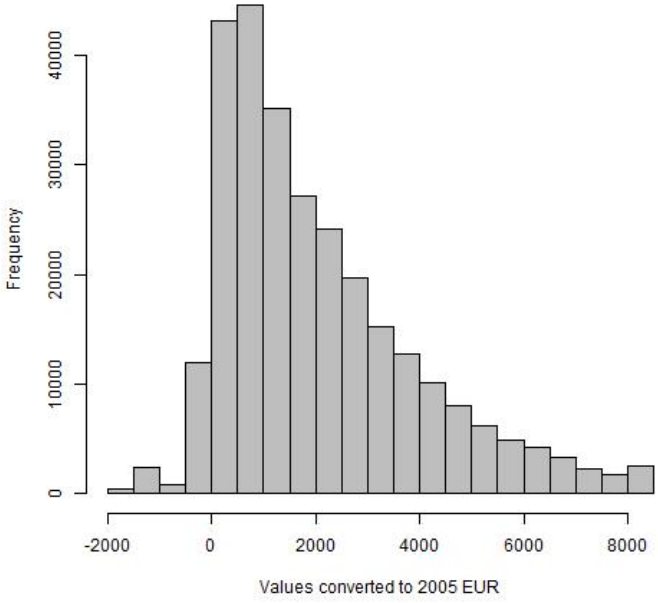

Figure 1: Opportunity cost of fathers to take parental leave terms of foregone monthly salary-related income

5.2 Foregone Promotion Opportunities

The second measure of opportunity cost was constructed using the monthly values of salary-related income converted in 2005 EUR as described in Section 5.1. Average salary growth was computed using the formula displayed in equation 6. With this equation, growth equal to 1 corresponds to no changes in the salary. Values higher than 1 reflect positive growth or salary increase and values lower than 1 reflect negative growth or salary decrease.

As salary-growth could, similar to salary-levels, be affected by the knowledge of the employer and employee of a forthcoming parental leave, lagged values of six months were used for the analysis. The average salary-related income growth for the previous six months period ranged from 0 to 6 with 920 miss-

ing values[11]. It is difficult to say what the extreme values represnted, but quite possible they reflected the presence of periods where no income was recorded for a few months. It is possible that these periods represent unpaid leave or unpaid internship employment, however, as these periods to do not alter the social secutiry rights of the person they are not recorded specifically. Therefore, again, the variable was categorized whereby the lowest and highest values could be grouped together. Categorization also has the added advantage of allowing for the tracing of non-linear effects. The distribution of the varaible is displayed in Figure 2. For creating the histogram, the top and bottom 5 per cent of the values have been trimemd off - otherwise the presence of extreme values made the graph less readable. The distribution of the categorized variable is displayed in Appendix A.

$$\text{Average monthly growth from period } t \text{ to period } s = \left(\frac{wage_t}{wage_s}\right)^{\frac{1}{t-s}} \qquad (6)$$

6 Descriptive Analysis

769 fathers from the 5827 fathers observed in the five-year period after a child was born in their household took at least one parental leave. 666 are observations treated as censored because they do not have complete administrative records. A table with the characteristics of the men in the sample is provided in Appendix A.

6.1 Men Using Parental Leave Over Time

To gain an overall understanding of how the event of interest is distributed over time, one could take advantage of the Kaplan-Meier curve, which is

[11] The mean values of the variable showed to vary significantly across years. It is possible that the difference is due to macro-economic factors. To correct for this, I subtracted the mean growth for all observation periods from each observation. When the variable was entered in this format in the multivariate analysis, there were only minimal changes in the coefficients, occuring after the second or third decimal sign. There were no changes in the significance levels or in other coefficients. In view of this, I left the variable in its original form for the analysis, as it made interpretation easier.

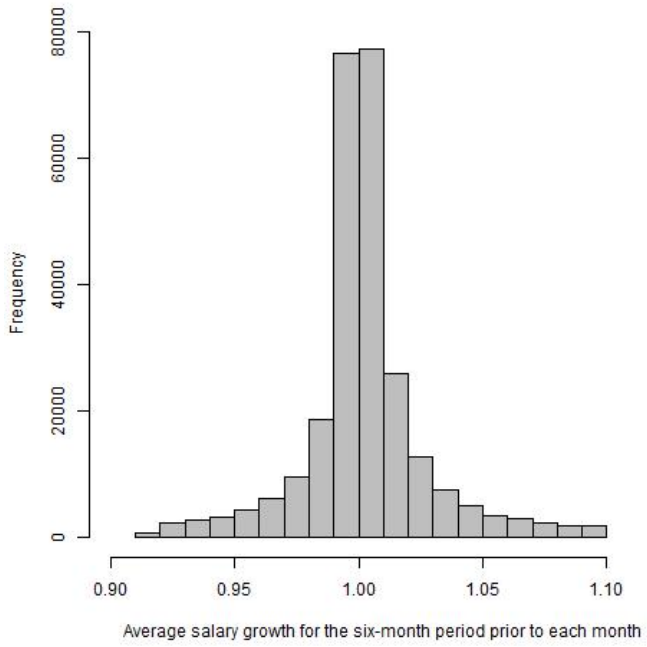

Figure 2: Opportunity cost of fathers to take parental leave terms of presumed salary related growth

