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Abstract

A number of contributions have found evidence for motherhood being a critical life event for women's employment careers. This study presents a detailed model for the duration of maternity leave in which young mothers can make a transition into a number of states related to employment and unemployment among others. The model incorporates a large number of factors including the legal framework, individual and firm characteristics. We provide a comprehensive picture of the sorting mechanisms that lead to the differentiation of women's employment careers after birth. Our empirical evidence is derived from large linked administrative individual labour market data from Germany for a period of three decades. We obtain unprecedented insights how women's skills, the quality of the previous job match, firm level characteristics, labour market conditions and leave legislation are related to the length of maternity duration.

Keywords: work interruptions, cumulative incidence, leave legislation
JEL: J13, J18, C41

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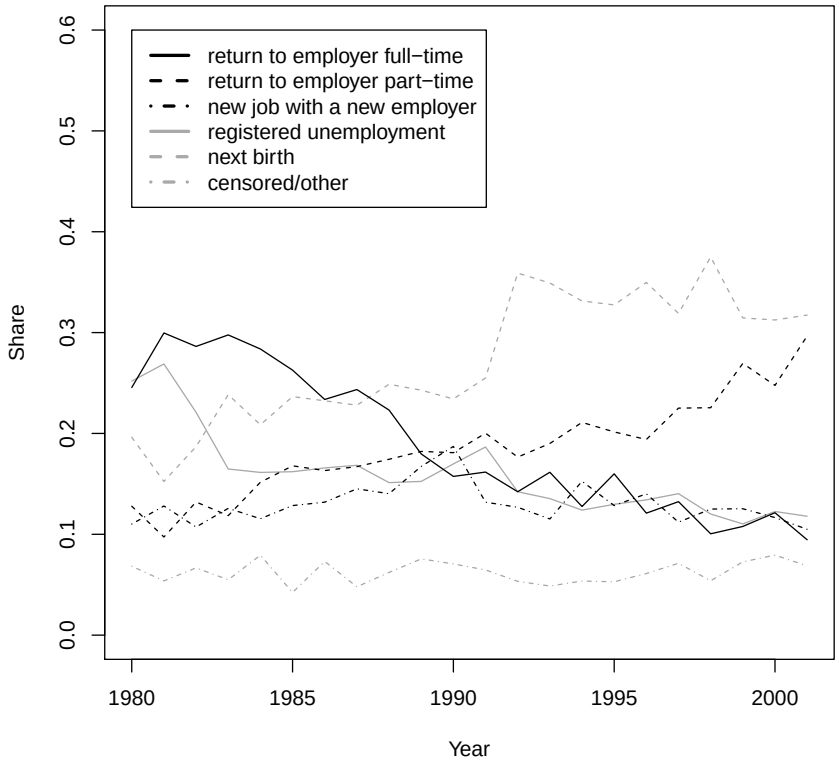
1 Introduction

The transition to motherhood can be considered a critical life event for women's subsequent employment careers. Whereas prior to the first birth a high and increasing share of women are working full-time, there appears to be a strong differentiation of career paths afterwards with many women returning only part-time or not returning at all (Angrist and Evans 1998, Lundberg and Rose 2000, Gjerdingen and Center 2005, Baxter et al. 2008, Schober 2013). In fact, Gustafsson et al. (1996) find that differences in female labour force participation across Sweden, Germany and Great Britain are solely due to post-birth differences. Moreover, there are numerous studies suggesting persistent wage losses from motherhood that seem to be largely driven by birth-related work interruptions and the subsequent return to reduced working hours (Waldfogel 1997; Budig and England 2001; Phipps et al. 2001; Baum 2002; Gangl and Ziefle 2009; Viitanen 2012). Birth-related career interruptions thus appear to be an important determinant of the family and gender wage gap as has already been suggested by Mincer and Polacheck (1974). Hence, whether, when and how a mother returns to the labour market after a child-related work interruption becomes a crucial research question.

In fact, even among women who give birth to their first child and have all been working full-time prior to birth, the related work interruption leads to a strong differentiation of subsequent labour market paths as suggested by Figure 1[1]. The figure shows the proportion of German women who end their birth-related work interruption by either returning to their previous job in full-time or part-time, by taking up a job with another employer, delivering another child or starting a period of unemployment, education or training. In addition to suggesting a strong differentiation of women's labour market paths after birth, the figure also indicates that there have been notable changes across the observation period between 1980 and 2000, thus raising the question as to what drives this differentiation process. In fact, yielding better insights into this process is of major concern since the transitions are differently desirable for mothers, employers and the economy as a whole. For employers, for example, work interruptions, especially by women with long tenure and good job performances, are costly because firm-specific human capital may get lost and can be substituted for only by a costly hiring and training process of new employees (Alewell and Pull 2001). Moreover, a fast return to the pre-delivery employer has been found to reduce the wage loss from motherhood (Baum 2002; Waldfogel 1997; Phipps et al. 2001; Ziefle 2004) which is desirable both from the perspective of mothers as well as the economy as a whole. Furthermore, staying attached to the labour market should be preferable from the individual as well as societal perspective if future career options are to be preserved.

[1]For details on the data source and definition see section 3.

Figure 1: Share of observed transitions after inactivity by year of birth, 1985-2005.



In a cross-country comparison of European countries, Gutierrez-Domenech (2005) find that the impact of first birth on women's subsequent careers is strongest in Germany. Among those employed one year before birth, only around 50 percent are working five years after birth compared to two thirds in most other countries. Moreover, this share of working mothers is only few percentage points higher than two years after birth. Understanding the initial sorting process is thus of particular relevance in the German context

Therefore, the goal of this paper is to gain deeper insights into a woman's decision process after first birth. We do so by estimating a competing risk model for the out of work duration of previously full-time employed mothers who can return to either of the states shown in Figure 1. In particular, we examine how the return decision is related to various factors such as women's productivity, the pre-delivery job match quality, the characteristics of the previous employer, leave policies, labour market conditions, and child care availability. We can perform such a detailed analysis because we use German administrative individual data for a period of more than two decades that records the exact date of births, the employment history including information on employers. Moreover, we can exploit changes in leave regulations, childcare availability and aggregate labour market conditions across a long period. This comprehensive approach closes several research gaps in the existing literature.

First of all, most of the literature focusses on the decision of women to return to either employment in general or the previous job. There are only few exceptions that also consider "next birth" (Lalive and Zweimüller, 2009), full- vs. part-time employment (Ondrich et al., 2000) or the probability to return to the previous employer (Schönberg and Ludsteck 2014). However, women can typically choose between a much broader range of options that may subsequently affect their employment careers. By allowing for a much broader range of career options within a competing risks model, our analysis improves our understanding of the decision when and how to return to the labour market since a negative relationship for one risk could otherwise be leveled out by a positive relationship for another risk.

Secondly, much of the literature focusses on the impact of leave policies only. By exploiting policy reforms for identification, most studies find that a longer maximum leave duration induces mothers to delay the job return, see Baum (2003) for the US, Hanratty and Trzcinski (2009) for Canada and Ondrich et al. (2003), Lalive and Zweimüller (2009), Schönberg and Ludsteck (2014) for Austria and Germany. Moreover, more generous leave policies also appear to be associated with reduced post-birth labour supply and wages, even though the evidence is not fully conclusive, see Gangl and Ziefle (2009) for a review. Compared to the numerous studies on the impact of leave policies, however, only few studies aim at a broader analysis of the determinants of women's return decision. For the US, Leibowitz et al. (1992) and Klerman and Leibowitz (1994), for example, focus on the impact of women's skills, family income and child care options. Fitzenberger et al. (2010) derive first detailed insights into the relationship of firm and individual characteristics and the distribution of maternity leave duration, but their analysis is restricted to employees from one large German firm. Our study exceeds this literature by examining the relevance of a broad set of factors in determining the post-birth differentiation in labour market states using a large random sample of individual administrative records covering a period of more than two decades. This will provide insights for policy makers and employers how individual, firm and job characteristics as well as the institutional setting and general labour market conditions are related with a woman's return decision after birth. Hence, our results may help politics to design leave policies and employers to develop a human resource management that decrease the likelihood for long, potentially career-damaging out of work periods.

Thirdly, with the exception of Fitzenberger et al. (2010), the literature estimates the probability of a return to the labour market at one or a small number of time points using discrete choice models due to lack of comprehensive data or simplicity of the analysis. Hence, the results do not provide a full picture of mothers' out of work duration and transition probabilities. By employing a competing risks duration model, we can construct conditional transition probabil-

ities for any point of the out of work duration. In particular, we employ the semiparametric dependent competing risks model for cumulative incidences (Fine and Gray, 1999) to estimate conditional probabilities of a transition to a risk taking place without imposing any identifying restrictions on the interdependence structure between competing risks.

Finally, the German case since the 1980s is of particular interest for an international readership. A number of significant changes in the leave legislation has dramatically increased the options for the young mother to return to the pre-birth job. Hence, the German case sheds light on the relevance of the legislative framework in shaping labour market outcomes of mothers. With many countries having adopted similar maternity leave policies, this should be of great public interest also beyond Germany.

We find transitions times to employment and unemployment clearly related to the design of leave legislation with mass transitions taking place at the time the mother looses some form of entitlement. We also find that extensive job protection periods of up to 3 years do not simply lead to a later return to the previous employer but are related with higher probabilities of making an employer change or giving birth to the second child towards the end of the job protection period. Thus our results cast some question marks on the economic sense of key elements of family policy in various European countries. At the same time we find evidence for provision of child care to be suited to reduce maternity related out of work duration.

The paper is structured as follows. Section 2 develops some theoretical predictions regarding the relationship between the different set of covariates and decision when and how to return to the labour market. Section 3 describes the data and section 4 presents the duration model. Section 5 presents the main empirical results.

