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## UNION INSTABILITY AND FERTILITY: A MICROSIMULATION MODEL FOR ITALY AND GREAT BRITAIN

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## Abstract

Family dynamics are changing in Europe, but only few studies investigate how cohort completed fertility is affected by partnership behaviours and how this has changed over time. We use microsimulation techniques to investigate the effect of the increasing prevalence of union dissolution on completed fertility levels in Italy and Great Britain, two countries with very different systems of value. We find that the net effect of union instability is to decrease fertility (by about 0.5 children for Italian and 0.2 to 0.4 children for British cohorts) but the magnitude of the difference depends on the timing of union formation and separation. As expected, re-partnering produces more children in new partnerships if the separation occurs earlier. Nonetheless, it is only if separation takes place after the second birth and if all women re-partner that additional childbearing would almost compensate for births lost due to union disruption.

## Keywords

Family forms, fertility, microsimulation, union dissolution, repartnering.

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# Union Instability and Fertility: A Microsimulation Model for Italy and Great Britain

Maria Winkler-Dworak, Eva Beaujouan, Paola Di Giulio, Martin Spielauer

## 1 Introduction

Like most Western countries, European countries have witnessed significant changes in the pattern of family formation since the 1960s. Over the past few decades, men and women have been marrying less, and they have been cohabiting and divorcing more (Kiernan 2004); they have also been having fewer children than their predecessors, and at older ages. Because of the decreasing stability of marriages and consensual unions, higher-order unions have become more widespread (Billari 2005) and childbearing is no longer restricted to only one marital or consensual union (Kiernan 1999; Pinnelli et al. 2002). One of the most widely used concepts framing the observed changes in family formation and fertility in Europe is the narrative of the 'Second Demographic Transition' (SDT) (Lesthaeghe 2010, 1995; van de Kaa 1987). The SDT theory links the changes in family behaviour with ideational changes and transformation in values, rising importance of individual autonomy and self-actualisation, and an increasing symmetry of gender roles (Lesthaeghe 2010).

Although the narrative of SDT plausibly describes the "behavioural and normative changes, which took place recently in Europe, the theory has little or no predictive power" (Lutz 2007, p.16). In 2011, more than 500 population experts participated in an online questionnaire about future demographic trends (Lutz et al. 2014). In particular, the experts were asked to judge the degree of correctness for numerous arguments on future trends that might affect population dynamics, and additionally, to gauge their likely impact on the respective demographic component. Table 1 reports the top three arguments with highest validity in the 'low fertility' module and their impact on future fertility (Basten et al. 2014). While there was little disagreement on the effect of educational expansion and postponement, there was no consensus on the impact of partnership instability on fertility, so that even the mean net impact averages to zero.[1]

[1] In fact, one-quarter of the experts estimated a negative impact of union disruption on fertility, while around another one-quarter of them expected the impact to be positive. The remaining half of the experts assigned a zero effect to union dissolution on fertility.

Table 1: IIASA–Oxford expert survey; arguments most likely to be valid

| Argument | Validity Score | Mean Net Impact | Index of Disagreement |
|---|---|---|---|
| 'More young adult years enrolled in education and training' | 0.78 | -0.26 | 0.03 |
| 'Delayed childbearing yet more common' | 0.75 | -0.23 | 0.12 |
| 'Partnership dissolution and repartnering more common' | 0.73 | 0.00 | 0.85 |

Source: Basten et al. (2014), Zeman (2014)

Since childbearing predominately takes place within partnerships, union instability, presumably, leads to lower fertility, as union disruption curtails time spent in partnerships. At younger ages, union instability at least delays family formation which is generally associated with lower fertility. On the other hand, union instability produces a pool of persons who may enter new partnerships and have additional children in stepfamilies (Thomson et al. 2012). It is the balance of these opposing forces that influences not only future completed fertility levels and family size but also the diversity of family compositions.

In this study, we develop a microsimulation model in order to investigate the interrelationships of partnership and childbearing for selected European countries. In particular, we estimate hazard regression models of birth and union events for Italian and British women born in the 1940s to the mid-1990s, which will serve as parameters to our microsimulation model. The microsimulation generates hypothetical populations of women with different union and childbearing histories for all cohorts, even for those cohorts who are still in their reproductive age. The latter allows to assess the changes in family forms that occur and expand across cohorts, including families which have been identified as vulnerable (Philipov et al. 2014; Mynarska et al. 2015).

## 2 Background

Childbearing and partnerships are interlinked and, thus, union instability may effect fertility via several mechanisms. First, partnerships produce births: The vast majority of children in European countries are born to mothers and fathers co-residing either in unmarried cohabitation or in a marriage. In fact, individuals in cohabitation or marriage show much higher childbearing rates than singles, even with controls for common unobserved predispositions to enter parenthood and partnerships (Aassve et al. 2006; Baizán et al. 2003, 2004). Furthermore, individuals in partnerships are more certain about their childbearing intentions (Ní Bhrolcháin and Beaujouan 2011) than singles and they are also more likely to have children among those who want or intend so (Spéder and Kapitány 2009). Thus, union dissolution is expected to depress fertility by *curtailing time spent in*

*partnerships*. Even prior to union dissolution, fertility might be lower because of reduced frequency of intercourse and by motivated prevention of conception (Thornton 1978).

Furthermore, children present the largest investment in partnership (Lillard and Waite 1993). Indeed, a stable partnership or a supportive partner are the most or second most important factors in the decision to have children (Malpas and Lambert 1993; Testa 2007). A stable partnership lowers childrearing costs for each parent and may enhance the benefits of children through mutual enjoyment and caring (Thomson et al. 2012). *Unwillingness to form a stable partnership*, particularly at young ages (Basten et al. 2014), thus, may lead to delayed family formation.

Moreover, the presence of children (especially when young) raises the emotional and financial costs of a union dissolution. A union disruption might imply either to raise the children alone or to have reduced contact with the children. Awareness of the negative consequences of parental separation on children (de Graaf and Kalmijn 2006) and persisting norms against dissolving a union with children (Liefbroer and Billari 2010) further raise separation costs for couples with children and thus lowering fertility if the couple is not sure about its long-term stability (*avoidance of lone parenthood*). On the other hand, Friedman et al. (1994) argue that relationship quality may have a negative effect on the propensity to parenthood, as couples with low relationship quality or perceived instability of partnership may have children to *`revitalize´ their relationship* (Rijken and Liefbroer 2009).

Lastly, union instability produces a pool of persons who may enter *new partnerships.* New unions represent new opportunities for childbearing for both childless couples and those in which one or both partners have already children (Guzzo 2017). Similar to what has been argued for partnerships in general, childbearing in second or subsequent union can be motivated by rendering adult status—indeed, an increasing share of first births are born in second or subsequent unions (e.g., Beaujouan 2011)—or signalling a couple's commitment to each other and to solidify their status as a family unit (Griffith et al. 1985). Stepfamilies might even feel greater pressure to symbolize their commitment (Guzzo 2017) and value a shared birth more as stepfamilies-relationships are weaker and dispose of less social capital than families without stepchildren (Stewart 2002). A shared birth may contribute to the creation of social capital and may express the commitment to the reconstituted family (Astone et al. 1999; Coleman 1988). Moreover, stepfamilies might also have a higher risk of having a first shared birth or having it sooner in order to have siblings close in age (Guzzo 2017). A second shared child may be valued for her/his biological relationship to the first, as well (Henz and Thomson 2005). The values of *partnership commitment, adult status, and sibling relationships* may overcome higher costs that stepfamily couples face when they already have children from previous partnerships (Griffith et al., 1985). Indeed, birth intentions and birth risks in new partnerships have shown to be higher than would be predicted from the number of children partners already have (Thomson et al. 2002; Thomson 2004; Vikat et al. 1999.)

Establishing the overall effect of union instability on completed fertility levels, i.e. the balance of these opposing forces, is not straightforward. But surely, union dissolution increases the heterogeneity of childbearing, as some individuals will have "additional" births after repartnering, while for others union dissolution curtails time in union and reduces fertility (van Bavel et al. 2012).