commonly the starting point in survival analysis. The Kaplan-Meier curve, is, in short a plot of the distribution of the survival rate throughout the observation period. The survival rate is the fraction of cases who have not yet experienced the event of interest at time t. In this case the event of interest is taking parental leave. Therefore the survival rate is the fraction of fathers who have not yet taken parental leave. The Kaplan-Meier curve incorporates the information about censored observations. This is achieved by considering each father "at risk" as long they are in observation, i.e. for as long as they have a statistical record. The overall Kaplan-Meier curve for the sample is shown in Figure 3. To read the figure, one must keep in mind that the horizontal axis corresponds to time, while the vertical axis corresponds to survival rate, or in other words the fraction of fathers who have not yet taken parental leave. Please note that the vertical axis does not start at zero, but at 0.80. Therefore the graph presents a "zoomed" view of the survival curve. This presentation makes it easier to trace developments

over time, as otherwise the curve appears rather flat and all developments would be concentrated in the top part of the graph.

In Figure 3, the curve is flat for the first two months. This corresponds to the two months after the birth of the child when the mother is still on maternity leave and thus fathers are not able to take parental leave at this time point. The first time-point when the slope of the curve becomes more steep is around the second month. At around twelve months after the birth of the child, there also seems to be an increased rate of parental leave taking.

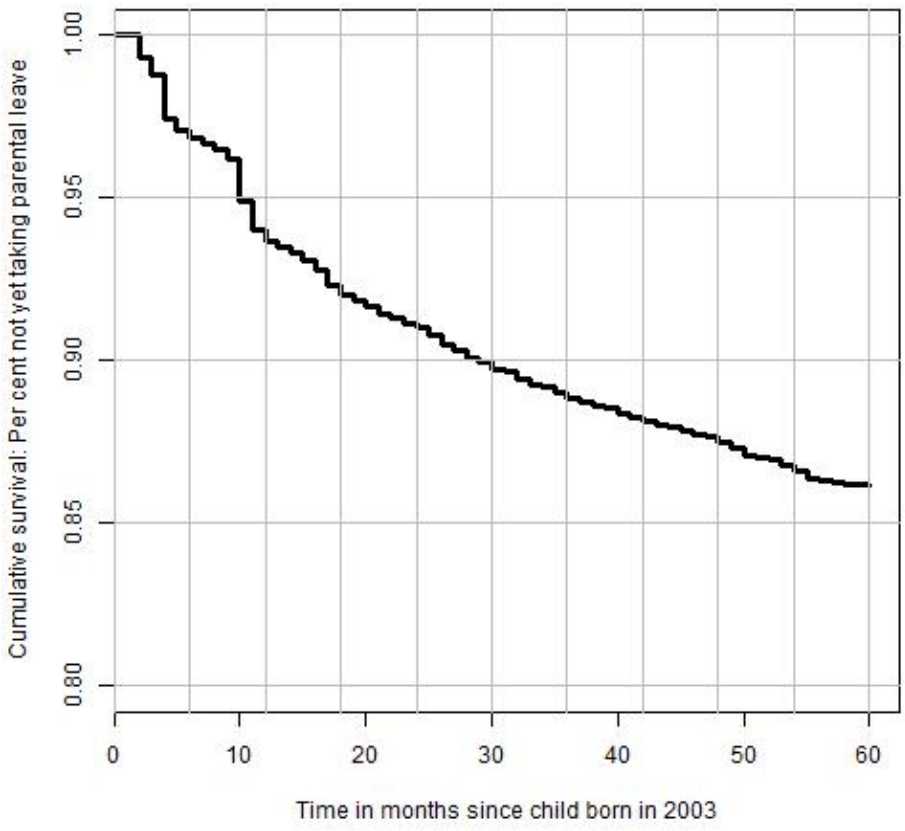

Figure 3: Kaplan-Meier curve

In the remaining part of the curve the slope is flattening, which means there are fewer or no take up cases in that period.

6.2 Opportunity Cost and Taking Parental Leave Over Time

In this study, I measure opportunity cost of taking parental leave in two ways: first in terms of the difference between the full-time benefit amount and the salary-related income on a monthly basis and second in terms of salary growth in a period of six months prior to any of the time-points included in the analysis. To gain an understanding of how these two measures of opportunity cost may be related to the hazard of taking parental leave over time, I draw the Kaplan-Meier curves at their different levels. The Kaplan-Meier curves are displayed in Figures 4 and 5. It must be noted that the Kaplan-Meier curves can provide only an initial insight into the association, as they do not control for any other characteristics of the fathers.