2 A Framework for the Return Decision of Mothers

Economic models for the return decision of the mother have already been considered in previous studies. For instance, Ondrich et al. (2000) focus on the question whether the mother stays at home or returns to her previous job and apply their model to survey data from Germany. More generally, the decision of mothers about the duration and exit state after maternity leave could be interpreted as a dynamic discrete choice model (compare Aguirregabiria and Mira, 2010). These models are increasingly popular for modelling the timing of economic decisions such as the retirement date or educational choices. Although, these models are a powerful tool for

applied economic analysis, they are only identified under a number of identifying restrictions (compare Section 4). Given the large number of competing risks in our model and that some of these states can be entered upon the choice of the mother while others require search (such as finding a new employer), we only discuss plausible scenarios for expected utilities of staying at home or changing to another state. We also present a number of hypotheses how the expected utility profiles translate into realised transition times and probabilities. These hypotheses are tested with data in the subsequent sections. In contrast to dynamic discrete choice models our semiparametric statistical model avoids assumptions on the dependence structure between competing risks, the distribution of covariates and parametric assumptions for the distributions of failure times.

In order to develop some plausible hypotheses regarding the processes that take place after birth, one needs to discuss the incentives for continuing the out of work period compared to alternative states that a mother might choose. This choice set and the related incentives are closely linked to the institutional setting. In Germany, there is a mother protection period (MP) of two months after birth during which the mother may not return to work, but receives full salary in the meantime. Afterwards, a mother is entitled to a parental leave during which she may not be laid off by her pre-birth employer. This legally guaranteed job protection period (JP) has been extended stepwise from 8 months in 1979 to 36 months since 1993, see Figure 4 (Appendix). In addition to this job protection period, women may receive a means-tested benefit after the mother protection period. The entitlement period for this maternity benefit (MB) has been prolonged stepwise from 4 to 22 months between 1979 and 1993, see Figure 4 (Appendix). The corresponding maximum maternity benefits that a mother may receive thus also increased from a total of 1500 euros to almost 7000 euros during the entitlement period, see Figure 5 (Appendix). Still, these benefits are rather low compared to a full time salary.

Hence, due to the institutional setup, mothers can decide to return to their previous employer at any time after the mother protection period as long as the maximum job protection period has not been exhausted. Moreover, women can usually choose between returning full- or part-time.[2] After the job protection period, the employer need not re-employ the mother. However, having the next child within the job protection period immediately renews both the entitlements to job protection as well as maternity benefits. Hence, having another child within the job protection period is another option that a women may seek. If, for some reason, returning to the previous

[2]Since 2001, women are legally entitled to return part-time rather than full-time unless an employer proves that the job is not compatible with part-time work. Before 2001, there already had been a widespread and increasing acceptance of part-time work which was reflected in an increasing number of part-time-friendly collective labour agreements during the 1980s and 1990s.

employer is not an attractive option, a woman may also seek entering a new job rather than returning to the old employer. If she has not found a job yet, she may also quit her previous job and register unemployed to possibly receive unemployment compensation. Finally, she may also decide to enter education or training, become self-employed or start a minor employment with only few working hours. Since of all these latter states tend to be rare, we pool them to a residual category.

Therefore, we assume that a mother compares the discounted expected utility from staying home and caring for her child full-time ($U_{H,t}$) to the discounted expected utility from choosing between

1. returning to the same employer full-time ($U_{FT,t}$),
2. returning to the same employer part-time ($U_{PT,t}$),
3. entering a new job with a new employer ($U_{NJ,t}$),
4. registering unemployed and searching for a new job ($U_{U,t}$),
5. having the next child ($U_{NC,t}$),
6. entering other state (education, training, self-employment, minor employment) ($U_{oth,t}$),

with $U_{...}$ as the discounted expected utility when choosing a particular exit state in period t. Note that two of these choices, namely having a next child and finding a new job, have a random element such that the time of transition to these states cannot be fully chosen. Still, the incentive to seek one or the other option should be driven by the corresponding expected utility. For simplification, we hence assume that a woman stays at home as long as this option yields the highest expected utility. She then switches to the state whose expected utility is the first to exceed $U_{H,t}$. Both the out of work duration as well as the transition state thus depend on the time-varying utility differential between staying home and all other states. Hence, we briefly characterize the utility associated with the most important states across time in turn and derive a number of testable hypotheses:

The utility from staying home ($U_{H,t}$) corresponds to the utility of caring for your child fulltime plus the utility derived from receiving maternity benefits and having the option to return to the pre-birth employer within the job protection period. We thus expect $U_{H,t}$ to have downward kinks when the mother protection period with full salary compensation ends, when maternity benefits are exhausted and when the legal job protection period ends. In addition, we

assume that $U_{H,t}$ declines in between these kinks because the demand for fulltime care decreases as the child gets older, see left panel of Figure 6 (Appendix) for a stylized profile. We can thus derive hypothesis H1.

> **H1:** ***Transitions should mainly occur at the kinks of*** $U_{H,t}$***. With the institutional changes as discussed above, these kinks in the distribution of out of work duration are shifted accordingly.***

The utility from returning to any type of work ($U_{FT,t}, U_{PT,t}, U_{NJ,t}$) depends on the expected wage income and job satisfaction related to the job minus childcare costs. The opportunity costs of not working should thus be highest for women with a high earnings potential.

> **H2:** ***The higher a woman's productivity and the better the availability of childcare, the more likely a woman returns to (fulltime) employment early after birth.***

For women with good pre-birth job matches and a high level of firm-specific human capital, returning to the previous employer should initially yield a higher level of utility than entering a new job with a new employer. On the other hand, firm-specific human capital attached to the pre-birth employer depreciates in addition to general human capital while staying at home. In this case, the decline in the expected utility from returning to the previous employer should exceed the decline in the utility from seeking an alternative job. On the other hand, the chances to generate job offers that exceed the utility from returning to the previous employer may deteriorate the longer someone stays at home.

> **H3:** ***The shorter the job protection period and the better the pre-birth job match, the more likely women return to their previous employer.***

For some women, the pre-birth job may prove to be incompatible with family responsibilities due to, for example, shift work or the lack of part-time schemes. In this case, a woman may immediately seek alternative job offers. Hence, the availability of family-friendly job schemes at the previous workplace may be decisive for the return decision.

> **H4:** ***The more a pre-birth firm offers family-friendly job schemes, the more likely a mother returns to her previous employer, albeit more often in part-time.***

The utility from unemployed job search ($U_{U,t}$) corresponds to the expected return from

seeking an alternative job offer and the receipt of unemployment benefits. If a mother registers unemployed between the end of the mother protection period and the end of the job protection period within one year after birth, she receives 67% of the wage earned in the year prior to birth. When registering unemployed later, she receives 67% of a lump-sum fictive wage income depending on her formal education. For most women, this fictive wage income is lower than the actual wage income prior to birth, hence reducing $U_{U,t}$ at that point, see right figure of Figure 6 (Appendix) for a stylized utility profile. Moreover, maternity benefits are deducted from unemployment benefits, resulting in an increase of $U_{U,t}$ when these benefits are exhausted. At the end of the job protection period, $U_{U,t}$ drops notably since, afterwards, women can only apply for means-tested unemployment assistance at a lower level than unemployment benefits. However, women with low pre-birth wages in low-income households that are entitled to receiving social benefits on top of unemployment transfers receive a time-independent and high wage replacement rate as indicated by the dashed line in Figure 6 (Appendix) increasing the probability of registering unemployed early after birth. Finally, unfavourable labour market conditions might deter women from quitting their pre-birth job as the chances of finding a new job deteriorates, hence reducing transitions to registered unemployment. We can thus derive H5:

> **H5:** ***Transitions to registered unemployment mainly occur at the upward kinks of*** $U_{U,t}$ ***during periods of favorable labour market conditions. Low-productivity women in low-income households are more likely to enter unemployment.***

The utility from having a next child before returning to work ($U_{NC,t}$) corresponds to the utility derived from renewing entitlements to both job protection and benefits. If, for example, the job protection length amounts to 36 months, a mother with three consecutive children born at the end of the previous leave period can have a total of nine years with a legally guaranteed return to her previous employer. For this reason, we assume that there is a positive, but constant utility attached to having a child prior to ending the job protection period. However, if the job protection period is too short to realistically give birth to a child prior to the end of JP, this utility may in fact be zero. Moreover, whether having the next child is the first alternative state whose utility exceeds $U_{H,t}$ likely depends on the opportunity cost of staying home for a prolonged period which should be higher for high-productivity women whose human capital is subject to depreciation. Hence, we derive the last hypothesis:

> **H6:** ***The higher a woman's productivity and the shorter the job protection period, the less likely she will have a next child before returning to***

employment.

We have thus identified a number of factors that likely affect a women's decision whether, when and how to return to the labour market after birth. In the next two sections, we will discuss how we aim to test these hypotheses empirically.

3 Data

Our analysis uses biographical data in Germany (BASiD) that links administrative records from the German statutory pension insurance scheme (Rentenversicherung) and the Federal Employment Agency (Bundesagentur für Arbeit). The data comprise of individuals holding an active pension account at the end of 2009, i.e. who have at least one pension-relevant observation until 2009 and have not retired yet. Since most individuals collect pension-relevant spells during their education and work history, the 579K individuals that are included in the data constitute a 1% random sample of around 96% of the German population.

The data contain daily spell information about employment periods, periods of training and education, periods of registered unemployment. The data also contain information about salaries, basic demographic variables such as age and gender, firm characteristics and regional identifiers among others. The distinctive feature of these data compared to similar German administrative labour market data such as Integrated Employment Biographies (IEB) is that, in addition, they contain verified information about education and schooling periods and birth dates of own children. Thus, these data allow us to determine the time of delivery and therefore the begin of a maternity period. For more details about BASiD see Hochfellner et al. (2012). We restrict our sample to females aged 18-45 who give birth to their first child in the period 1985–2005 and who were full-time employed at the time of conception. This latter restriction ensures that we have a relatively homogeneous sample of women in terms of labour force attachment. As a matter of fact, the majority of 90.2% of all women who give birth for the first time work fulltime prior to birth. This leaves us with 19,535 women whose first births took place between 1985–2005.