Empirically, Thomson et al. (2012) find using microsimulation techniques that union instability is actually not enhancing macro fertility for women in France. Meggiolaro and Ongaro (2010) find equivalent results in Italy using Poisson regressions. This is also in line with more descriptive results on French men and women (Beaujouan 2010) and on the effect of divorce on completed fertility levels in 23 European countries (van Bavel et al. 2012). However, the amplitude of the negative impact of divorce varied across countries and gender, though without a clear pattern (van Bavel et al. 2012). As expected, European divorced men and women display a higher dispersion of childbearing behaviour than non-divorced ones, where the authors conclude that "[this] might also prelude transition towards a positive divorce–fertility link, as may already be the case to some extent for remarried men" (van Bavel et al. 2012, p. 773).

Moreover, countries differ greatly by the cultural, institutional and legal context in which childbearing takes place (Klüsener et al. 2012; Perelli-Harris and Sánchez Gassen 2012). For instance, while in Italy partnerships and childbearing are established in a traditional setting, in France today most births take place within unmarried unions, and also in Great Britain both unpartnered and unmarried births are frequent. Although in many countries being in a marriage is still seen as the ideal setting to start and complete family plans (Barlow and Probert 2004; Thornton and Young-DeMarco 2001), we have witnessed a change in the link between marriage, cohabitation and fertility (Perelli-Harris et al. 2010b), and sometimes in the proportion of births outside any union. The link between childbearing and instability evocated earlier could thus be itself affected by the change in partnership circumstances at birth. The variety in the dynamics of partnerships over time and across countries would then be a determining factor of the variation in fertility outcomes.

Partnership and fertility depend on the level of education, and this relationship has changed over time (Kravdal and Rindfuss 2007; Torr 2011; Ní Bhrolcháin and Beaujouan 2013). It also changes substantially between countries (Rendall et al. 2010). We thus expect the link between separation and fertility to vary not only over time but also between educational groups. For instance, less educated enter their first partnership/marriage earlier, mainly because they remain enrolled in education for a shorter time (Marini 1978; Prioux 2003); however, partnerships formed at young ages are also the most likely to break up (Lyngstad and Jalovaara 2010). Taking into account these differences in partnership formation and dissolution will enrich the study of educational differentials in fertility; and the other way round, information on education differences will improve the analysis of the link between union dynamics and fertility.

The aim of this research is to extend the understanding of the link between union dynamics and fertility and its change across recent birth cohorts. We set our working frame, based on Thomson et al. (2012): our models assume that childbearing is contingent on union status and stability and, at the same time, we take into account potential effects of children already born on union formation and dissolution. More specifically, we estimate hazard regression models of conception risks up to the fourth birth as a function of the current union status and of the union status at prior births. Furthermore, we estimate the formation and disruption of first and second partnerships conditional on the number of previous births and the union in which they take place. We extend this framework in two ways: first, by additionally differentiating between marriage and unmarried cohabitation (cf. Bélanger et al. 2010); second, by considering enrolment and level of education in the microsimulation. We do so by generating standard age-specific trajectories of enrolment and obtained degrees for each level of education and adjust the age-specific parameters in the microsimulation accordingly. The outcome will be a set of simulated fertility histories over the family life course under different partnership and education scenarios. The simulated childbearing and union histories enable us to investigate how the observed relationships of partnership and fertility and education shape the family forms, even for cohorts which are still in their reproductive years.

Finally, in order to evaluate the influence of cultural, institutional and legal context on the link between childbearing and partnerships, we contrast the outcome of the microsimulations for Italy versus Great Britain.[2] While partnerships and childbearing in Italy usually follow traditional patterns, an increase of cohabitations, out-of-wedlock births and divorce rates has been observed since the early 2000s (Rosina and Fraboni 2004; Vignoli and Ferro 2009; Gabrielli and Hoem 2010; Meggiolaro and Ongaro 2010; Gabrielli and Vignoli 2013; Basten et al. 2014). In Great Britain, by contrast, fertility outside marriage is socially accepted and union dissolution has become a common experience, especially for cohorts born after 1960 (Basten et al. 2014). Thus we expect a stronger negative effect of union instability on fertility in Italy than in Great Britain, where partnership dissolution and childbearing after a separation are more common. On the other hand, the expected negative effect in Italy might be mitigated by the late union formation and childbearing pattern, as fertility levels are generally low, also for those living in an intact union during their childbearing years.

## 3 Data

The Italian data come from the multi-purpose household surveys on "Family and Social Subjects", carried out in 2003 and 2009. The first is internationally known as the Italian GGS survey, and we use the version that has been harmonised by the participants to the Nonmarital Childbearing Network (Perelli-Harris et al. 2010a, see www.nonmarital.org). The 2003 survey provides information about 49,500 respondents, while the 2009 survey had

[2] The parameter estimates for Great Britain come from Beaujouan et al. (2015).

44,000 respondents, males and females of all age groups in both cases. In our study we select only women born from 1940 onward, excluding those who had a first child or entered a first partnership before the age of 15 or after the age of 49, or were born abroad. Eventually, our sample comprises the partnership and childbearing histories of 30,255 women.

For Great Britain, we employ parameter estimates from identical hazard regression models derived in Beaujouan et al. (2015). Their analysis is based on a series of datasets that comprise information on past fertility and partnership histories, i.e. 10 datasets (2000–2009) from the Centre for Population Change GHS database 1979-2009 (see Beaujouan et al. 2014 for details) merged with the first wave of the Understanding Society Survey (2009). The quality of this merged database is good for partnership histories (Berrington et al. 2011) but only reasonable for birth histories, the number of births being underestimated in the latest surveys of the GHS database (Ní Bhrolchaín et al. 2011)[3]. Their working sample consists of 61,718 women with consistent partnership and childbearing histories and selected on the same criteria as described above for Italy.

Table 2 contrasts the family trajectories by age 40 of Italian and British women, over the cohorts 1940–49 to 1960–69. Overall, Italian women are more likely to remain un-partnered than British women, and the proportion and contrast has grown slightly in the last cohort. When there has been a first union, its pattern differs widely across cohorts and countries. The overall proportion of women separating is much higher in Britain than in Italy, and even more so in the recent period (23% against 6.5% in the 1940–49 birth cohort, and 38% against 13.5% in the 1960–69 birth cohort). Because of this, the proportion of women in intact unions at age 40 has gradually decreased and reaches 57% in Britain and 77% in Italy in the last cohort. Repartnering, however, is much more widespread in Great Britain than in Italy.

In parallel, the number of women childless at age 40 has increased, only slightly in Britain (14% to 16%) but in Italy it has jumped from 12% to 20%. Again, the context of births differs widely between the two countries. First of all, while births outside a union or before the first union still remain rare in Italy (slightly more than 3% of all women experience this event), in Great Britain their level has grown from 5.5% to 9.5%. Births in cohabitation have not spread as much in Italy as in Great Britain either, affecting less than 3% of all Italian women compared to more than 9% of British women born in 1960-69. Consequently, the proportion of births in married first unions has dropped much less in Italy than in Great Britain, while already starting from higher levels: in the last cohort 72% of women had their first baby in a marriage in Italy and 55.5% in Great Britain.

[3] Therefore, the simulated number of births will be lower compared to register data.

Table 2: Unions and births to Italian and British women born 1940-69

| | Italy | | | Great Britain | | |
|---|---|---|---|---|---|---|
| | Birth cohort | | | Birth cohort | | |
| | 1940-49 | 1950-59 | 1960-69 | 1940-49 | 1950-59 | 1960-69 |
| Birth and union histories to age 40 | | | | | | |
| Never in a union | 5.39% | 5.74% | 9.29% | 3.12% | 3.98% | 5.29% |
| First union | | | | | | |
| Intact | 87.98% | 83.76% | 76.95% | 73.78% | 66.36% | 56.95% |
| Separated/not repartnered | 5.07% | 7.69% | 9.19% | 8.18% | 9.31% | 11.33% |
| Repartnered | 1.55% | 2.81% | 4.57% | 14.92% | 20.35% | 26.43% |
| Childless | 11.69% | 13.18% | 19.85% | 13.90% | 15.86% | 15.96% |
| 1st birth | | | | | | |
| Before first union | 3.31% | 3.25% | 3.17% | 5.56% | 6.26% | 9.39% |
| Cohabiting first union | 0.77% | 1.19% | 2.78% | 0.93% | 2.75% | 9.30% |
| Married first union | 83.66% | 80.99% | 71.85% | 76.61% | 68.40% | 55.70% |
| After first union | 0.57% | 1.39% | 2.35% | 3.00% | 6.73% | 9.65% |
| 2nd birth | | | | | | |
| In 1st childbearing union | 64.48% | 59.88% | 51.75% | 65.74% | 60.89% | 55.23% |
| After 1st childbearing union | 0.43% | 0.84% | 0.87% | 1.87% | 2.69% | 3.74% |
| 3rd birth | | | | | | |
| In 1st childbearing union | 22.69% | 16.34% | 11.76% | 24.84% | 20.92% | 18.43% |
| After 1st childbearing union | 0.23% | 0.36% | 0.43% | 2.49% | 3.04% | 3.95% |
| 4th birth | | | | | | |
| In 1st childbearing union | 6.92% | 3.50% | 2.02% | 7.30% | 6.11% | 4.78% |
| After 1st childbearing union | 0.13% | 0.15% | 0.15% | 1.98% | 1.76% | 1.97% |

Source: Authors' analysis of data from FSS 2003/09 (Italy) and Centre for Population Change GHS database 1979-2009 and USOC 2009 (Great Britain).