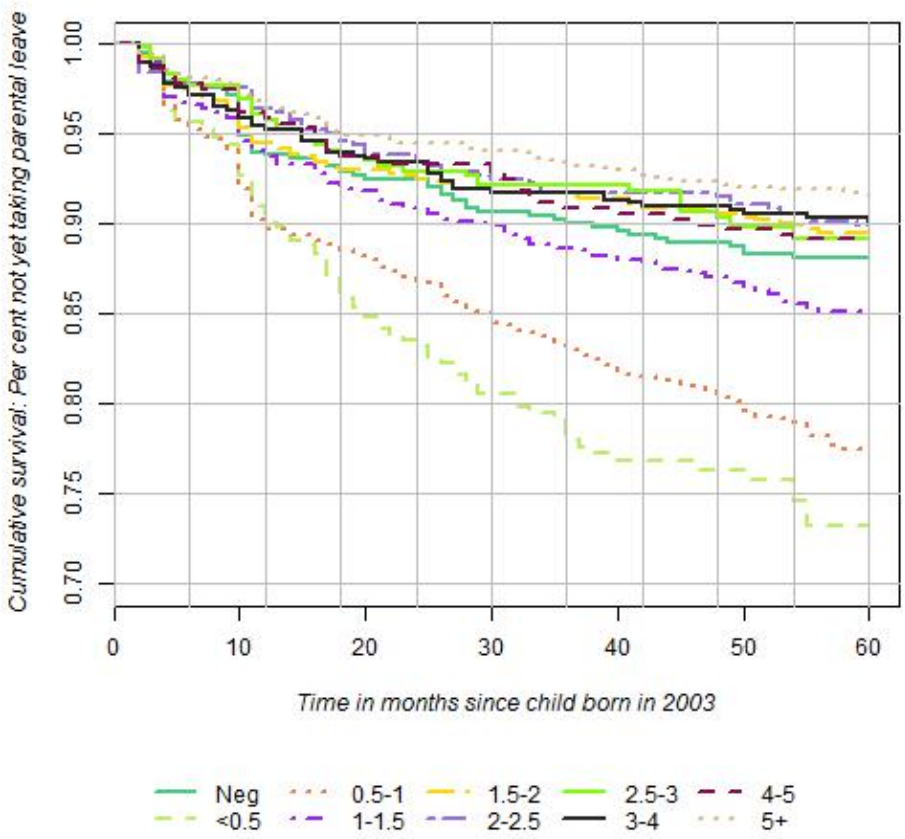

Figure 4: The Kaplan-Meier curve for men taking parental leave according to salary-related opportunity cost

Figure 4 displays the survival rates (the proportions of fathers who have not taken parental leave) along the sixty months of observation for fathers with different levels of salary-related opportunity costs. Note that the values are lagged six months, as explained in the previous section, as this is the time frame within which parental leave must be formally applied for. In Figure 4 we see that the group with the lowest survival rate (i.e. with the highest fraction of men taking parental leave) is the group for which the opportunity cost would be positive, but below 500 EUR per month. In terms of probability to take parental leave, this group is followed by the group with

an opportunity cost between 500 and 1000 EUR and 1000 to 1500 EUR. The relationship between salary-related opportunity cost and taking parental leave is clearly non-linear, as the group with a negative opportunity cost (i.e. earning less than the full-time benefit amount per month) has a higher survival rate than the three before-mentioned groups. The group with the highest survival rate appears to be the one where the opportunity cost would be over 5000 EUR per month. The results from the score test from a Cox proportional hazard model with opportunity cost as the only variable in the model[12] suggests that the difference is significant($\chi^2 = 138.5, df = 9, p = 0$). However, Figure 4 also displays that the difference between the groups does not remain constant over time. This means that the assumption of proportional hazards is violated. This might affect the validity of the score test and pose a a problem for the multivariate analysis applying the Cox proportionate hazards model.

Figure 5 displays the survival rates across time for fathers with different levels of salary growth in the previous six months. The group with lowest survival rate seems to be the group with the third lowest rate of salary-growth (0.994 to 0.9976). This level of salary growth is negative and, in fact, indicates a decrease in the salary-related income level. The group with even higher decrease of salary growth (0.973 to 0.994), seems to be the group with slightly lower survival rate, but relatively higher than the rest, especially after month 30th. The other groups seems to have almost the same survival rates. The results from the score test from a Cox proportional hazard model with salary growth as the only variable in the model[13] suggests that the difference is significant($\chi^2 = 17.36, df = 7, p = 0.015$).

[12] under the proportional hazards assumption this is a test equivalent to the log-rank test, see Section 4.2

[13] under the proportional hazards assumption this is a test equivalent to the log-rank test, see Section 4.2