From these data we construct maternity leave periods. Maternity leave is not directly available in the data but is constructed from other information. By knowing the birth date of children and having information about various other labour market states, we define maternity leave as any unobserved period after delivery until the female is entering one of the following observable

post-maternity states:

1. Return to the same employer full-time ($U_{FT,t}$),
2. Return to the same employer part-time ($U_{PT,t}$),
3. New job with a new employer ($U_{NJ,t}$),
4. Registered unemployment ($U_{U,t}$),
5. Next birth ($U_{NC,t}$),
6. Other state (education, long-term training, self-employment, minor employment) ($U_{oth,t}$),

In our model, these risks are not assumed to be independent but there is independent censoring at end of data in 2009. Table 1 reports the number of observed transitions and the share of observed destination states in our sample. Around 38% of young mothers return to their former employer (around 20% as part-timer) and around 13% change the employer. Almost a quarter of women deliver their second child and add a subsequent maternity duration. Note that these women could return to their previous employer later on. In fact, the total share of women returning to the previous employer at some point amounts to 52%. This is compatible with numbers from the German NEPS data[3] that suggests that around 45% of all women return to their previous employer at some point after the first birth. While we could have modelled the next birth as simply prolonging the out of work duration rather than as a separate type of exit, we decided to explicitly look at these transitions as the institutional regulations likely affect the incidence of this state and likely prolong the out-of-work duration. Finally, a non-negligible share of 15% register unemployed, while only 4% exit to some other state. Fitzenberger et al. (2010) observe somewhat larger shares of return to the same employer and lower job separation shares but this might be attributed to the fact that their data is from one large firm only.

In order to get a first insight regarding the timing of these transitions while taking account of censored observations, Figure 2 presents nonparametric estimates of unconditional cumulative incidences for the risks of interest. The cumulative incidence refers to the probability of having experienced a transition to state j at some time period t in the presence of other competing risks.[4] Note that these cumulative incidences are on the grounds of pooled data from the

[3]NEPS refers to the adult survey of the National Educational Panel Study in Germany that contains extensive biographies of almost 12,000 adults in Germany born between 1956 and 1986.

[4]The estimated cumulative incidences are obtained without assuming a specific dependence structure between competing risks. Conventional methods such as the Kaplan-Meier estimator normally require independent competing risks. Compare Kalbfleisch and Prentice (1980).

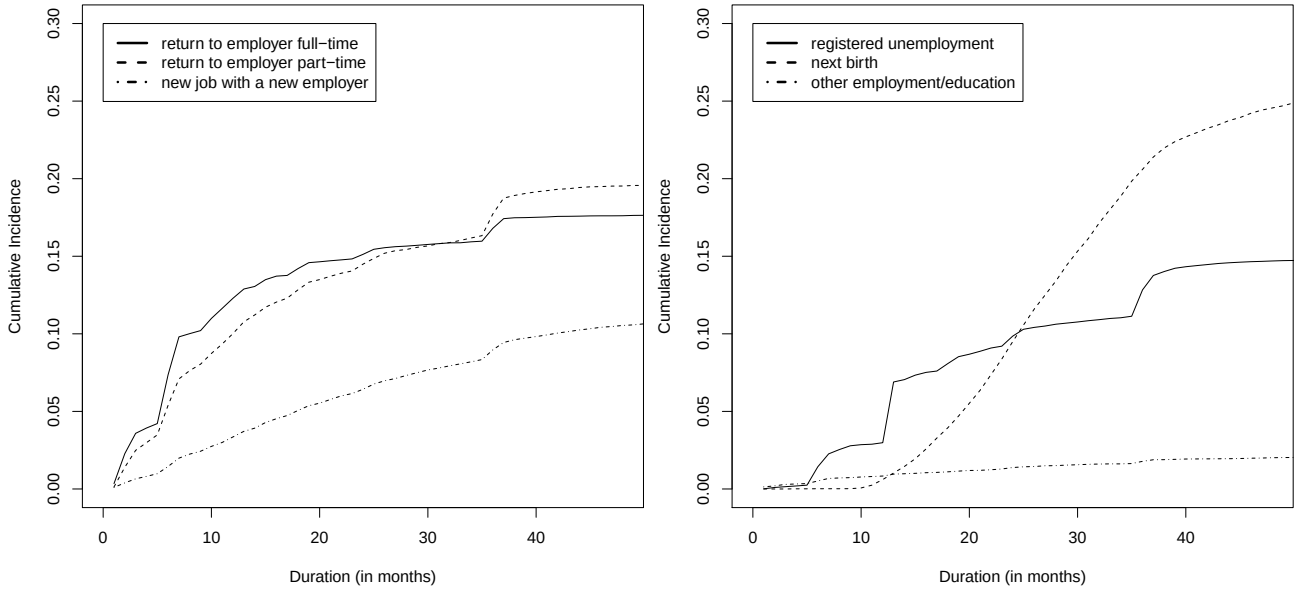
Table 1: Sample size and share of transitions into risks

Risk	Freq.	Percent
Return to job full-time	3,488	17.86
Return to job part-time	3,947	20.20
Job with new employer	2,490	12.75
Unemployment	2,969	15.20
Next birth	5,299	27.13
Other employment/education	447	2.29
Right-censored	895	4.58
Total	19,535	100.00

period 1985-2005, hence spanning different institutional regimes as discussed in the previous section. Still, the cumulative incidences for returning to the previous employer in part-time jump visibly at 36 months which is the maximum length of job protection for young mothers after 1992, but we also see minor jumps when job protection ended under previous regimes. Return to the previous employer in full-time appears to be less concentrated around these expiry points compared to the return as a part-timer. Moreover, it is not surprising that there are hardly any transitions to the former employer after this period has elapsed. Using similar data, Schönberg and Ludsteck (2014) also find evidence for the returns taking more likely place around these points but only few in between or after 36 months. In contrast to Fitzenberger et al.'s (2010) results we do not observe considerable increases in cumulative incidences for the return after more than 3 years. Furthermore, as hypothesized previously (H3), employer changes somewhat gain in importance relative to returning to the pre-birth employer after two years and even more so after job protection has been fully exhausted after 36 months. Also, transitions to unemployment seem to be strongly driven by the institutional regulations as has been discussed in the previous section. In fact, transitions to unemployment jump strongly after around 6, 12 and 36 months which correspond to maximum entitlement periods to job protection and maternity benefits. Transitions to having the next child, on the other hand, increase smoothly after the biological minimum of 10-12 months. Finally, transitions to other exit states such as minor employment or education are only of minor relevance and will thus not be in the focus of the subsequent empirical analysis.

In order to get a more detailed picture whether cumulative incidences respond to the kinks in the expected utility profiles (as discussed in Section 2), Figure 3 presents the increase in cumulative incidences for four different periods that reflect the increasing generosity of the leave and maternity benefit regulations. See Figures 4 and 5 (Appendix) for the definition of these periods.

Figure 2: Nonparametric estimates of unconditional cumulative incidences.



The plots clearly suggest that the timing of transitions respond to the institutional design. In particular, as suggested by hypothesis **H1**, mass transitions to the previous employer tend to occur when job protection (JP) ends and/or maximum entitlements to maternity benefits (MB) expire. Moreover, the peaks in the return to the former employer occur later as regulations become more generous. This is in line with the literature on the impact of leave policies on the return to work decision of women (compare Ondrich et el., 2003 and Schönberg and Ludsteck, 2014). Transitions to another employer also seem to be affected by the institutional setting, but transitions are much less concentrated at few mass points.

As suggested by hypothesis **H5**, transitions to registered unemployment peak when entitlements to unemployment benefits (UB) are due to expire. Also, note that women are much more likely to opt for registering unemployed rather than returning to employment if the leave regulations are less generous, see also Figure 1. This indicates that in case of very short job protection periods women are not willing to return to work and rather register unemployed than returning to the previous employer even if that means loosing the legal right of returning to the pre-birth job.

Finally, the share of females in maternity leave who directly deliver their second child increases with the generosity of leave legislation as can also be seen from Figure 1. While these figures provide some evidence that institutional regulations affect the incidence and timing of transitions to certain states differently, they do not allow for deeper insights into the conditional distributions of transition times. In order to obtain a more detailed picture, we subsequently estimate a multivariate competing risk duration model that relates transitions times to dif-

ferent institutional factors and other characteristics (such as individual-, job- and firm-related factors).