Differences in the context of first and further births act in accordance with the spread of separations and repartnering, which is more prevalent in Great Britain: many more births of all orders took place after the first union in Great Britain, and also after the first childbearing union. Further births (of order 2+), already less frequent in Italy, remain extremely rare in stepfamilies (less than 1% for births beyond the first one over the three birth cohorts). Childbearing after the first fertile union seems to really make a difference in Great Britain, because while risks of further births tend to decrease in a first childbearing union, they tend to increase in subsequent ones. For instance, the share of women having a second birth in their first childbearing union dropped from 65.5% in the 1940–49 birth cohort to 55% in the 1960–69 birth cohort, while it increased from less than 2% to more than 3.5% after the first childbearing union.

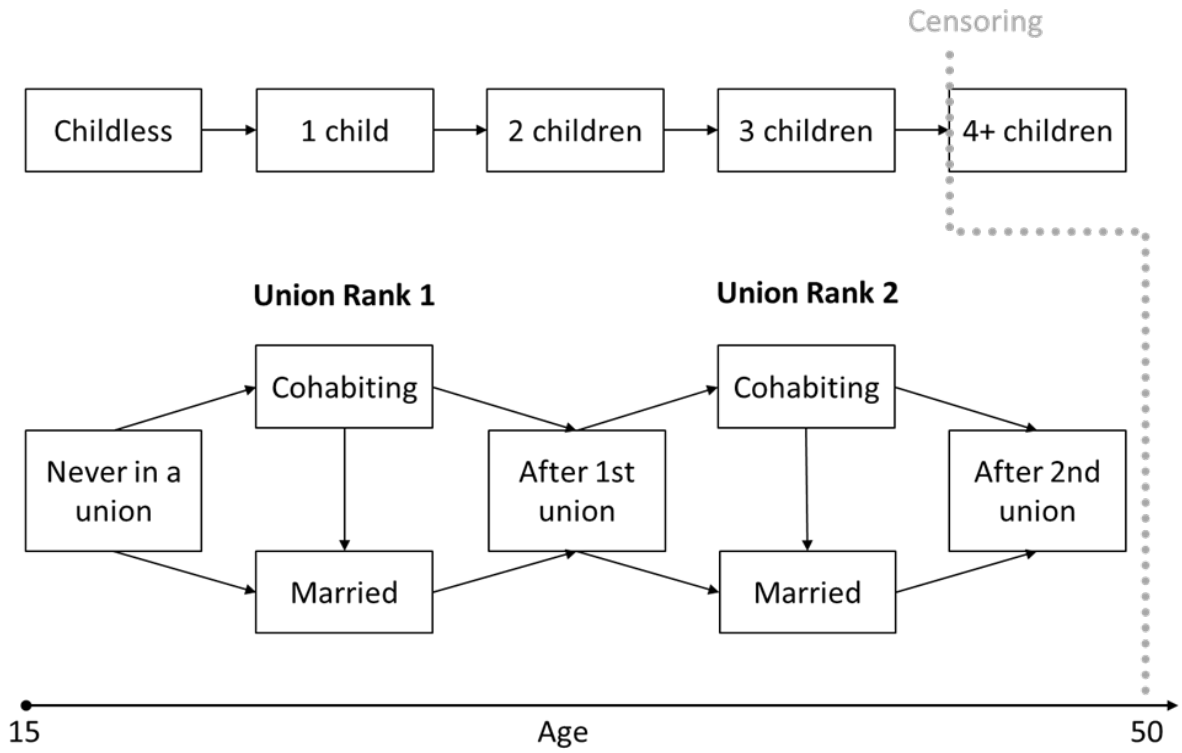
# 4 The Microsimulation Model

## 4.1 Model Structure

We develop a continuous-time, competing risk microsimulation model, comparable to the one employed by Thomson et al. (2012), but additionally differentiating between marriage and unmarried cohabitation (Bélanger et al. 2010). The state-space representation of the model is sketched in Figure 1, and further described in the following section. All women are assumed to be childless and never in a union at age 15. For the birth processes, we consider the transitions up to parity 4, while we model transitions into and out of marital/non-marital partnership up to union rank 2. We censor at conception of the fourth child or at age 50, whichever occurs first. In order to estimate the transition rates between the states we use hazard regression, which will be described below. The simulation model is implemented in Modgen, a generic microsimulation programming language developed and maintained at Statistics Canada (2009). The microsimulation model generates 50,000 synthetic life courses of birth and union events for each cohort, based on the parameters produced from the hazard regression analysis. Simulations of events at later ages depend on the parameters observed only for older cohorts. This holds particularly for the most recent cohort 1980–93/4, where we had to postulate the same cohort-specific rates as in the 1970–79 cohort for higher-order birth and union processes. Eventually, we analyse the simulation output by comparing completed fertility levels of the simulated life courses with one or another type of union history. In particular, we differentiate between simulated populations, where first unions are dissolved to simulated populations, where the first unions endure, overall and by timing of union formation and separation.

In order to investigate educational differences in the interrelationship of partnership dynamics and fertility, we re-estimate all the transitions by adding enrolment and educational level as covariates for Italy. We then define standard age-specific educational paths of enrolment and highest educational levels obtained for lower, medium or high education, where the ages at leaving school and obtaining the degree correspond to the observed respective median ages in completed years. That means, Italian women with a low educational level have left school with that degree by age 15, while medium-educated women continue being enrolled until including age 18 when their highest obtained educational level changes from low to medium. Eventually, highly educated Italian women remain further enrolled until including age 24, by which they get promoted from medium to highest educational level. The British educational system differs from the Italian one by the ages at which pupils obtain their degree and leave school: While lower-educated and medium-educated women leave school only by age 16 and 18, respectively, highly-educated women already receive their first university degree by age 22.

Figure 1: State space representation of the model




### 4.2 Hazard Regression of Transition Rates

For the hazard regression of progression to each birth order and to the formation and dissolution of union for first and second unions we use piecewise constant exponential models. Conception is determined to have occurred nine months prior to a reported birth. Union and marriage formation are treated as competing risks, as women out of a partnership can choose either to marry or to enter an unmarried cohabitation. To do so, we employ stratified models with transition-specific covariates. In the same way, marriage and separation of cohabiting union are treated as competing risks. The covariates for all transitions include age, birth cohort and detailed combinations of past unions and births.

For conception of the first live birth, the baseline duration is measured by the age of the woman, or more specifically, the time since the 15th birthday. For higher-order births, it is the age of the youngest child. The baseline duration of forming a union of rank 1 independent of the type of the union is again the time since a woman's 15th birthday. For the formation of a union of rank 2, the baseline duration is measured by the time since the end of the union of rank 1 (separation of married or unmarried cohabitation). The baseline duration for converting an unmarried cohabitation into a marriage or separating is measured by the time since formation of the unmarried cohabitation, and for divorce, by duration of marriage.

To account for cohort differences in the timing of the events, we include a duration–cohort interaction using linear duration splines.[4] The competing risk processes were estimated by using stratified models with transition-specific covariates. As outlined above, observations are censored by the respondent's 50th birthday or the conception of the fourth child or by the date of survey, whichever occurs first. Model selection is based on the Bayesian information criterion (BIC) statistics. All models were estimated by maximum likelihood as implemented by the R package "eha" (Broström 2014).

The following paragraphs summarise the estimated relationships between union dynamics and fertility for Italy and contrast them to corresponding estimates for Great Britain, obtained in Beaujouan et al. (2015). The full set of estimated parameters can be found in the Appendix.