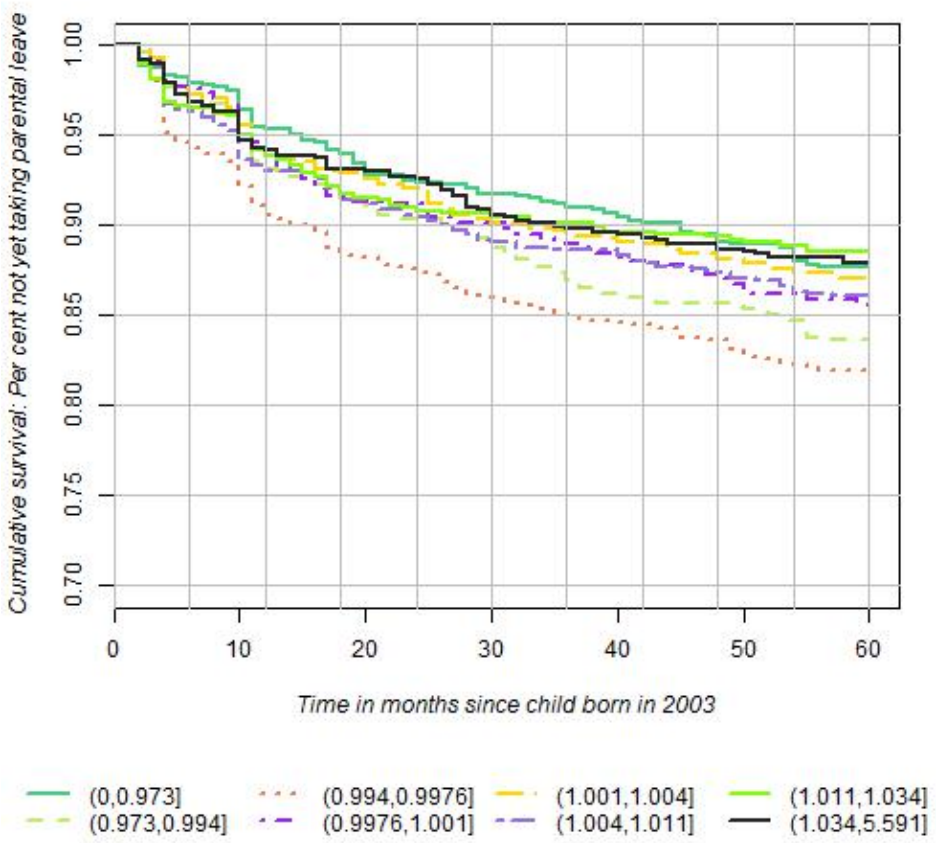

Figure 5: The Kaplan-Meier curve for men taking parental leave according to salary-growth in past six months

7 Multivariate Results

To examine the effect of a number of covariates on the probability that a father will take parental leave over time, I use a Cox proportional hazards model with time-varying and fixed covariates. The results are displayed in Table 3. The table is organized as follows. The first column displays the names of the variables entered into the analysis. The second column displays the exponentiated values of the coefficients, which are in fact the hazard ratios. Hazard ratios greater than one indicate a positive association between the predictor variable and the hazard of the event, in this case, a greater chance of taking parental leave. Negative relationships are indicated by hazard ratios smaller than one, in this case, this means that as the value of the predictor increases, there are less chances for the father to take parental leave. The significance of the hazard ratios is displayed in column three. Column four presents the exponentiated values of the coefficients of interaction terms between time and these predictors, which were identified to have non-constant effects over time by the Schoenfield residuals test, displayed in Appendix D. The significance of the interactions terms is shown in the last column. Coefficients of predictors where time interactions are present in the model should be interpreted after multiplying the two interactions together.

The hazard ratios of the dummy variables for the first measure of opportunity cost - foregone income - seem to decrease, as the dummy variables increase, although significant differences are only observed between the reference group (where opportunity cost would be $1500-2000$ EUR per month) and the groups of fathers for whom the opportunity cost would be lower than 1500 EUR per month who all have a higher probability than the reference to use parental leave. Higher earning fathers, however, do not have significantly lower probabilities than the reference group to use parental leave, except the group of very high-earners, where the opportunity cost would exceed 5000 EUR per month. The Schoenfield residuals test did not suggest a violation of the proportional hazards assumption, so the variable was assumed to have the same effect over time and interactions with time were not included in the model. To sum up, although the coefficients are monotonically decreasing, the p-values suggest some kind of non-linearity in the relationship between foregone income and taking parental leave, whereby the association is more prominent at the two extreme ends of distribution of foregone income. These results offer a partial support to the hypothesis tested in this study, whereby it was expected that higher levels of opportunity cost would be associated

with a lower hazard of taking parental leave.

The second measure of opportunity cost, averaged salary growth in the past six months, also yielded non-linear results. The expectation for this variable was that fathers who have a higher levels of salary growth in preceding periods of six month would have a lower hazard of taking parental leave, as this would suggest a potentially higher level of foregone promotion opportunities. The results are somewhat mixed, however, the overall trend is that the relationship runs in the opposite direction. The reference group for this variable was chosen to be fathers with average growth rates between 1.001 and 1.004. With the exception of the coefficient of the third group (0.994 to 0.9976), the coefficients seem to increase - that is higher levels of growth, relative to the reference group, are associated with more instances of taking parental leave over time. The coefficients are significant, however, only for the difference between the reference category and the third group (0.994 to 0.9976) and the groups with higher levels of growth, above (1.004). The relationship was not constant over-time, evident in the Schoenfield residuals test (see Appendix D) and the significant (negative, except for the first group) interactions with time (see columns 4 and 5 in Table 3), suggesting that with time, the difference between these groups and the reference group tends to decrease.

The correlation between the two measures of opportunity cost was tested using Kendall's tau-b coefficient. This method was chosen because the variables were entered into the Cox model as sets of dummies and not in their continuous forms. Spearman's rho statistic could not be applied in this particular case because there were ties in the data. The value of Kendall's tau-b coefficient was estimated to be 0.131, which was statistically significant ($z = 95.47$, $p < 0.001$).