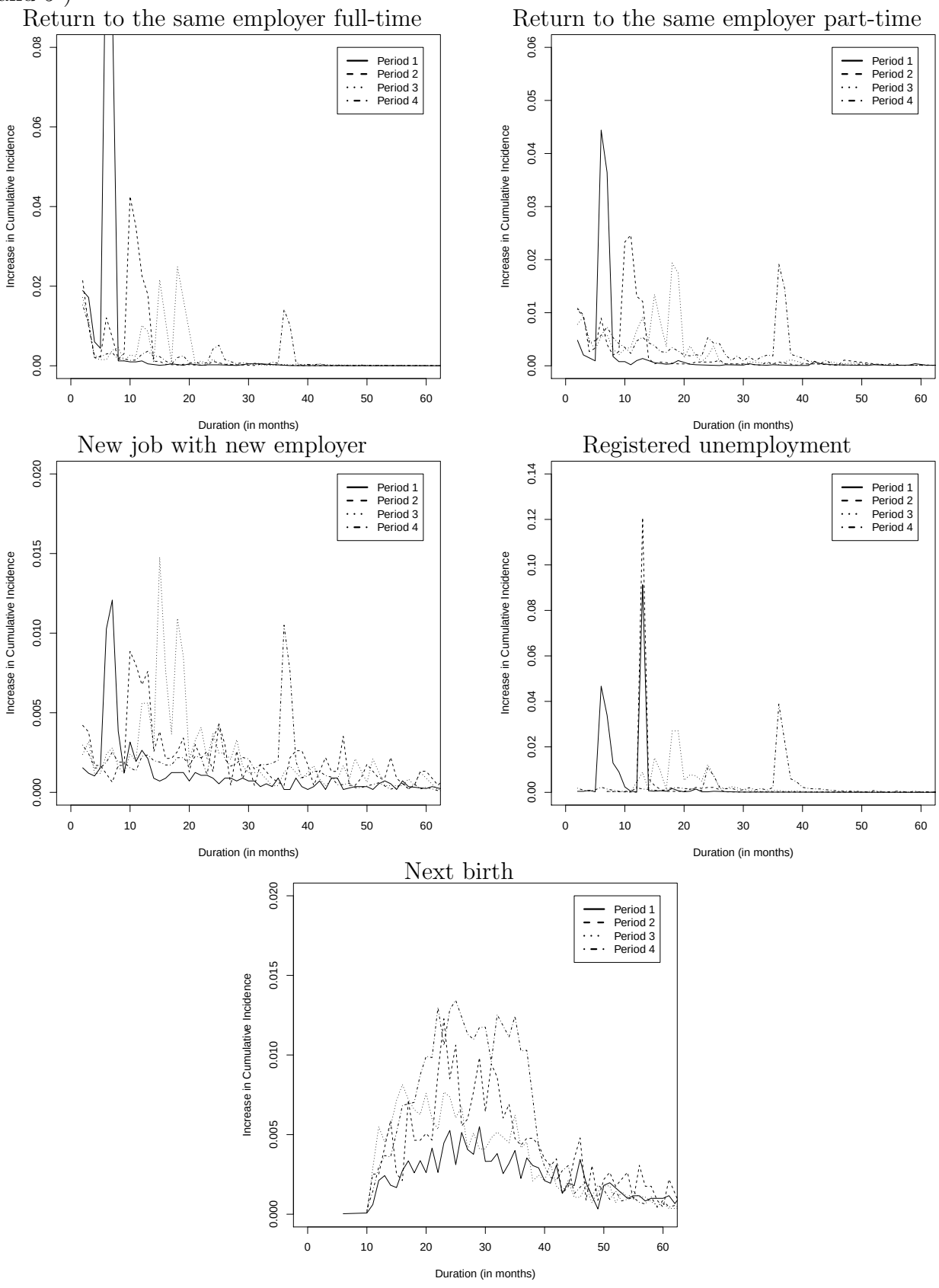
4 Econometric approach

As already mentioned in the previous sections, we apply a competing risks duration model with six exit states to relate maternity leave duration to a number of variables. We therefore consider a model with $j = 1, \ldots, 6$ competing random variables T_j. $\mathbf{X}$ is a $K \times 1$ vector of observable regressors. Due to the competing risks structure it is only possible to observe $(U, \epsilon, \mathbf{X})$ with $\epsilon = \text{argmin}_j\{T_j\}$ and $U = \min_j\{T_j\}$. Our model also allows for independent censoring with censoring point C. Thus, observable duration is $T = \min\{U, C\}$ and let $\Delta = \mathbb{1}(U \leq C)\epsilon$ with indicator function $\mathbb{1}$. Let $(t_{ji}, c_i, \delta_i, \mathbf{x}_i)$ be $i = 1, \ldots, N$ realisations of $(T_j, C, \Delta, \mathbf{X})$ and $F_j(t; \mathbf{x}) = \Pr(T_j \leq t, \Delta = j; \mathbf{x})$ be the cumulative incidence curve for risk j. The cumulative incidence corresponds to the probability that a transition to state j has occurred by time t.[5]

In empirical economics, the more frequently used approach to duration analysis is to estimate the marginal distributions for each risk $\Pr(T_j \leq t; \mathbf{x})$. However, this necessitates identifying restrictions on the dependence structure between competing risks which are hard to test. The Cox proportional hazard model, for example, assumes independent T_js conditional on observables and the Mixed proportional hazard model assumes independent T_js given observables and unobservables. While for some research questions it may be informative to estimate the marginal effects of covariates on the risk-specific marginal distribution, this marginal effect need not, however, say much about the observed change in transitions due to the covariate change. In fact, a transition to a particular risk may even decrease despite a positive marginal effect if the positive marginal effect on the other risks is stronger. For this reason, the life sciences tend to prefer modelling cumulative incidences that directly refer to observable quantities. For our research question, we also consider cumulative incidences to be more informative as we want to identify the effect on the observable sorting of women into different exit states after birth. Another increasingly popular approach in empirical economics is estimating a dynamic discrete choice model (Aguirregabiria and Mira, 2010). In contrast to these models, the model in our analysis does not impose identifying restrictions on the dependence structure between risks (Assumption CI-Y in Aguirregabiria and Mira, 2010), does not require a specific covariate structure (assumption DIS in Aguirregabiria and Mira, 2010), nor makes explicit parametric assumptions on the distribution of failure times (assumption CLOGIT in Aguirregabiria and

[5]For more details about cumulative incidences see Kalbfleisch and Prentice (1980).

Figure 3: Increase in unconditional cumulative incidences for 4 periods (as defined in Figures 4 and 5)



Mira, 2010).

In order to estimate the risk-specific cumulative incidence, we apply the model by Fine and Gray (1999) who consider the cause-specific subdistribution hazard function

$$\begin{aligned}\lambda_j^s(t;\mathbf{x}) &= \lim_{\Delta t\to 0}\frac{1}{\Delta t}P(t\le T\le t+\Delta t, \delta=j;\ T\ge t\cup(T\le t\cap\delta\neq j),\mathbf{x})\\ &= -\frac{\partial \ln[1-F_j(t;\mathbf{x})]}{\partial t}.\end{aligned}$$

This hazard is difficult to interpret but it is convenient to determine F_j from it (see below). Fine and Gray suggest a proportional hazard model of the form

$$\lambda_j^s(t;\mathbf{x}) = \lambda_{j0}^s(t)\exp(\mathbf{x}'\boldsymbol{\beta}_j),$$

where $\lambda_{j0}^s(t)$ is the nonparametric baseline subdistribution hazard. In this model the cumulative incidence is

$$F_j(t;\mathbf{x}) = 1-\exp[-\Lambda_{j0}^s(t)\exp(\mathbf{x}'\boldsymbol{\beta}_j)],$$

where $\Lambda_{j0}^s(t;\mathbf{x})=\int_0^t\lambda_{j0}^s(u)du$ is the cumulative baseline subdistribution hazard. The marginal effect of a continuous x_k on $F_j(t;\mathbf{x})$ is not simply β_{jk} but

$$\frac{\partial F_j(t;\mathbf{x})}{\partial x_k} = (F_j(t;\mathbf{x})-1)\ln(1-F_j(t;\mathbf{x})\beta_{jk}.$$

β_{jk} therefore do not have a direct quantitative interpretation but they directly reveal the direction of the marginal effect on the cumulative incidence and the order of marginal effects across regressors as $|\frac{\partial F_j(t;\mathbf{x})}{\partial x_k}| > |\frac{\partial F_j(t;\mathbf{x})}{\partial x_l}|$ iff $|\beta_{jk}|>|\beta_{jl}|$. The magnitude of the marginal effect varies with t but its sign does not change in t. This restriction on the direction of the marginal effect also exists for the Cox proportional hazard model, where the sign of the marginal effect on the conditional quantile function does not change across quantiles (Koenker and Geling, 2001). In our application we determine marginal effects of continuous covariates as given above. For binary covariates we evaluate F_j for both values of the covariate and take the difference in the F_js.

For completeness we sketch the likelihood function of the Fine and Gray (1999) model. In absence of censoring they suggest a convenient partial likelihood:

$$L(\boldsymbol{\beta}_j)=\prod_{i=1}^n\left[\frac{\exp(\mathbf{x}_i\boldsymbol{\beta}_j)}{\sum_{k\in R_i}\exp(\mathbf{x}_i\boldsymbol{\beta}_j)}\right]^{\mathbf{I}\{\delta_i=j\}}$$

with R_i defined as $\{k:(T_k\ge T_i)\cup(T_k\le T_i\cap\delta_k\neq j)\}$. R_i is the risk set at the time of exiting maternity leave for the i'th female. In this model, parameters are estimated separately for each

risk. Fine and Gray also cover estimation in presence of censoring but the likelihood is much more complex and therefore not presented here. $\lambda_{0j}(t)$ is obtained by a Breslow-type estimator after $\boldsymbol{\beta}_j$ has been estimated. We use the R package `cmprsk` by Bob Gray for estimation. We use the bootstrap for inference.

When we discuss estimation results we focus on the estimated F_j as they have a direct interpretation. Therefore, we also consider changes in F_j in response to changes in regressors (partial effects). But notice, that each F_j is jointly determined by $\Pr(T_j \leq t; \mathbf{x})$ for all j and the dependence structure between risks (which is unknown). It is therefore difficult to draw conclusions for changes in $\Pr(T_j \leq t; \mathbf{x})$ when F_j changes.

Choice of Covariates. We have a comprehensive set of covariates, comprising individual and firm level information in administrative registers, variables computed from the employment trajectories of individuals and linked regional and national aggregated data. We made efforts to collect as many covariates as possible to be able to test the hypotheses of Section 2. In particular, we require observable characteristics for a woman's productivity, pre-birth job match quality and the compatibility of her previous job with childcare responsibilities. Table 2 contains the list of covariates that will be used to capture these characteristics together with institutional regulations, childcare availability and aggregate economic conditions. Column 2 links the covariates to the related hypothesis, while column 3 shows the data source.