### 4.2.1 Birth Intensities

The Italian first-birth risks exhibit the usual bell-shaped pattern with increasing age of the women, where the intensities decline across cohorts (Table A.2). However, the reductions are more pronounced at younger ages across cohorts, implying a delay of parenthood to later ages for more recent cohorts. In contrast, first-birth risks for Great Britain are marked by high rates of teenage pregnancies. Higher-order birth risks decline with the mother's age in Italy as well as in Great Britain.

Birth risks vary with the partnership status and with the context of previous births (if any). Births are more likely at all parities among married women than among the others: those never in a union are also less likely to experience a first birth, and in general women not currently in a partnership are less likely to have a (further) child than those in a union/cohabitation. In addition, higher-order birth risks are elevated if the prospective birth is the first or second in a new partnership. Moreover, first-birth risks decline with total union duration (that includes the length of an unmarried cohabitation preceding a marriage), where older cohorts used to proceed much quicker to motherhood after union formation compared to younger cohorts. In Great Britain, women in a second union also conceive a first birth faster after a union formation than their peers in a first union.

Furthermore, birth risks differ by educational level and enrolment status. As expected, first-birth intensities are strongly depressed by enrolment in education. However, the effect of educational attainment varies by birth order and country: While lower-educated women always show a higher propensity to conceive a(nother) child compared to medium-educated women, the effect of a high educational level on first birth risk is slightly positive in Italy but strongly negative in Great Britain. For second, third and fourth births, the

[4] When accounting for cohort differences in the timing of events, we had to assume the same duration-specific profile of the base hazard for the two most recent cohorts due to a lack of observations at longer durations in first and second birth and first union formation regressions.

estimated coefficient of higher educational level is strongly positive also in Great Britain, implying a J- or U-shape of the impact of educational attainment.

#### 4.2.2 Union Formation and Dissolution

Union transitions show the increasing diffusion of cohabitation and union separations in the younger cohorts, and the constant retreat from direct marriage. In fact, the decline in first marriage rates is much more pronounced at younger ages, implying also a shift of marriages towards older ages.

We estimated all union transitions conditional on the number of past births, the union status at birth, women's age, cohort and educational attainment. Pregnancy as well as the presence of a young child encourages the formation of a first union, both cohabitation and marriage, while having an older child before any union is related to a smaller risk of partnering or entering a marriage for British and Italian women. For second unions, the presence of children, unlike pregnancy, inhibits repartnering. In Great Britain, those having their previous children out of union even seem less likely to repartner than those having them in the first union, while there is no clear pattern visible for Italy.

Once cohabitation is entered, the union remains stable and the cohabitation is more often transformed into a marriage if the woman is pregnant. By contrast, the presence of children (whether or not shared with the current partner) depresses the risk of marriage. At the same time, it lessens separation risks, though in Britain this holds only for children born from the current first cohabiting union. Similarly, sharing or expecting a child with the current partner reduces the risk of dissolving a marital union compared to childless women. Children born before the current union inflate the divorce risk relative to childlessness, in Great Britain even outweighing the protective effect of shared children for first marriages and only to a lesser degree for a second marital union.

Finally, enrolment status and educational level affect union transitions in Italy and Great Britain as follows: Being enrolled in education depresses the risk of cohabiting or marrying and increases union disruption risks. Highly-educated women tend to enter more frequently into cohabitation, but they are also more likely to transform cohabitation into a marriage. Conversely, less educated women have the highest propensity to marry directly. However, it is women with high education who most likely dissolve their married or unmarried unions in Italy. On the other hand, highly-educated British women are least likely to divorce and middle-educated women tend to dissolve a cohabiting union most often.

# 5 Results

The results of the hazard regression are fed into the microsimulation which generates 50,000 hypothetical life histories of childbearing and union events for each cohort. In what follows, we compare the simulated number of births of the hypothetical populations subject to the cohort-specific partnership and childbearing rates for Italy and Great Britain, respectively, for various family life pathways. First, Table 3 compares the completed family size of the simulated cohorts for Italian and British women depending on whether their first union remained intact or dissolved during their reproductive years or at least until the conception of their fourth child as we only consider union disruptions which may interfere with childbearing.

Table 3: Expected completed fertility by union dissolution and cohort

| First union | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93/4 |
|---|---|---|---|---|---|
| | | | Italy | | |
| Intact | 2.07 | 1.93 | 1.83 | 1.76 | 1.77 |
| Dissolved | 1.52 | 1.43 | 1.31 | 1.25 | 1.27 |
| | | | Great Britain | | |
| Intact | 2.25 | 2.19 | 2.18 | 2.08 | 2.09 |
| Dissolved | 2.02 | 1.92 | 1.91 | 1.77 | 1.72 |

Note: Estimates from life histories of 50,000 women in each cohort generated by microsimulation.

Overall, we find a negative effect of union instability on completed fertility levels for all simulated Italian and British cohorts. More specifically, women subject to Italian rates who experience a union dissolution on average end up with half a child less than their peers in an intact first union, where the difference is stable across cohorts. As expected, the difference is larger for Italian rates than for British rates, where women with a disruption of their first union on average bear 0.23 to 0.37 children less than those in an intact union. Strikingly, for British rates the gap has been widening across cohorts despite the fact that repartnering has become more frequent.

Table 4 compares the simulated mean number of children by various types of union histories for Italy (upper panel) and Great Britain (lower panel). Before investigating the net effect of union dissolution on fertility, we first differentiate between hypothetical populations of women with pre-union first births and hypothetical populations where women have their births after a first union is entered, as women with pre-union births usually show higher fertility levels than women with union births. In fact, the elevated fertility of women with a first pre-union birth is entirely due to younger ages at which these births occur. Indeed, Great Britain's fertility pattern is marked by high rates of teenage pregnancies (Beaujouan et al. 2015) explaining the stable high fertility levels of women with

a first pre-union birth in populations under British fertility and union rates. In contrast, the completed fertility of women with pre-union births is decreasing in populations subject to fertility and union rates of the younger Italian cohorts due to strong reductions in fertility rates particularly at younger ages across cohorts (see Table A.2).

Next, the middle section of each panel in Table 4 ("Separations occur…") shows a population where all women form a union before having children (if any): it compares the simulated fertility levels in case the first union dissolves to the corresponding levels in case it remains intact, depending on the family stage at which the separation takes place. For Italy, women dissolving the first union before a first birth occurs (if any) have on average 1.27 to 0.94 children less than women whose first unions do not dissolve, while the difference amounts to 1.07 to 0.65 children per woman for British rates. So the gap due to the separation of first unions before any birth has been diminishing in both countries. If the first union dissolution occurs after the first birth, differences between populations would be smaller, i.e. only 0.91 to 0.64 and 0.68 to 0.4 according to Italian and British parameter estimates, respectively. If unions dissolve after the second birth, differences between populations would shrink even further, from 0.36 to 0.19 and 0.28 to 0.12 children under rates observed in the Italian and British cohorts, respectively. Hence, union instability reduces completed family size but the later the separation occurs in the family stage (i.e. the higher the number of children born in the union), the smaller the effect. Strikingly, the effect is smaller in populations under rates observed in younger cohorts than under rates observed for the 1940s cohort, which is contrary to the differences in the overall completed fertility levels in Table 4, suggesting that the latter might result from a compositional effect. Indeed, in populations subject to the fertility and union transition rates observed for the younger cohorts, separations occur at lower parities than in populations under rates observed for the 1940s cohort. While in the 1940s birth cohort only about 30 per cent were childless at union disruption, this figure would be expected to rise to almost 50 per cent in the most recent cohort.

Finally, the lower section of each panel in Table 4 contrasts the simulated number of births in populations where all women remain single to populations where all women form a second partnership after the first union is dissolved, by parity at separation. We find that for populations with a lower parity at separations more children are added via repartnering than in populations with a higher parity at first union disruption. While there are only minor differences among the populations under rates pertaining to the different British cohorts, an interesting disparity shows among populations dissolving with one or two children for Italian rates. Whereas for women with two children at separation, repartnering adds more children in populations under rates observed for the 1940s than for more recent cohorts, the opposite is true for populations where women had just one child at separation.