Monthly hours of work yielded somewhat surprising results. The reference group was chosen to represent men working exactly 173 hours per month. In Luxmebourg, this is the standard working hours per month figure. Fathers working less than that, were grouped together as "part-timers", while these working more than 173 hours were grouped together as "overtimers". It must be noted that in Luxembourg, typically, only blue-collar workers are expected to record their exact hours of work. For white-collars and civil servants, overtime hours of work measure the contracted hours and not necessarily the hours actually working. The distribution of hours worked according to category of employment is displayed in Table 1. The percent-

ages are calculated across rows and indicate that, indeed, blue collar workers are most likely to have overtime working hours, while civil servants almost always have standard working hours of 173 hours per month. It must also be noted that for many of the fathers in the dataset, the working hours represent the combined working hours from a number of working places. In some cases, these different working places can have different categories. These situations were solved by using the category of the workplace where the father worked the majority of hours per month. Unfortunately due to the large number of missing cases, the variable could not be directly included in the analysis.

	<173	173	173+	Missing Values	Total
Value	Per Cent	Per Cent	Per Cent	Per Cent	Count
Blue Collars	22	59	19	0	142353
White Collars	27	16	58	0	118962
Civil Servants	2	94	4	0	33181
Missing Values	27	33	23	17	2074
Total(Count)	63571	134430	98069	500	296570

Table 1: Distribution of monthly working hours according to category of employment

The other work-related variable in the analysis, size of the enterprize, seemed to have an effect consistent with previous findings, whereby persons working in very large enterprizes (over 1000 employees) had the highest hazard of taking leave compared to the reference group working in large enterprizes. The hazard for fathers working small enterprizes was significantly less than for these in the reference group (large enterprizes with employees between 200 and 1000)

Family-related variables showed effects consistent with expectations based on previous studies. Fathers were more likely to use parental leave when the child born was the first one. The hazard of taking leave for the second child was only 60 per cent of that for the first child and for the third or higher parity only 30 per cent. However, these results can be interpreted

directly only for households where there are no other children under five years old. The two variables must be interpreted in conjunction with each other because throughout the observation period, the variable recording the number of children in the family can take different values reflecting the births of more children in the family. The presence of other children than the child born in 2003 under five years old in the household had a significant positive effect on the hazard of taking leave, whereby the hazard for a father to take leave was more than three times higher if there were three or more small children in the family compared to none or only one. The combined interpretation of the two variables is that fathers are more likely to use the parental leave for the first child. However, if there are two or three birth close to each other, which results in the presence of small children under five during the observation period, then fathers are more likely to use the leave. Therefore, it seems like not only birth order, but also the spacing of births play a role in the decisions of fathers and the effects are running in somewhat counter-balancing directions.

There did not seem to be any differences associated with multiple births (twins or triplets) or with the gender of the child. Finally the variable indicating the marital status of the fathers in the sample showed no significant difference between non-married (single, divorced, cohabitant or widowed) fathers and married fathers. However, fathers for whom it was not the first marriage (re-married) were significantly less likely to take leave compared to single fathers.

With regards to the marital status variable, the results were quite interesting, as no difference was found between married and non-married fathers with regards to taking parental leave. Luxembourg provides a legal alternative to marriage, known as a *Partenariat (PACS)*, which provides the same tax, civil and social security rights as marriage. However, in the administrative data co-habiting couples are coded as "not married" and it is not possible to find the difference between single and cohabiting fathers. In addition, Luxembourg does not recognize registered partnerships in other countries. Therefore co-habiting couples from other countries are also considered as single persons. This is illustrated in Table 2, which shows that from the fathers living in Luxembourg only 3 per cent are not married, while for fathers in other countries of residence this number can be over 40 per cent. Due to the almost perfect correlation between nationality and residence (virtually all Luxmebourgish nationals in the sample reside in Luxembourg), it was not possible to include residence in the analysis separately.

	Not Married	Married	Re-Married	Missing Values	Total
Value	Per Cent	Per Cent	Per Cent	Per Cent	Count
Belgium	17	79	4	0	29213
France	42	56	2	0	55493
Germany	24	71	5	0	14581
Luxembourg	3	89	8	0	156798
Other	44	51	5	0	1270
Missing Values	0	0	0	100	39215
Total(count)	37474	203995	15886	39215	296570

Table 2: Distribution of marital status by nationality

The model also controlled for nationality and age. The effect of age was positive and significant, however, there was a negative and significant quadratic effect. Thus older fathers tended to have a higher hazard of taking leave. After a certain age, however, the relationship revered and older fathers when they tended to have a lower hazard. Including nationality in the model revealed that relative to Luxembourgish fathers, Portuguese fathers and fathers with nationalities other than the ones included in the grouping were less likely to use parental leave. For both groups, the differences seemed to slightly increase with time, as there were positive and significant time interactions.