For the individual productivity, we are able to exploit a woman's entire pre-birth employment and earnings history in order to generate useful proxies. In particular, we consider a woman's pre-birth wage quintile to be most informative. In addition, total work experience and past unemployment experience may also proxy for a woman's productivity level. The quality of her job match prior to birth, on the other hand, is captured mainly by tenure as there is ample evidence in the literature that good job matches tend to persist longer. In addition, we use information on a woman's career development prior to birth by creating dummy variables for whether a woman climbed up or down the ladder in terms of earnings while working for her pre-birth employer. We consider an upward move prior to conception to be a proxy for a good job match. As further job characteristics we include information about the complexity of occupational tasks and the probability of shift work or overtime by occupational groups. We do not include the educational degree of the woman because of a high degree of misclassification and many missing values (compare Fitzenberger et al. 2006, Wichert and Wilke 2012). As educational degree and salary possess a pronounced positive correlation, the coefficients on individual income will to some extent reflect the joint relationship of these variables with the

Table 2: Variables for the multivariate model

Variables	Hypothesis/es	Source
Individual productivity	**H2/H5/H6**	
wage (by quintile within year)		A
total labour market experience (in months)		A
past unemployment experiences (yes/no)		A
Pre-birth job characteristics and match quality	**H2**	
tenure (in months)		A
increase/decrease in pre-birth wage quintile		A
complexity of occupation (3 categories)		A
occupational risk of shift work/overtime		A,F
Pre-birth firm characteristics	**H4**	
firm size (3 dummies)		A
share of female pre-employer staff		A
share of pre-employer staff aged < 30		A
Availability of child-care	**H2**	
child-care places per child aged <3 (annual state level data)		B
Leave legislation	**H1/H3/H5/H6**	
job protection period (4 dummies with < 10, $10 - 12$, $15 - 18$, 36 months)		C
maximum maternity benefit entitlements (in Euro, deflated in 1995 prices)		C
Labour market conditions	**H5**	
GDP growth rate (national)		D
unemployment rate (by education/year/state)		E
Further control variables		
age		A
inactivity/illness during pregnancy		A
federal state of residence (dummies)		A
decade dummies (1980s, 1990s)		A

A - BASiD, individual level data; B - Federal Statistical Office, annual state-level data;

C - coded according to regulations as shown in Figures 4 and 5

D - Economic Research Service, United States Department of Agriculture, annual data

E - IABS-04, annual state-level data by three educational levels

F - Mikrozensus (Census) - Federal Statistical Office, survey data

length of maternity leave.

In order to proxy for the compatibility of a firm with family responsibilities, we include firm size of the pre-birth employer since the possibility to offer part-time jobs and other family-friendly human resource practices are likely to be more common in larger firms. In addition, firms with a higher share of women among its workforce may be more compatible with childcare responsibilities. In contrast, employers whose staff is pre-dominantly young and thus often childless, likely puts less effort in offering family-friendly conditions.

We include a variable for the availability of public childcare places for children aged below three to capture the institutional setting of a woman's return decision. This information is linked to our individual data based on workplace location and calender time. For the same reason we include dummy variables for the leave legislation that applied at the time when a woman gave birth and also include a measure for the deflated maximum amount of maternity benefits a woman might be entitled to given the birth date of her child. Unfortunately, we do not have individual level data on the actual entitlements to maternity benefits because actual entitlements depend on household income, an information that is not available in our individual data. The actual receipt of benefits does, however, vary less across individuals than the maximum entitlement and therefore we expect that we underestimate the magnitude of the relationship between benefits and maternity duration.

In addition, we include the national GDP growth rate and the unemployment rate that is observed for a woman's educational level in her state of residence in order to control for the labour market conditions at the time of birth. Further controls that are not directly linked to our hypotheses, but should be included in order to absorb unobserved individual heterogeneity, are the age of the woman when giving birth, an indicator for her health status prior to birth, and her occupation as well as time dummies for the 1980s and 1990s. These time dummies together with the labour market conditions may help to disentangle the effect of institutional changes across time from other influences that may also have changed across time. Finally, we control for the state of residence in order to capture unobserved regional heterogeneity which may stem from economic as well as mentality differences across Germany.

Finally, note that our administrative data does not include household level information that may be relevant for the return decision, for example, due to income effects or due to the potential availability of childcare by relatives. Given assortative matching, a woman's productivity, for example, is likely to be positively related to the income of her spouse. Hence, given these omitted variables, our analysis can only recover the partial relationship of each of the included

variables with the probability of observing a transition, holding all other variables in the model constant. Hence, given the number of covariates included, our estimated marginal effects show interesting relationships. But due possibly important omitted variables and by considering cumulative incidences it is hard to relate our estimates to the data generating process. The full variable list and descriptive statistics of our sample are given in Table 5 (Appendix).

5 Empirical Results

We have already discussed unconditional cumulative incidences and how they vary with policy regimes in Section 3. As conditional cumulative incidences on the grounds of the multivariate model confirm these observations we mainly focus on marginal effects in this section. For completeness, we present estimated conditional cumulative incidences for a reference mother in Figure 7 in the Appendix. Although, the level of the estimates is partly slightly different, their general shape and the occurrence of mass points is rather similar to their nonparametric unconditional counterparts in Figure 2.

In what follows we focus on presenting and discussing marginal effects on the risk-specific cumulative incidences when we change one covariate (holding all other covariates constant). These marginal effects correspond to percentage changes in the probability that a transition to a particular exit state takes place at some point when the covariate changes holding all other variables fixed at the values for the reference mother (compare Table 6). We report these marginal effects at two lengths of maternity duration: after one year and after three years. This allows us to test particular features of the hypotheses of Section 2 which suggest changing patterns over the course of the duration. In contrast to Schönberg and Ludsteck (2014) who consider the event that the mother is employed after up to 5 years after giving birth, we consider only up to three years. We do not consider a longer period because there are only few transitions out of maternity leave after more than three years (compare Figure 3) and cumulative incidences are broadly flat (compare Figure 2). Table 3 presents the corresponding marginal effects for five of the six risks. We do not present results for the residual pooled risk as these results would be difficult to interpret.

In what follows we discuss a the main findings of this table and indicate whether they provide support (indicated by ✓) or provide evidence against (indicated by ×) the hypotheses developed in Section 2. The full set of estimated model coefficients of the competing risks model is presented in Table 7 in the Appendix for completeness.

Table 3: Estimated marginal effects of covariates on cumulative incidences (in%)

		marginal effect									
		next birth		unemployment		return full time		return part time		change employer	
	months after birth	12	36	12	36	12	36	12	36	12	36
individual productivity	wage, 1st quintile	0.060	1.818	-1.089***	-4.725***	-1.599***	-2.211***	-3.597***	-6.394***	0.873***	2.268***
	wage, 2nd quintile	0.015	0.460	-0.407***	-1.745***	-2.099***	-2.902***	-0.915*	-1.606*	0.731***	1.902***
	wage, 4th quintile	0.043**	1.310**	-0.292***	-1.245***	0.587*	0.807*	3.412***	5.862***	-0.366**	-0.964**
	wage, 5th quintile	0.014	0.450	-0.545***	-2.340***	0.539	0.742	7.337***	12.366***	-0.319**	-0.838**
	labour market experience	0.006*	0.170*	0.003	0.012	-0.553***	-0.761***	0.065	0.113	-0.007	-0.019
	dummy for past unemployment	-0.010	-0.295	0.766***	3.209***	-0.460*	-0.634*	-0.325	-0.569	-0.235**	-0.618**
job characteristics and match quality	tenure at current firm	-0.003	-0.093	-0.012	-0.051	0.246***	0.338***	0.363***	0.634***	-0.258***	-0.677***
	decrease in wage quintile	0.117***	3.525***	0.123	0.521	-0.342	-0.472	-1.257***	-2.210***	0.051	0.133
	increase in wage quintile	-0.014	-0.435	0.015	0.062	0.129	0.177	0.228	0.397	0.234	0.611
	low complexity tasks	-0.051	-1.575	0.303*	1.274*	2.669***	3.649***	-0.966**	-1.698**	-0.125	-0.330
	high complexity tasks	0.031	0.932	-0.424***	-1.820***	1.094**	1.501**	0.373	0.648	-0.348*	-0.917*
	risk of shift work	-0.003***	-0.105***	-0.029***	-0.122***	0.117***	0.160***	0.004	0.007	0.006	0.016
	risk of overtime	0.005**	0.138**	0.029***	0.125***	-0.051	-0.070	0.112***	0.195***	0.046***	0.121***
firm characteristics	firm size <20	0.011	0.340	0.183*	0.773*	-0.686**	-0.946**	-1.145***	-2.012***	-0.018	-0.048
	firm size >1000	0.022	0.676	-0.461***	-1.978***	1.255***	1.722***	1.296***	2.248***	-0.417**	-1.098**
	share of female workers	0.205***	6.292***	-0.169	-0.718	-2.240***	-3.083***	4.728***	8.259***	0.716***	1.877***
	share of young workers	0.169***	5.200***	0.930***	3.952***	-1.489**	-2.050**	-0.036	-0.064	0.732***	1.919***
child-care	child care places per 100 children	-0.012***	-0.366***	-0.042***	-0.180***	0.103***	0.141***	0.059***	0.103***	0.046***	0.121***
policy framework	job protection 10–12 months	0.003**	0.100**	0.074***	0.315***	-0.724	-0.994	0.738	1.292	-0.047*	-0.122*
	job protection 15–18 months	0.115	3.416	-0.584**	-2.510**	-0.640	-0.887	0.022	0.028	0.688**	1.784**
	job protection 36 months	0.114***	3.321***	-0.622***	-2.685***	-1.308**	-1.813**	-0.462	-0.829	1.282	3.297
	maternity benefits (in 1000 Euros)	0.311	10.162	-4.116	-16.098	-5.214**	-7.077**	-0.998***	-1.723***	0.673	1.780
labour market conditions	GDP growth	0.021***	0.643***	-0.149***	-0.631***	-0.337***	-0.464***	0.063	0.110	0.115**	0.302**
	unemployment rate	-0.029***	-0.879***	-0.047	-0.198	0.997***	1.372***	-0.284**	-0.497**	0.011	0.030
further controls	individual age	-0.025***	-0.771***	-0.007	-0.028	0.292***	0.401***	-0.026	-0.046	-0.004	-0.011
	illness during pregnancy	-0.011	-0.352	0.123***	0.523***	-0.119	-0.164	-0.027	-0.047	-0.083	-0.218
	inactivity period during pregnancy	-0.034	-1.074	0.423*	1.777*	0.718	0.985	-2.485***	-4.395***	-0.201	-0.530
	regional dummy for Hessia	-0.036	-1.106	-0.547***	-2.348***	0.484	0.665	0.641*	1.115*	0.861***	2.238***
	regional dummy for BW	0.150***	4.483***	-1.027***	-4.447***	1.024**	1.406**	-0.878***	-1.542***	0.718***	1.869***
	regional dummy for Bavaria	0.067***	2.035***	-0.314***	-1.343***	-0.095	-0.131	-0.644**	-1.128**	0.368**	0.962**
	dummy for years 1990 to 1999	-0.021	-0.679	0.562**	2.352**	0.329	0.448	-0.892	-1.571	-0.138	-0.367
	dummy for years 2000 to 2004	-0.131**	-3.922**	0.123	0.529	-0.638	-0.875	0.602	1.056	-0.481	-1.254