Table 4: Simulated births in populations with varying union experience

| | | By cohort age-specific birth/union rates | | | | |
|---|---|---|---|---|---|---|
| | | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93/4 |
| | | Italy | | | | |
| 1st births before 1st union | | 2.32 | 2.08 | 2.00 | 1.97 | 1.98 |
| 1st births in/after first union | | 2.14 | 2.00 | 1.94 | 1.96 | 1.95 |
| Separations occur while/with … | | | | | | |
| Childless | Separated | 0.65 | 0.60 | 0.53 | 0.60 | 0.63 |
| | Union intact | 1.92 | 1.78 | 1.61 | 1.56 | 1.57 |
| One child | Separated | 1.25 | 1.26 | 1.30 | 1.40 | 1.38 |
| | Union intact | 2.16 | 2.03 | 1.98 | 2.02 | 2.03 |
| Two children | Separated | 2.12 | 2.10 | 2.08 | 2.10 | 2.10 |
| | Union intact | 2.48 | 2.35 | 2.29 | 2.29 | 2.29 |
| Parental status at separation | | | | | | |
| Childless | No repartnering | 0.35 | 0.25 | 0.21 | 0.19 | 0.21 |
| | Repartnering | 1.09 | 0.96 | 0.84 | 0.89 | 0.91 |
| One child | No repartnering | 1.17 | 1.15 | 1.14 | 1.18 | 1.17 |
| | Repartnering | 1.48 | 1.49 | 1.56 | 1.69 | 1.67 |
| Two children | No repartnering | 2.09 | 2.05 | 2.05 | 2.06 | 2.05 |
| | Repartnering | 2.52 | 2.35 | 2.26 | 2.28 | 2.30 |
| | | Great Britain | | | | |
| 1st births before 1st union | | 2.44 | 2.39 | 2.43 | 2.44 | 2.42 |
| 1st births in/after first union | | 2.30 | 2.22 | 2.18 | 2.10 | 2.08 |
| Separations occur while/with … | | | | | | |
| Childless | Separated | 0.92 | 0.97 | 1.10 | 1.03 | 1.06 |
| | Union intact | 1.99 | 1.91 | 1.89 | 1.75 | 1.70 |
| One child | Separated | 1.65 | 1.66 | 1.70 | 1.72 | 1.80 |
| | Union intact | 2.33 | 2.28 | 2.26 | 2.20 | 2.20 |
| Two children | Separated | 2.25 | 2.28 | 2.31 | 2.30 | 2.35 |
| | Union intact | 2.53 | 2.51 | 2.52 | 2.48 | 2.48 |
| Parental status at separation | | | | | | |
| Childless | No repartnering | 0.18 | 0.27 | 0.45 | 0.46 | 0.51 |
| | Repartnering | 1.07 | 1.10 | 1.21 | 1.13 | 1.15 |
| One child | No repartnering | 1.21 | 1.22 | 1.31 | 1.38 | 1.45 |
| | Repartnering | 1.77 | 1.81 | 1.86 | 1.90 | 1.95 |
| Two children | No repartnering | 2.11 | 2.14 | 2.16 | 2.18 | 2.21 |
| | Repartnering | 2.35 | 2.39 | 2.42 | 2.41 | 2.47 |

Note: Estimates from life histories of 50,000 women in each cohort generated by microsimulation.

Contrasting simulated fertility levels of populations where all women form a new partnership to those of populations with intact first unions, we find that repartnering compensates only partly for births not had due to union disruption, if the latter occurs at earlier family stages. It is only in populations where all women had two children at separation and all repartnered that we find almost the same simulated completed fertility levels as in populations with all first unions intact. Hence, repartnering may be particularly important for third and more births.

We noted above that for given parities, the net effect of union dissolution on completed fertility levels is smaller in populations under rates observed for more recent cohorts than under rates observed for cohorts born in the 1940s and 1950s. However, union formation and childbearing rates in recent cohorts differ markedly from their predecessors by a postponement of the entry into first unions and parenthood to later ages. In fact, Italian women born in the 1940s on average entered a first union at age 23.7 and had a first birth at 25.1 years. In contrast, under the rates for the Italian 1980–93 cohort, women would have formed a first union only by age 28.3 and would have had a first birth at 29.7 years. The corresponding estimates for Great Britain are 22.3 and 24.3 years for the 1940s cohort and 23.5 and 26.7 years for the most recent cohort, respectively.

These contrasts suggest that the timing of family formation also affects the impact of union instability on fertility. Indeed, Thomson et al. (2012) showed that union dissolution reduces completed fertility to a greater degree if unions are formed before rather than after age 30. Table 5 and Table 6 present simulated completed fertility levels by the timing of union events for our Italian and British estimates.

Indeed, we find a smaller gap in the completed fertility levels between women with an intact union and those separating if first unions are formed after age 30 for both Italian and British estimates. As Thomson et al. (2012) argue, this finding seems counterintuitive at first sight, as an earlier union formation might imply more time to repartner and compensate for lost births if the first union is dissolved. However as can be seen from Table 5 and Table 6, it is the completed fertility of women in intact unions which drops sharper than that of separated women if union formation is postponed after age 30. In fact, women forming first unions after age 30 might be selective of those who desire smaller families or no children at all (Thomson et al. 2012, p.188). On the other hand, the biological clock of women with delayed union formation and childbearing is also more likely to run out of time and they may experience difficulties in conceiving at older ages (Beaujouan and Solaz 2008). The latter argument may hold also for women separating after age 30, as fewer children are added via repartnering if unions are dissolved later (cf. Table 5 and Table 6 lower panel).

Table 5: Simulated births in populations by timing of union events, Italy

| | | By cohort age-specific birth and union rates | | | | |
|---|---|---|---|---|---|---|
| | | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93/4 |
| First unions at age < 30 | | | | | | |
| Separations occur while/with … | | | | | | |
| Childless | Separated | 0.76 | 0.74 | 0.72 | 0.88 | 0.90 |
| | Union intact | 2.15 | 2.01 | 1.98 | 2.08 | 2.09 |
| One child | Separated | 1.27 | 1.28 | 1.33 | 1.48 | 1.46 |
| | Union intact | 2.21 | 2.07 | 2.04 | 2.13 | 2.14 |
| Two children | Separated | 2.13 | 2.10 | 2.08 | 2.11 | 2.11 |
| | Union intact | 2.50 | 2.36 | 2.31 | 2.33 | 2.33 |
| First unions at age 30+ | | | | | | |
| Separations occur while/with … | | | | | | |
| Childless | Separated | 0.15 | 0.08 | 0.10 | 0.19 | 0.20 |
| | Union intact | 1.02 | 0.98 | 1.00 | 1.13 | 1.14 |
| One child | Separated | 1.02 | 1.06 | 1.10 | 1.20 | 1.19 |
| | Union intact | 1.46 | 1.52 | 1.57 | 1.71 | 1.72 |
| Two children | Separated | 2.00 | 2.04 | 2.03 | 2.05 | 2.05 |
| | Union intact | 2.08 | 2.09 | 2.09 | 2.14 | 2.14 |
| Separations at age < 30 | | | | | | |
| Parental status at separation | | | | | | |
| Childless | No repartnering | 0.71 | 0.61 | 0.55 | 0.56 | 0.57 |
| | Repartnering | 1.30 | 1.23 | 1.15 | 1.27 | 1.27 |
| One child | No repartnering | 1.40 | 1.37 | 1.35 | 1.37 | 1.38 |
| | Repartnering | 1.75 | 1.71 | 1.82 | 1.99 | 1.93 |
| Two children | No repartnering | 2.38 | 2.23 | 2.22 | 2.25 | 2.23 |
| | Repartnering | 3.02 | 2.61 | 2.59 | 2.55 | 2.56 |
| Separations at age 30+ | | | | | | |
| Parental status at separation | | | | | | |
| Childless | No repartnering | 0.11 | 0.07 | 0.09 | 0.11 | 0.12 |
| | Repartnering | 0.48 | 0.32 | 0.30 | 0.46 | 0.49 |
| One child | No repartnering | 1.07 | 1.08 | 1.09 | 1.15 | 1.14 |
| | Repartnering | 1.14 | 1.21 | 1.27 | 1.47 | 1.49 |
| Two children | No repartnering | 2.03 | 2.03 | 2.03 | 2.05 | 2.04 |
| | Repartnering | 2.12 | 2.18 | 2.14 | 2.22 | 2.24 |

Note: Estimates from life histories of 50,000 women in each cohort generated by microsimulation.