The model was estimated on a 253431 number of spells, with a total of 729 events occurring. The method used for resolving ties was the Efron approximation. The log likelihood ratio test is significant (-2LogLikelihood = 1217, df=52, $p<0.001$), meaning that the coefficient of at least one of the covariates is different from 0. The Akaike Information Criteria (AIC) of the model equalled 11225.5.

	coefficient(exp)	p	time-interaction(exp)	p
Salary Opportunity Cost: Negative	2.82	0	-	-
Salary Opportunity Cost: <500 EUR	5.556	0	-	-
Salary Opportunity Cost: 500-1000 EUR	2.875	0	-	-
Salary Opportunity Cost: 1000-1500 EUR	1.198	0.32	-	-
Salary Opportunity Cost: 2000-2500 EUR	0.717	0.103	-	-
Salary Opportunity Cost: 2500-3000 EUR	0.789	0.267	-	-
Salary Opportunity Cost: 3000-4000 EUR	0.718	0.096	-	-
Salary Opportunity Cost: 4000-5000 EUR	0.773	0.245	-	-
Salary Opportunity Cost: 5000+	0.488	0	-	-
Salary Growth in past 6 months:(0,0.973]	0.86	0.549	1.002	0.867
Salary Growth in past 6 months:(0.973,0.994]	1.442	0.114	0.992	0.365
Salary Growth in past 6 months:(0.994,0.9976]	1.818	0.014	0.983	0.071
Salary Growth in past 6 months:(0.9976,1.001]	1.191	0.447	0.999	0.898
Salary Growth in past 6 months:(1.004,1.011]	1.598	0.048	0.984	0.082
Salary Growth in past 6 months:(1.011,1.034]	1.642	0.04	0.976	0.019
Salary Growth in past 6 months:(1.034,5.591]	2.147	0.002	0.985	0.115
Monthly Working Hours: <173	1.628	0	-	-
Monthly Working Hours: 173+	1.409	0.001	-	-
Birth Order: Second	0.599	0	-	-
Birth Order: Third+	0.37	0	-	-
Child Sex: Male	0.906	0.187	-	-
Multiple Births	0.926	0.779	-	-
Nationality: France	1.18	0.344	0.989	0.178
Nationality: Portugal	0.338	0	1.032	0
Nationality: Belgium	0.969	0.876	1.004	0.651
Nationality: Germany	0.745	0.419	1.007	0.651
Nationality: Other	0.501	0.001	1.03	0
Age	1.161	0.03	-	-
Squared Age	0.998	0.032	-	-
Marital Status: Married	0.994	0.975	1.022	0.036
Marital Status: Re-married	0.42	0.021	1.046	0.003
Children under Five: 2	1.978	0	0.986	0.022
Children under Five: 3+	3.199	0.001	0.987	0.312
Size Enterprize: Medium(50-200)	0.802	0.205	-	-
Size Enterprize: Small(<50) or Not Applicable	0.802	0.161	-	-
Size Enterprize: Very Large(1000+)	10.178	0	-	-

Table 3: Cox Proportional Hazard Model with Time Interactions. Reference Categories: Salary Opportunity Cost 1500-2000 EUR, Negative Salary Growth(past six month), Birth Order: First, Child Sex: Female, Nationality: Luxembourg, Marital Status: Single, Divorced or Widow, Children under Five: None or One, Size of the Enterprize: Large(500-1000)

8 Discussion

The main finding of the paper is that income-related opportunity costs have a non-linear effect on fathers' use of parental leave. Measuring opportunity cost in terms of foregone earnings revealed that fathers with lower opportunity cost were more likely to take parental leave than the group for whom the opportunity cost would be between 1500 and 2000 EUR per month. For the higher income groups, there appeared to be no significant differences, except in the case of the extreme high-earners (for whom the opportunity cost would be more than 5000 EUR per month), who were least likely to use parental leave. Supplementing this variable with the measure of the average salary-growth in the previous six months, aimed at controlling for developments in the income trajectory of the fathers. The hypothesis was that fathers who are experiencing a period of salary growth would be less likely to take parental leave, as they will face a higher opportunity cost in terms of foregone salary-growth opportunities during the leave. While the relationship is exactly not linear, the results indicate that this is not necessarily the case. The reference group was the group of father experiencing a very slightly positive growth (ranging from 1.001 to 1.004). All groups of fathers experiencing higher levels of growth were more likely to take parental leave, however, with time the difference tended to become less pronounced. This result is contrary to what was expected. One possible interpretation is that fathers prefer to take parental leave when they have reached a relatively higher position in their work and thus evaluate that they are in a more stable situation, so that they can afford the (possible)income-reduction associated with the leave.

The control variables also revealed some interesting patterns. Fathers working with standard working-hours contracts of 173 hours, were less likely to use parental leave than fathers working part-time or over-time. Consistent with previous research, fathers working in larger organizations had a higher probability of taking parental leave. On the family level, there were no significant effects for multiple births and the gender of the child. Fathers were more likely to use parental leave if the child born in 2003 was the first child, however, when there were more children in the family under the age of five, they were also more likely to use the leave. Age seemed to be non-linearly related to taking parental leave, whereby younger fathers tended to be more likely to take leave until a point, in which the coefficient would start to decline. Relative to Luxembourgish men, fathers of Portuguese nationality or

one of the less represented nationalities were less likely to use leave. There were no significant differences between Luxembourgish, Belgian, French and German fathers.