significance levels: *** 1%, ** 5%, * 10%

With regard to individual characteristics we find a strong differentiation of transition paths. In particular, the higher a woman's pre-birth wage, the more likely she returns to employment (**H2**: ✓). However, this effect is driven by a differential rate of return to the previous employer only. Women earning a pre-birth wage in the highest wage quintile are around 18 percentage points (3 percentage points) more likely to be back in part-time (full-time) with their previous employer three years after birth than women with the lowest wage level, while low-productivity women are 2.5 percentage points more likely to start working for a new employer. Apparently, women with higher wages and probably higher education levels have both a higher labour market attachment as well as a higher attachment to their previous employer. Contrary to our expectations though, and despite the lower employment rates three years after birth, low-productivity women are less likely to register unemployed (**H5**: ×). At the same time, these women are only somewhat more likely to have their next child directly after the first birth, suggesting that a large share of these women experience a period of inactivity after first birth that continues beyond three years. Moreover, mothers with past unemployment experiences are more likely to enter unemployment but less likely to return to employment (**H2**: ✓). Also, note that contrary to our expectations, individual characteristics do not seem to be strongly related to the probability of having a next child within one or three years after birth (**H6**: ×).

With regard to job characteristics, tenure as an indicator of a good pre-birth job match increases the probability of returning to the previous employer and decreases the probability of an employer change (**H3**: ✓). We therefore confirm this finding by Fitzenberger et al. (2010). An additional month worked for the pre-birth employer even increases the probability of having returned to the employer by 0.7 percentage points three years after birth. Mothers who have been recently demoted in the salary distribution are more likely to deliver their second child out of inactivity and are less likely to immediately return the previous employer (**H2**: ✓), thus resulting in prolonged out of work durations. Women who have been promoted recently, on the other hand, seem to have particularly good outside options and are more likely to change the employer. In contrast, if the pre-birth job is characterised by a high degree of occupational complexity, this is related with a lower probability of employer change. Moreover, it is related with a lower probability of unemployment but a higher probability of full-time return to the previous job. The latter is also the case for low complexity occupational tasks, whereby these are also characterised by a slightly higher probability of unemployment. The higher the probability for a shift work pattern, the more likely the mother returns full-time to her previous job and the less likely she terminates the leave period by getting her second child or by becoming unemployed. When there is a higher occupational risk of overtime, this increases the probability of entering all states except the return to full-time employment to the previous job. While

the latter finding suggests that systematic overtime working pattern may not be compatible with family life, there is not similar evidence for shift work. Our findings therefore confirm the broad observations by Fitzenberger et al. (2010) that promotions, job responsibilities and intra firm standing of the young mother seem to play a role for her decision when weighting her options. But due to data limitations their variables differ to the variables in our analysis and results are not fully comparable.

Firm characteristics also play an important role. Mothers previously working with small firms are less likely to return and more likely to end up in registered unemployment, while mothers in large firms are more likely to return to the previous employer, albeit more so in part-time. If we assume that large firms are able to offer a human resource management that facilitates the compatibility of work and family responsibilities by offering, among others, more part-time schemes, this is in line with our hypothesis H4 (**H4**: ✓).

Mothers working in firms with a larger share of females are more likely to deliver their second child and change employer but less likely to return full-time. Given that we control for a woman's occupation, this may indicate that firms with a high share of woman reflect a work environment that puts less penalty on working part-time or not returning for a prolonged period. In contrast, a pre-birth employer with a very young workforce appears to push mothers to seek alternatives as they are more likely to deliver their second child, end up in unemployment or start working for a new employer, while returning to the pre-birth employer in full-time decreases. As discussed in section 4, this might reflect that firms with very young and often still childless workforces put less effort in being compatible with family responsibilities.

The variables reflecting the policy framework often have expected effects. In particular, a better availability of childcare, and hence lower childcare costs, clearly increases the employment rate of mothers and reduces the share of women who register unemployed or have their second child out of inactivity (**H2**: ✓). This is a desirable result both from a policy as well as individual perspective as childcare seems to preserve women's labour force attachment and, hence, likely also future career prospects.

An extensive job protection period, on the other hand, seems to be no good news from the perspective of the previous employer who wants to preserve firm-specific knowledge. At least in case of extensive job protection of 36 months, the share of women returning to the previous workplace tends to decline while the share entering a new job tends to increase with the length of job protection (**H3**: ✓). Moreover, a generous job protection strongly increases the share of women who deliver their second child out of inactivity within three years after the first

birth (**H6**: ✓). Note, however, that at least for a job protection of up to 18 months, there is no parallel decline in the probability of returning to employment. Hence, the results also indicate that women who are more likely to have their second child in response to a prolonged job protection period are mainly the ones with prolonged periods of inactivity in case of a less generous job protection. Our observation that the marginal effects are increasing with duration seem to contradict some of the findings of Schönberg and Ludsteck (2014). They provide evidence for the effect of the job protection period on the probability of being in the workforce declining in time from giving birth (5 years compared to 3 years). However, the two sets of results are not directly comparable because they do not estimate transition probabilities but the crude probability of being employed. Moreover, they compare 3 with around 5 years after giving birth, while we only consider up to three years. We do not report marginal effects for longer durations because there are hardly any transitions out of maternity leave after a bit more than three years (compare Figure 3). Finally, the results of our regression type analysis should be read as partial statistical relationships between observable quantities rather than an attempt to uncover changes in the data generating process.

As expected, unfavourable labor market conditions as reflected in a high unemployment rate make women exercise their right to return to their previous employer rather than quitting the job (**H5**: ✓). Moreover, they tend to return in full-time. This may indicate that women want to signal their attachment to their job in order to reduce the risk of being laid of. Moreover, higher unemployment rates may disrupt the spouses wage income, hence increasing the necessity to earn a higher income share. In fact, periods of high GDP and hence also wage growth, seem to reduce the necessity to work full-time, hence again pointing to the relevance of an income effect.

The results for further controls suggest that there are partly considerable differences across federal states and decades. The latter observation is important as the policy variables may to some extent also absorb general behaviourial trends in calender time.

While the above findings for particular covariates are certainly interesting and insightful, we also consider the effects of changing a group of related variables (such as those related to institutional setup, individual or firm characteristics) to obtain insights on the relevance of variable groups for explaining variation in transition probabilities. Table 4 reports estimated group effects, where groups of variables are as defined in Table 2. To make these effects interesting and comparable across groups, we consider the switch from a "min" to a "max" profile in each case. The "max" profile refers to the maximum probability for each exit state that can be observed based on all covariates of a group, i.e. the (latent) linear predictor is

Table 4: Estimated marginal effects of covariate groups on cumulative incidences (in %-points)

12 months after birth

	next birth	unemployment	return full-time	return part-time	change employer
ind. productivity	0.114**	1.836***	6.869***	9.751***	1.504***
job charact. & match qual.	0.340***	1.700***	7.772***	5.693***	2.790***
firm characteristics	0.210***	0.957***	3.969***	5.142***	1.122***
child-care	0.117***	0.418***	1.011***	0.580***	0.454***
policy framework	0.299**	1.634***	9.601***	5.037*	0.980
labour market	0.129***	0.567***	3.309***	0.837**	0.381*
further controls	0.725***	2.433***	6.798***	4.797***	3.085***

36 months after birth

	next birth	unemployment	return full-time	return part-time	change employer
ind. productivity	3.463**	7.852***	9.467***	16.803***	3.930***
job charact. & match qual.	10.215***	7.180***	10.598***	9.970***	7.276***
firm characteristics	6.397***	4.085***	5.450***	8.946***	2.953***
child-care	3.605***	1.776***	1.391***	1.013***	1.190***
policy framework	9.707**	6.665***	13.002***	8.673*	2.589
labour market	3.971***	2.401***	4.550***	1.463**	1.000*
further controls	20.726***	10.431***	9.258***	8.529***	7.892***

maximized. The "min" profile is such that it minimizes this predictor. For these profiles, we fix binary variables to zero or one (depending on the sign of their coefficients) and continuous variables at their sample means minus or plus one standard deviation for the two profiles. We do not choose the continuous variables's observed minimum and maximum because the edges of their support could correspond to an outlying observation. Variables which do not belong to the group of interest are held at the values of the reference mother (Table 6, Appendix). The resulting marginal effect is the difference between the estimated cumulative incidences for the maximum and minimum profiles. Hence, these effects yield insights into the relative importance of different groups of variables in affecting the different transition types. We focus the discussion of these results on the first five groups of variables as the group "further controls" is only a remainder term capturing region and period effects. Several interesting observations can be made in Table 4.

First of all, when focussing on the relative importance of the different variable groups for the five transition types, we find that whether a woman has a next child within her inactivity period is largely determined by job characteristics, match quality and leave legislation. Similarly, the probability of registering unemployed is related to the leave legislation, although factors related to individual productivity, job characteristics and match quality are also estimated to play a

role. Note, however, that the marginal group effects for next birth and unemployment are rather small at 12 months, but partly increase strongly after three years.

Whether a mother returns to her former employer strongly hinges on a mother's individual productivity characteristics. Women with favourable individual characteristics are 17 (9) percentage points more likely to have returned to the former employer in part-time (full-time) after 36 months. Moreover, our findings suggest that former employers may exert some influence on a mother's probability of returning in part-time, while returning full-time seems to be less in the employer's control. In particular, job and firm characteristics have a similar impact on the probability of returning to the former employer in part-time than a woman's individual productivity (19 percentage points after 36 months). In contrast, the probability of returning to the former employer in full-time is more related to leave legislation, especially after 36 months (13 percentage points), while the leave legislation exerts only a comparably small effect on the decision whether to return part-time. For a transition to a new employer, job characteristics and match quality are estimated to possess the strongest partial relationships.