Table 6: Simulated births in populations by timing of union events, Great Britain

| | | By cohort age-specific birth and union rates | | | | |
|---|---|---|---|---|---|---|
| | | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93/4 |
| First unions at age < 30 | | | | | | |
| Separations occur while/with… | | | | | | |
| Childless | Separated | 1.15 | 1.20 | 1.32 | 1.20 | 1.22 |
| | Union intact | 2.30 | 2.28 | 2.30 | 2.19 | 2.20 |
| One child | Separated | 1.68 | 1.70 | 1.76 | 1.76 | 1.83 |
| | Union intact | 2.42 | 2.38 | 2.38 | 2.30 | 2.30 |
| Two children | Separated | 2.29 | 2.32 | 2.36 | 2.35 | 2.39 |
| | Union intact | 2.61 | 2.59 | 2.59 | 2.55 | 2.56 |
| First unions at age 30+ | | | | | | |
| Separations occur while/with… | | | | | | |
| Childless | Separated | 0.06 | 0.15 | 0.20 | 0.21 | 0.24 |
| | Union intact | 0.67 | 0.72 | 0.86 | 0.81 | 0.77 |
| One child | Separated | 1.24 | 1.15 | 1.17 | 1.23 | 1.24 |
| | Union intact | 1.71 | 1.66 | 1.63 | 1.59 | 1.56 |
| Two children | Separated | 2.11 | 2.06 | 2.08 | 2.09 | 2.11 |
| | Union intact | 2.13 | 2.15 | 2.17 | 2.14 | 2.13 |
| Separations at age < 30 | | | | | | |
| Parental status at separation | | | | | | |
| Childless | No repartnering | 0.76 | 0.76 | 1.04 | 0.99 | 0.97 |
| | Repartnering | 1.59 | 1.50 | 1.56 | 1.43 | 1.43 |
| One child | No repartnering | 1.69 | 1.80 | 1.86 | 1.86 | 1.85 |
| | Repartnering | 2.07 | 2.09 | 2.17 | 2.16 | 2.19 |
| Two children | No repartnering | 2.74 | 2.73 | 2.89 | 2.81 | 2.77 |
| | Repartnering | 2.76 | 2.80 | 2.88 | 2.85 | 2.83 |
| Separations at age 30+ | | | | | | |
| Parental status at separation | | | | | | |
| Childless | No repartnering | 0.04 | 0.09 | 0.17 | 0.19 | 0.21 |
| | Repartnering | 0.23 | 0.38 | 0.49 | 0.47 | 0.49 |
| One child | No repartnering | 1.05 | 1.09 | 1.13 | 1.17 | 1.19 |
| | Repartnering | 1.22 | 1.28 | 1.40 | 1.42 | 1.43 |
| Two children | No repartnering | 2.04 | 2.06 | 2.08 | 2.09 | 2.09 |
| | Repartnering | 2.12 | 2.18 | 2.23 | 2.24 | 2.25 |

Note: Estimates from life histories of 50,000 women in each cohort generated by microsimulation.

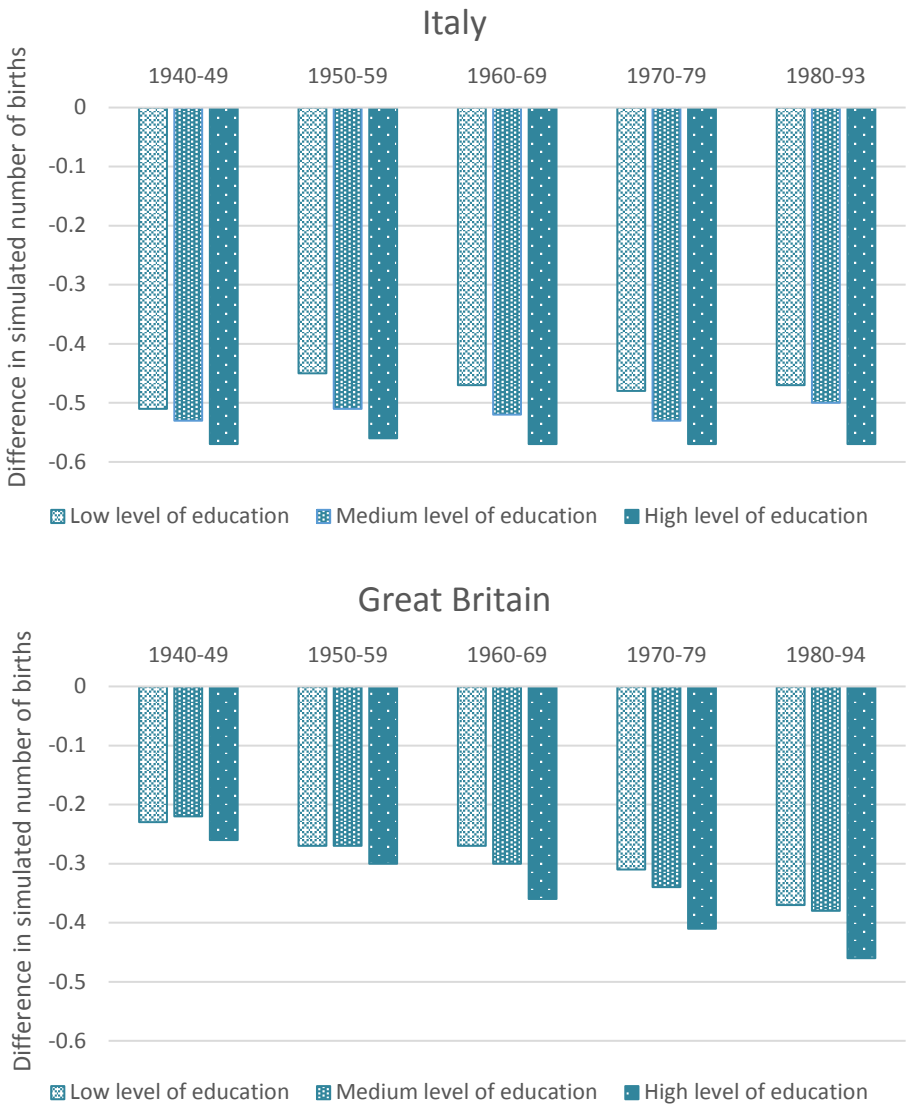
Next, like in a thought-experiment, we ask how educational differences in partnership and childbearing transitions translate into educational differences in the impact of union dissolution on fertility. Will the educational differences along the family life pathways offset each other or rather reinforce one another? Therefore, we re-ran our microsimulations by adjusting the age-specific parameters according to the typical educational paths of enrolment and highest level of education obtained for low, medium and high education.

Figure 2 displays the differences in the simulated number of births between populations with disrupted unions to populations with intact unions by the level of education and cohort according to the Italian and British rates. Overall, there are only small differences in the net effect of union disruption on completed fertility between educational levels, with more highly educated women showing a slightly wider gap, i.e. at most 0.1 simulated number of children per women, between women experiencing union dissolution and those in intact first unions in populations. Due to longer enrolment in education, more highly educated women tend to enter a first union and motherhood later than less educated women, which implies lower fertility levels according to our estimates regardless of whether or not these postponed unions are dissolved. On the other hand, the mean age at first union disruption is about the same across all educational levels, which means that first unions are dissolved at an earlier family stage for highly educated women than for medium and less educated women. Indeed, there are about twice as many women childless at first union separation in the highly educated populations than among the less educated populations subject to Italian or British rates from the 1940s and 1950s and still about 30-40 per cent more in populations simulated with rates from recent cohorts.[5] Thus, union dissolution reduces fertility more for highly educated women than for those with lower and medium education. However, the negative effect of union disruption is mitigated by the later ages at union formation and childbearing, as the completed fertility of highly educated women in intact first unions is smaller as well.

Summing up, our findings show that, using parameters estimated from Italian and British cohorts, union disruption during childbearing years actually reduces the average completed family size but that the reduction is smaller if unions are formed later and separations take place at higher parities.

[5] Results available on request from the authors.