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A Distribution of Covariates

Table 4: Distribution of Covariates

Variable	Count	Per cent	Events
Salary Opportunity Cost			
Negative	15693	5.29	96
< 500 EUR	43103	14.53	199
500-1000 EUR	44575	15.03	124
1000-1500 EUR	35145	11.85	69
1500-2000 EUR (reference)	27185	9.17	60
2000-2500 EUR	24176	8.15	44
2500-3000 EUR	19736	6.65	38
3000-4000 EUR	27941	9.42	48
4000-5000 EUR	18210	6.14	35
5000+ EUR	40306	13.59	56
Missing Values	500	0.17	0
Salary Growth in past 6 months			
(0,0.973]	36957	12.46	83
(0.973,0.994]	36956	12.46	114
(0.994,0.9976]	37434	12.62	107
(0.9976,1.001]	36478	12.3	103
(1.001, 1.004](reference)	36996	12.47	101
(1.004,1.011]	36916	12.45	95
(1.011,1.034]	36956	12.46	82
(1.034,5.591]	36957	12.46	83
Missing Values	920	0.31	1
Monthly Working Hours			
< 173	63571	21.44	279
173 (reference)	134430	45.33	285
173+	98069	33.07	205
Missing Values	500	0.17	0
Birth Order			
First (reference)	114614	38.65	400
Second	91129	30.73	245
Third +	51612	17.4	94
Missing Values	39215	13.22	30
Child Sex			
Female (reference)	139351	46.99	376

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Variable	Count	Per cent	Events
Male	157219	53.01	393
Missing Values	0	0	0
Multiple Births			
Single Birth (reference)	290615	97.99	754
Twins or triplets	5955	2.01	15
Missing Values	0	0	0
Nationality			
Luxembourg (reference)	92465	31.18	303
France	72459	24.43	156
Portugal	38117	12.85	84
Belgium	41575	14.02	95
Germany	19626	6.62	24
Other	32320	10.9	107
Missing Values	8	0	0
Age			
Mean	35.93	-	-
SD	5.4	-	-
Min	19	-	-
Max	65	-	-
Missing Values	8	0	0
Marital Status			
Not Married (reference)	37474	12.64	80
Married	203995	68.78	624
Re-Married	15886	5.36	35
Missing Values	39215	13.22	30
(Other) Children under Five			
None (reference)	174582	58.87	451
One	76709	25.87	262
Two+	6064	2.04	26
Missing Values	39215	13.22	30
Size Enterprize			
Micro/Small <50 or Not Appl	75381	25.42	100
Medium: 50-200	55886	18.84	64
Large: 200-1000 (reference)	59025	19.9	69
Very Large: 1000+	63567	21.43	497
Missing Values	42711	14.4	39

B Construction of Covariates

Variable Notes	Description	Construction
Salary Opportunity Cost	-	-
Salary Growth in past 6 months	-	-
Monthly Working Hours	Monthly working hours could reflect either contracted hours (white-collar workers) or actual worked hours (blue-collar workers). The standard employment contract in Luxembourg is 173 hours/month, so this value was chosen as the reference category for the multivariate analysis	Information about working hours is provided on monthly basis. In case a person has several employers all hours were summed together. There were observations (person-months) where hours were very extreme, over 300 per month, which could have reflected past payments due together or measurement errors. By categorizing the variable, these extreme values were all included in the category working 173+ hours.
Birth Order	This variable measures whether there were other children in the household when the baby was born in 2003.	The variable was constructed using annual-based data provided by the IGSS. In the annual-based data, persons are matched to households based on tax-related information. Birth order was computed based on these "fiscal" households. Any children 18 years-old or under were counted in 2003. In rare cases it is possible that the "fiscal" household does not represent a family that actually lives together. It is also not possible to know if children in the "fiscal" household are biological children of the two adults.
Child Sex	Male or Female	This variable was constructed based on the annual-based IGSS information.
Multiple Births	Twins and triplets were counted as "multiple births"	This variable was constructed based on the annual-based IGSS information.
Nationality	The most common nationalities are listed separately, others are grouped together.	This variable was constructed based on the annual-based IGSS information. Nationality does not necessarily correspond to ethnicity.
Age	Age measured in years, time-varying covariate	The variable was constructed from the year of birth.
Children under Five	Time-varying covariate, which counts the number of children under five, excluding the baby born in 2003	This variable was constructed based on the annual-based IGSS information. Not possible to find out if children in the "fiscal" household are biological children.
Size of the Enterprize	Time-varying covariate, recording the number of employees in the enterprize	Variable extracted from IGSS annual-based records. Status corresponds to December in the previous year.