Finally, Table 4 also yields another interesting insight. While individual, job, and firm characteristics exert the strongest impact on the probability of returning to part-time both after 12 and after 36 months, the policy framework mainly affects the probability of returning to the former employer in full-time after 12 months, but the partial effect on transitions to a next child increases much stronger within the following two years (9.4 vs. 3.4 percentage points). This is interesting as it suggests that the window of opportunity for the policy framework to increase the likelihood of a full-time return tends to be mainly within the first year of maternity.

6 Summary and recommendations

We present a detailed analysis of transition times from maternity leave into various labour market states. We provide evidence for pronounced changes in distributions over a period of almost three decades. In particular, part-time return to the former employer and giving birth to the second child have strongly increased over the decades, while full-time return to the former employer and becoming unemployed have decreased strongly. We find marked evidence for mass transitions taking place at the time the mother looses some form of entitlement. These mass points move over time in conjunction with changes to the maternity leave legislation. We therefore confirm previous results for the decision to return to work (Schönberg and Ludsteck, 2014) but show that similar patterns exist for most destination states in our model. Our results

therefore confirm patterns of rational behaviour of young mothers when choosing their options. Our findings exceed the previous international literature on maternity leave (Baum, 2003, Hanratty and Trzcinski, 2009, Ondrich et al., 2003, Lalive and Zweimüller, 2009, Schönberg and Ludsteck, 2014) by considering a multiple competing risks model and a number of policy changes over almost three decades.

Although the share of transitions to unemployment has decreased from more than 30% in the early 1980s to just over 10% in the mid 2000s, our results provide evidence that the unemployment insurance is systematically misused. Mass transitions into this state at legally relevant time points reveal that unemployment (by claiming unemployment benefits) corresponds to the state with the highest utility level for them. It is therefore advisable to have some hurdles for mothers to enter unemployment while still in job protection. This might then also contribute to a reduction in the considerably longer length of unemployment among females of child-bearing age (Wichert and Wilke, 2008).

We estimate a competing risks duration model to reveal partial effects of each covariate and group effects of similar covariates on conditional transition probabilities. We obtain evidence for extensive job protection periods of three years being related with a higher probability of making an employer change or giving birth to the second child towards the end of the job protection period. However, only for very extensive job protection periods of 36 months this seems to go along with reduced rates of return to the former employer after three years, suggesting that the role of leave legislation increases in its importance for the return decision with the length of the leave period. Given the results of previous studies (Baum 2002; Waldfogel 1997; Phipps et al. 2001; Ziefle 2004) extensive job protection periods might therefore induce a long term wage penalty for mothers. Our results therefore provide evidence for longer job protection periods being related with longer economic inactivity periods and therefore with increased costs for firms and the economy as a whole.

We also provide evidence for firm characteristics, individual productivity, job match quality and the supply of public child-care being related with the observed differentiation of female careers after first birth, broadly confirming our economic hypotheses. While characteristics related to a mother's productivity strongly affect the decision whether to return to the previous employer, the policy framework has a notable impact only on the probability of returning full-time or having the next child. Also, our results indicate that former employers may exert some influence on a mother's probability of returning in part-time, while returning full-time seems to be less in employer's control. This is an important finding as it allows firms to some extent to avoid some costs related to filling the vacant posts temporarily and to retrain and hire new

staff (Alewell and Pull, 2001).

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A Appendix

A.1 Tables

Table 5: Descriptives

	next birth		unemployment		return full-time		return part-time		new job		all	
Variable	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
length	31.082	14.262	21.666	14.625	12.140	11.939	17.903	16.450	32.094	29.496	24.231	25.009
wage. 1st quintile	0.041	0.198	0.032	0.176	0.038	0.190	0.011	0.103	0.059	0.236	0.038	0.191
wage. 2nd quintile	0.125	0.331	0.143	0.350	0.095	0.294	0.060	0.238	0.171	0.377	0.118	0.322
wage. 4th quintile	0.314	0.464	0.300	0.459	0.319	0.466	0.310	0.462	0.265	0.442	0.302	0.459
wage. 5th quintile	0.290	0.454	0.255	0.436	0.333	0.471	0.477	0.500	0.261	0.440	0.325	0.468
labour market experience (months)	6.655	3.489	6.656	3.614	6.377	3.896	7.886	3.869	6.137	3.798	6.871	3.843
dummy for past unemployment	3.470	2.985	0.359	0.480	0.268	0.443	0.267	0.442	0.304	0.460	0.296	0.456
tenure at current firm (months)	3.470	2.985	3.304	2.859	3.547	3.019	4.499	3.489	2.786	2.767	3.566	3.146
decrease in wage quintile	0.107	0.309	0.102	0.302	0.080	0.271	0.066	0.248	0.092	0.290	0.088	0.284
increase in wage quintile	0.125	0.330	0.132	0.339	0.130	0.337	0.116	0.320	0.135	0.341	0.123	0.328
low complexity tasks	0.038	0.191	0.050	0.217	0.083	0.277	0.036	0.186	0.047	0.212	0.049	0.217
high complexity tasks	0.041	0.199	0.040	0.196	0.034	0.182	0.046	0.210	0.031	0.174	0.039	0.195
occupational risk for shift work	0.056	0.077	0.056	0.079	0.080	0.099	0.058	0.088	0.063	0.079	0.062	0.085
occupational risk for overtime	0.064	0.040	0.062	0.035	0.062	0.041	0.070	0.041	0.063	0.040	0.064	0.040
firm size <20	0.345	0.476	0.348	0.476	0.216	0.411	0.242	0.428	0.353	0.478	0.298	0.457
firm size >1000	0.124	0.330	0.107	0.309	0.204	0.403	0.189	0.392	0.108	0.310	0.144	0.351
share of female pre-employer staff	0.658	0.266	0.638	0.279	0.578	0.271	0.627	0.263	0.657	0.261	0.622	0.281
share of pre-employer staff aged $¡$30	0.419	0.211	0.436	0.233	0.375	0.206	0.359	0.204	0.432	0.238	0.394	0.230
child care places per 100 children	1.961	3.689	1.841	4.159	2.594	6.004	2.737	5.416	2.592	5.631	2.317	4.920
job protection 10-12 months	0.105	0.306	0.128	0.335	0.158	0.364	0.101	0.301	0.132	0.339	0.121	0.326
job protection 15-18 months	0.111	0.315	0.138	0.345	0.115	0.319	0.115	0.319	0.157	0.364	0.124	0.329
job protection 36 months	0.616	0.486	0.423	0.494	0.373	0.484	0.636	0.481	0.500	0.500	0.529	0.499
maternity benefits (in 1000 Euros)	5.445	2.269	4.504	2.478	4.175	2.500	5.602	2.216	5.003	2.348	5.035	2.411
GDP growth (%-points)	1.862	1.505	1.909	1.588	1.870	1.523	1.822	1.534	2.044	1.591	1.885	1.543
unemployment rate (%-points)	3.807	1.079	3.978	1.135	4.053	1.242	3.847	1.062	3.870	1.155	3.897	1.128
individual age	26.847	3.755	26.831	4.053	26.985	4.670	28.395	4.166	26.584	4.338	27.275	4.271
illness during pregnancy	0.859	0.732	0.182	1.379	0.103	0.766	0.093	0.773	0.093	0.733	0.108	0.902
inactivity period during pregnancy	0.024	0.154	0.033	0.179	0.030	0.171	0.015	0.123	0.028	0.164	0.026	0.160
regional dummy for Hessia	0.089	0.284	0.087	0.282	0.097	0.297	0.113	0.316	0.113	0.316	0.098	0.297
regional dummy for BW	0.231	0.422	0.131	0.338	0.183	0.387	0.186	0.389	0.210	0.407	0.193	0.395
regional dummy for Bavaria	0.243	0.429	0.233	0.423	0.206	0.404	0.212	0.409	0.228	0.419	0.225	0.417
dummy for years 1990 to 1999	0.501	0.500	0.387	0.487	0.324	0.468	0.434	0.496	0.446	0.497	0.423	0.494
dummy for years 2000 to 2004	0.189	0.392	0.133	0.339	0.123	0.328	0.280	0.449	0.157	0.364	0.188	0.391
Observations	5299		2969		3488		3947		2490		19535	
fraction	27%		15%		18%		20%		13%		100%	

Missing entries due to privacy protection (less than 20 observations, upper bound is provided), descriptives for censored observations (509) and for a residual exit class (2605) are not displayed

Table 6: Characteristics of the reference person used for the plots in Figures 3 and 7

Variable	Value
wage	3rd quintile
labour market experience (months)	6.871
dummy for past unemployment	0
tenure at current firm (months)	3.566
decrease in wage quintile	0
increase in wage quintile	0
firm size	20 to 1000
share of female workers	0.622
share of young workers	0.394
firm information missing	0
child care places per 100 children	2.316
job protection	36 months
maternity benefits (in 1000 Euros)	5.035
GDP growth (%-points)	1.885
unemployment rate (%-points)	3.897
individual age	27.276
inactivity period during pregnancy	0
illness during pregnancy	0
job complexity	level 2
risk for shift work (%-points)	6.2
risk for overtime (%points)	6.4
regional dummy	Northrhine-Westfalia
decade	2000 to 2004