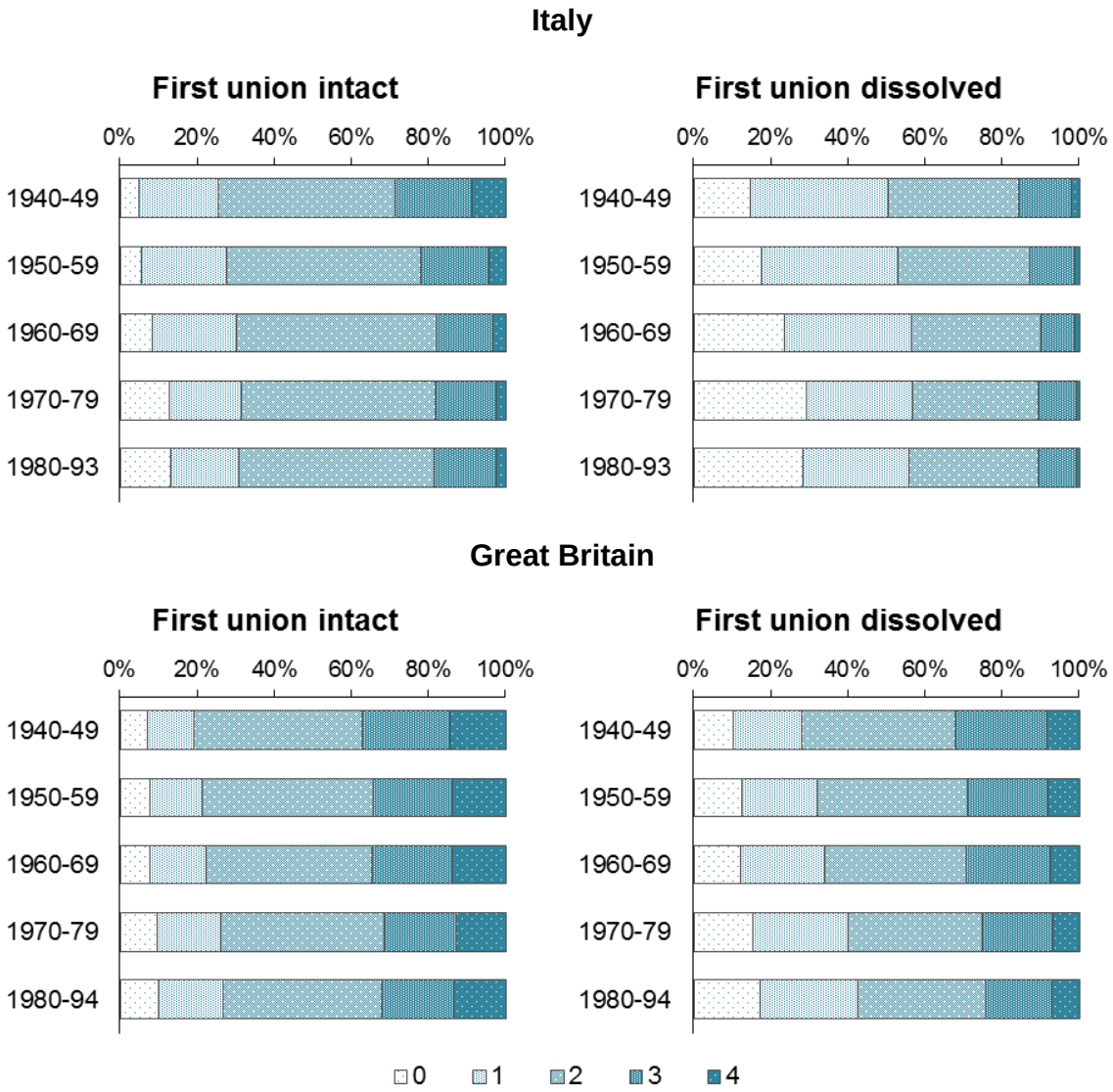
Figure 2: Difference in simulated births in populations by level of education and dissolution of the first union by cohort, Italy and Great Britain




Note: Estimates from life histories of 50,000 women in each cohort and educational level generated by microsimulation.

Figure 3 shows the simulated parity distribution by union disruption estimated for Italy and Great Britain. In fact, our results verify only a slight increase in the dispersion of family sizes for these two countries. For Italian union and childbearing rates, we rather find a strong reduction of the share of women with two and more children while the shares of childless women and of women with only one child markedly increase if first unions are dissolved. This finding is not unexpected as repartnering and further childbearing in subsequent unions is still rare in Italy.

Figure 3: Simulated parity distribution by union disruption and cohort, Italy and Great Britain

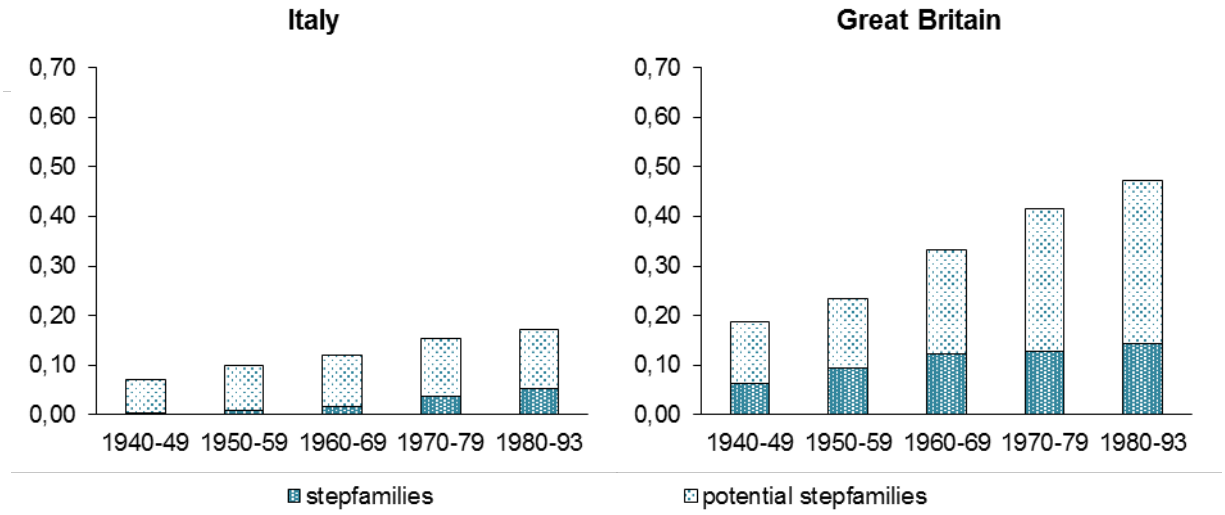



Note: Estimates from life histories of 50,000 women in each cohort generated by microsimulation.

According to British rates, the differences in the parity distribution are more attenuated between women with a union disruption and women in an intact first union. In case of a union dissolution, the share of childless women and women with one child increases, while the share of women with two or more children decreases also for British rates. For higher parities, it is only for women with three children that there is almost no reduction in numbers if a union dissolution occurred. Overall, the fertility pattern in Great Britain is more dispersed in case of separation, with high levels of childlessness and small reductions in the shares of women at higher parities, as would be expected in case of union dissolution and possible repartnering.

Given the smaller, or in the case of Great Britain, even absent reductions at parity three, Figure 4 displays the union status of birth among women with three children, where we differentiate between stepfamilies, i.e. births come from two different unions, and potential stepfamilies, that is the births were in one union and at least one of the births was out of union. We term this constellation 'potential stepfamily', because in data from observed populations such a combination of in- and out-of-union births could stem either from at least two different partners or just from one partner who was not co-residing with the mother at the birth of at least one of the children. A similar argument applies also to the case where all three births were out of union, so we added them to the potential stepfamilies. The difference to 100 per cent gives the share of women having all the births in one single union, either in the first or in the second one. As expected, stepfamilies are rare in populations subject to Italian union and childbearing rates, while such family forms are more prevalent according to British rates, particularly when combined with out-of-union births. According to our microsimulation output for Great Britain only one-half of all the women with parity three would bear their children in just one single union for the most recent cohort.