Table 5: Notes on the Construction of Control Variables

C Cox Proportional Hazards Model without Time Interactions

	coef	exp(coef)	se(coef)	z	p
Salary Opportunity Cost: Negative	1.00	2.72	0.18	5.50	0.00
Salary Opportunity Cost: <500 EUR	1.70	5.49	0.16	10.55	0.00
Salary Opportunity Cost: 500-1000 EUR	1.05	2.85	0.17	6.30	0.00
Salary Opportunity Cost: 1000-1500 EUR	0.19	1.21	0.18	1.05	0.29
Salary Opportunity Cost: 2000-2500 EUR	-0.35	0.71	0.20	-1.69	0.09
Salary Opportunity Cost: 2500-3000 EUR	-0.25	0.77	0.21	-1.19	0.23
Salary Opportunity Cost: 3000-4000 EUR	-0.34	0.71	0.20	-1.73	0.08
Salary Opportunity Cost: 4000-5000 EUR	-0.27	0.76	0.22	-1.22	0.22
Salary Opportunity Cost: 5000+	-0.74	0.48	0.20	-3.73	0.00
Salary Growth in past 6 months:(0,0.973]	-0.12	0.89	0.15	-0.76	0.44
Salary Growth in past 6 months:(0.973,0.994]	0.20	1.22	0.14	1.39	0.16
Salary Growth in past 6 months:(0.994,0.9976]	0.25	1.29	0.14	1.76	0.08
Salary Growth in past 6 months:(0.9976,1.001]	0.13	1.14	0.15	0.89	0.37
Salary Growth in past 6 months:(1.004,1.011]	0.13	1.14	0.15	0.89	0.37
Salary Growth in past 6 months:(1.011,1.034]	0.05	1.05	0.16	0.33	0.74
Salary Growth in past 6 months:(1.034,5.591]	0.47	1.60	0.16	2.99	0.00
Monthly Working Hours: <173	0.48	1.62	0.10	4.89	0.00
Monthly Working Hours: 173+	0.34	1.41	0.11	3.23	0.00
Birth Order: Second	-0.41	0.66	0.09	-4.54	0.00
Birth Order: Third+	-0.89	0.41	0.13	-7.07	0.00
Child Sex: Male	-0.11	0.90	0.07	-1.41	0.16
Multiple Births	-0.10	0.90	0.27	-0.38	0.70
Nationality: France	-0.03	0.97	0.12	-0.29	0.77
Nationality: Portugal	-0.44	0.64	0.14	-3.11	0.00
Nationality: Belgium	0.04	1.04	0.13	0.29	0.77
Nationality: Germany	-0.17	0.85	0.23	-0.73	0.47
Nationality: Other	-0.10	0.90	0.13	-0.83	0.41
Age	0.13	1.14	0.07	1.89	0.06
Squared Age	-0.00	1.00	0.00	-1.88	0.06
Marital Status: Married	0.34	1.41	0.13	2.63	0.01
Marital Status: Re-married	-0.03	0.97	0.22	-0.12	0.90
Children under Five: 2	0.38	1.47	0.09	4.44	0.00
Children under Five: 3+	0.80	2.23	0.21	3.81	0.00
Size Enterprize: Medium(50-200)	-0.23	0.79	0.17	-1.34	0.18
Size Enterprize: Small(<50) or Not Applicable	-0.23	0.80	0.16	-1.44	0.15
Size Enterprize: Very Large(1000+)	2.30	9.99	0.13	17.05	0.00

Table 6: The model without time-interactions

D Testing the Proportional Hazard Assumption

	rho	chisq	sig
Salary Opportunity Cost: Negative	0.01	0.02	
Salary Opportunity Cost: <500 EUR	0.01	0.07	
Salary Opportunity Cost: 500-1000 EUR	0.03	0.48	
Salary Opportunity Cost: 1000-1500 EUR	-0.03	0.49	
Salary Opportunity Cost: 2000-2500 EUR	0.01	0.04	
Salary Opportunity Cost: 2500-3000 EUR	0.02	0.20	
Salary Opportunity Cost: 3000-4000 EUR	-0.03	0.75	
Salary Opportunity Cost: 4000-5000 EUR	0.01	0.06	
Salary Opportunity Cost: 5000+	0.01	0.05	
Salary Growth in past 6 months:(0,0.973]	0.00	0.01	
Salary Growth in past 6 months:(0.973,0.994]	-0.02	0.40	
Salary Growth in past 6 months:(0.994,0.9976]	-0.07	3.35	.
Salary Growth in past 6 months:(0.9976,1.001]	-0.00	0.02	
Salary Growth in past 6 months:(1.004,1.011]	-0.07	3.73	.
Salary Growth in past 6 months:(1.011,1.034]	-0.08	4.88	*
Salary Growth in past 6 months:(1.034,5.591]	-0.06	2.24	
Monthly Working Hours: <173	-0.02	0.29	
Monthly Working Hours: 173+	-0.02	0.40	
Birth Order: Second	0.01	0.08	
Birth Order: Third+	-0.00	0.01	
Child Sex: Male	0.01	0.05	
Multiple Births	0.02	0.43	
Nationality: France	-0.04	1.16	
Nationality: Portugal	0.13	12.08	***
Nationality: Belgium	0.02	0.38	
Nationality: Germany	0.03	0.64	
Nationality: Other	0.14	14.62	***
Age	-0.00	0.01	
Squared Age	-0.00	0.00	
Marital Status: Married	0.07	3.03	.
Marital Status: Re-married	0.10	7.53	*
Children under Five: 2	-0.09	6.20	*
Children under Five: 3+	-0.05	1.90	
Size Enterprize: Medium(50-200)	0.02	0.36	
Size Enterprize: Small(<50) or Not Applicable	0.01	0.10	
Size Enterprize: Very Large(1000+)	0.06	3.18	.
GLOBAL		79.41	***

Table 7: Proportional hazards assumption test. Significance codes:$***p < 0.001, **p < 0.01, *p < 0.05, .p < 0.1$ Significant coefficients suggest that the hazard rates for the groups compared by the different levels of the variable are not constant. To correct for this violation of the proportional hazards assumption, these variables are included in the model together with interactions with time.

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