Table 7: Competing Risks Regression Results (Coefficients)

		next birth	unemployment	return full time	return part time	change employer
individual productivity	wage, 1st quintile	0.095	-0.659***	-0.235**	-0.642***	0.258***
	wage, 2nd quintile	0.024	-0.200***	-0.321***	-0.132*	0.223***
	wage, 4th quintile	0.069*	-0.137***	0.073	0.384***	-0.132**
	wage, 5th quintile	0.025	-0.277***	0.068	0.708***	-0.112*
	labour market experience	0.009	0.001	-0.072***	0.009	-0.003
	dummy for past unemployment	-0.016	0.295***	-0.062	-0.044	-0.080*
job characteristics and match quality	tenure at current firm	-0.005	-0.006	0.032***	0.049***	-0.087***
	decrease in wage quintile	0.179***	0.054	-0.046	-0.186***	0.019
	increase in wage quintile	-0.024	0.006	0.016	0.030	0.077
	low complexity tasks	-0.089	0.122	0.303***	-0.139*	-0.042
	high complexity tasks	0.048	-0.208***	0.131**	0.053	-0.126
	risk of shift work	-0.006***	-0.013***	0.015***	0.001	0.002
	risk of overtime	0.008**	0.013***	-0.007	0.015***	0.016***
firm characteristics	firm size <20	0.017	0.081	-0.090*	-0.166***	-0.008
	firm size >1000	0.036	-0.230***	0.152***	0.161***	-0.153**
	share of female workers	0.345***	-0.081	-0.294***	0.634***	0.243***
	share of young workers	0.282***	0.414***	-0.196*	-0.004	0.244**
child-care	child care places per 100 children	-0.020***	-0.019***	0.014***	0.008***	0.016***
policy framework	job protection 10–12 months	0.169**	-0.314***	-0.095	-0.007	0.195
	job protection 15–18 months	0.154	-0.350*	-0.204	-0.086	0.333*
	job protection 36 months	0.739***	-1.032***	-0.510**	-0.121	0.280
	maternity benefits (in 1000 Euros)	0.009	0.037	-0.093**	0.102**	-0.013
labour market conditions	GDP growth	0.035***	-0.067***	-0.044**	0.009	0.040*
	unemployment rate	-0.048***	-0.021	0.130***	-0.038*	0.003
further controls	individual age	-0.042***	-0.003	0.038***	-0.004	-0.001
	illness during pregnancy	-0.018	0.054***	-0.014	-0.003	-0.027
	inactivity period during pregnancy	-0.061	0.175*	0.090	-0.406***	-0.069
	regional dummy for Hessia	-0.061	-0.281***	0.059	0.083	0.254***
	regional dummy for BW	0.227***	-0.610***	0.122**	-0.125**	0.214***
	regional dummy for Bavaria	0.107***	-0.151***	-0.014	-0.089**	0.114**
	dummy for years 1990 to 1999	-0.044	0.211*	0.031	-0.130	-0.060
	dummy for years 2000 to 2004	-0.200*	0.055	-0.080	0.095	-0.152

significance levels: *** 1%, ** 5%, * 10%

A.2 Figures

Figure 4: Job protection periods and duration of maternity benefits by regime (with start date)

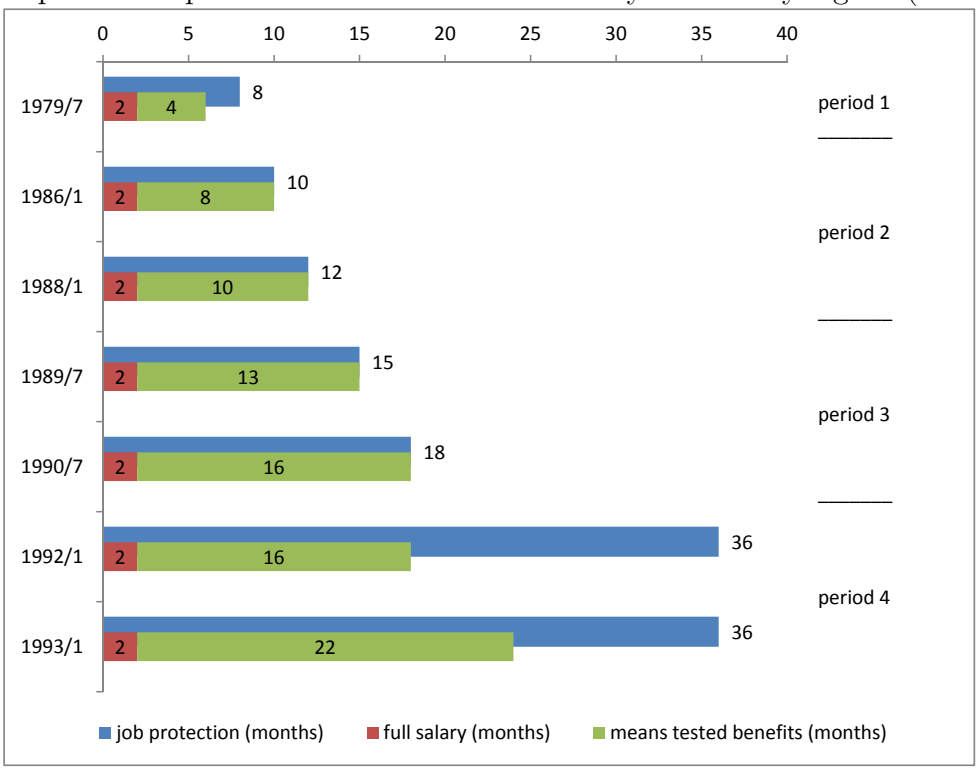


Figure 5: Maximum cumulative amount of means tested maternity benefits by regime (with start date)

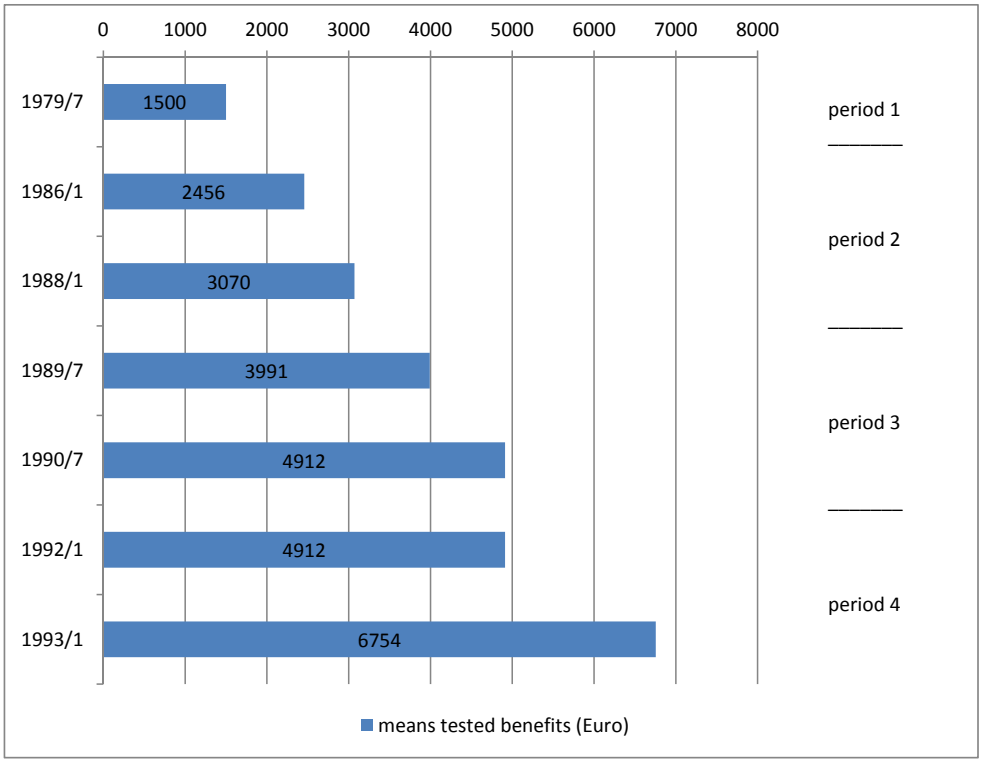
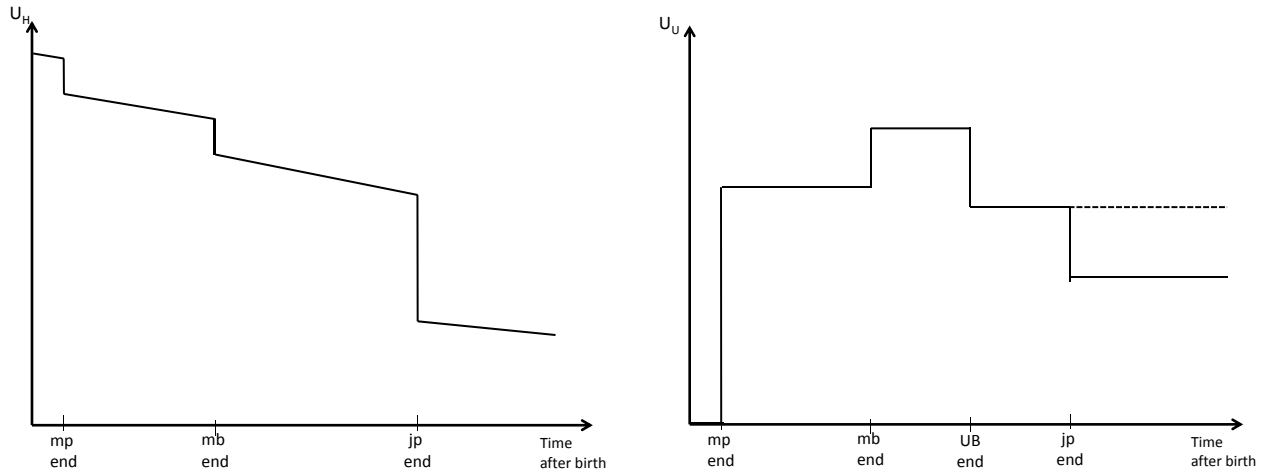


Figure 6: Stylized utilities by time elapsed since birth

(a) staying home ($U_{H,t}$) (b) unemployment ($U_{U,t}$)



The plots sketch stylized patterns for the utilities attached to staying home (a) and registering unemployed (b) by the time elapsed after birth. The level of the corresponding utilities as well as the exact slope of the utility curves may vary across individuals such that the figures below only reflect the timing of major kinks and general characteristics of the utility curves.

Note: "mp end" refers to end of mother protection period; "mb end" to the end of the maximum maternity benefit receipt and "jp end" to the end of the leave-specific job protection period. "UB end" corresponds to the time when the assessment base for unemployment benefit switches from the pre-birth earnings to a fictive (lower) wage income.

Figure 7: Estimates of cumulative incidences for the reference person (see Table 6).