Figure 4: Shares of women in stepfamilies or potential stepfamilies among women with three children



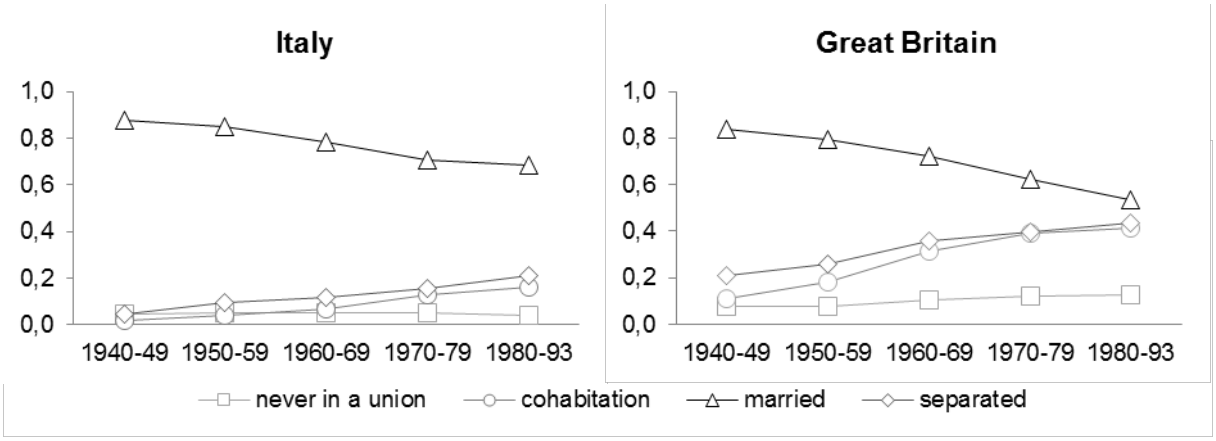

Note: Estimates from life histories of 50,000 women in each cohort generated by microsimulation.

Finally, Figure 5 shows the share of mothers ever in various union states according to the union and childbearing rates observed for Italian and British cohorts. Because of rising union dissolution rates, the share of separated mothers, expectedly, also increases in both countries, hitting 21.3 per cent in Italy and 43.4 per cent in Britain for the most recent cohort. Moreover, the share of mothers in unmarried cohabitation strongly increases, though the

Italian rates remain at a low level, while at the same time the share of married mothers decreases in both countries.

For the most recent cohort, the British rates would even imply almost equal shares of cohabiting and married mothers. A British peculiarity is the high level of pre-union childbearing; around 10 to 12 per cent of all mothers in recent cohorts would have at least one pre-union birth under British rates. According to the Italian rates, the latter figure just would amount to 4 to 5 per cent of all women.

Figure 5: Share of mothers in various union states




Note: Estimates from life histories of 50,000 women in each cohort generated by microsimulation.

## 6 Discussion

This paper aims at informing on future changes in family forms in selected European countries. As a starting point, we used the arguments of the 'low fertility' module of the IIASA–Oxford expert survey, which encompasses European fertility patterns, and their estimated impact on fertility (Lutz et al. 2014). The arguments ranked among the top three regarding their validity were associated with educational expansion, increasing postponement of parenthood and increasing prevalence of union dissolution and repartnering.

Based on the framework of Thomson et al. (2012), we developed a microsimulation model which simulates life courses of hypothetical women with up to four births and up to two unions, but additionally differentiating between unmarried cohabitation and marital unions, for data from Italy and Great Britain. Our estimates of the transition rates confirm the assessment of the experts; for younger cohorts, delayed childbearing as well as union disruptions and repartnering are more common than for their predecessors. While there was strong consensus among the experts on the impact of fertility of educational expansion and postponement of parenthood (which is assumed to be negative), the experts disagreed on the effect of union dissolution and repartnering on fertility.

Indeed partnership instability affects fertility in different ways. On the one hand, we find that birth rates are much higher in marriages and cohabitations than in periods out of a union, particularly for first and second births. Hence, a union disruption, i.e. cutting the total time spent in a union, reduces completed family size. On the other hand, union dissolution produces a pool of persons who may enter new partnerships and produce 'extra' children. Even more, if a new partnership is entered, birth risks are elevated if all the woman's children were born to previous (resident or non-resident) partners, i.e. the prospective birth would be the first in the stepfamily. However, the presence of children has also consequences on repartnering: First, women with prior children are less likely to form a further union. Even if new partnerships are formed, the latter are more fragile, as children born before the current union inflate separation risks of both cohabiting and marital unions, which might lessen the positive impact of further childbearing in stepfamilies on completed family size.

Overall, we reveal a net effect of union dissolution which is to decrease completed fertility by about 0.5 children for Italian and about 0.2 to 0.4 children for British cohorts. Our findings are in line with earlier studies on France using a similar framework (Thomson et al. 2012) and, albeit with different techniques, on Italy (Meggiolaro and Ongaro 2010) and France (Beaujouan 2010). Moreover, we find that despite increasing repartnering and childbearing in subsequent unions, the effect of union dissolution on fertility is larger for more recent cohorts than for women born in the 1940s. However, the latter may be explained by a changing composition of women regarding the number of children already born at separation. The earlier the union disruption occurs in the family stage, the stronger the completed fertility is reduced.

Similar to Thomson et al. (2012), our results highlight the role of timing, not only of separation, but also of union formation. Strikingly, we find that union dissolution reduces completed fertility levels more if unions are formed earlier rather than at later ages. In fact, when first union formation is delayed, the fertility of women is reduced regardless of whether the union endures or dissolves.

As expected, repartnering produces more children in new partnerships if the separation occurs earlier, not only in terms of age but also with respect to family stage, i.e. the number of children born before the separation. Nonetheless, it is only if separation takes place after the second birth and if all women repartner that additional childbearing would almost compensate for births lost due to union disruption. Hence, if first-time parents are likely to have two children together, repartnering succeeds to almost replace third and fourth children. Our microsimulation output estimates that about 14 per cent of all third children would be born in stepfamilies according to rates for the most recent British cohort.

Most strikingly, we revealed only small educational differences in the impact of union instability on fertility under Italian and British rates, where more highly educated women show only slightly higher reductions in completed fertility when unions dissolve in contrast

to intact unions. What seems to play here is that prolonged enrolment in education and a subsequent delayed entry into union and motherhood decrease fertility regardless of whether these unions are dissolved or not, and little difference is observed between highly educated women with and without union dissolution.

What seems striking as well is how similar the associations of union instability and fertility were despite the stark differences in the partnership and childbearing patterns between Italy and Great Britain. It seems that the commonalities in the transitions rates between union and parity status overshadowed the observed differences in the latter so that the dynamics of partnerships and childbearing eventually produced relatively similar fertility differences between family configurations across countries. In other words, it is what one might call "fundamentals" in childbearing and partnership behaviour where much of the similarity across countries arises as put by Thomson et al. (2014) in their study of multi-partner fertility in Australia, the United States, Norway, and Sweden.

The mechanisms of our microsimulation model allow us to draw inferences about the future development of fertility for the arguments with highest validity of the IIASA–Oxford expert survey on future demographic change. First and most importantly, if union formation and childbearing are delayed further, fertility levels will decrease regardless of whether unions endure or are dissolved. However, the difference in completed fertility levels between women with and without union dissolution is expected to be smaller according to our findings in the case of delayed childbearing. If union dissolution becomes more common, particularly at lower parities, that is for childless women or women with one child, the negative impact of union dissolution on fertility might still be reinforced. Even if all women were to repartner, our results show that additional childbearing in subsequent unions would only partly compensate for the births lost due to union disruption. Finally, educational expansion will decrease fertility levels due to longer enrolment in education and therefore delayed entry into unions and parenthood. Moreover, fertility might be reduced further by educational expansion in connection with increasing rates of union dissolution if highly educated women have relatively earlier separations in the family stage.

Beyond the impact of union instability on the sheer number of children, it is the family configurations in which these children are born and the consequences of the family dynamics for the children's well-being and life chances, which are highly relevant for policy makers. In fact, an accumulating body of research has documented negative associations of certain family forms and children's developmental outcomes (for a review see e.g. Amato 2000, 2010; Sigle-Rushton and McLanahan 2004; Garriga and Härkönen 2009; Amato and James 2010; McLanahan et al. 2013; Härkönen et al. 2017). Most notably, children who do not live with both biological parents fare worse than those who do in terms of psychological well-being, mental health, schooling, family relationships and labour market outcomes.

Moreover, recent qualitative research activities among stakeholders (Philipov et al. 2014, Mynarska et al. 2015; Riederer et al. 2017) emphasized the association of some family types

with particularly difficult conditions, exposing minors to *vulnerability*, that means "situations in families who are either potentially or currently disadvantaged" in terms of economic hardship, social exclusion, lack of stability, health problems, etc. (Philipov et al. 2014). Although it argued that no particular family configuration necessarily leads to vulnerability, there was a general consensus that some family forms are more at risk (Mynarska et al. 2015). Among the latter, non-traditional families, like cohabiting and non-cohabiting couples, and foremost, single parents, and various types related to divorce and separation (i.e. reconstituted families, but also families facing a risk of divorce), and lastly, large families were mentioned (Philipov et al. 2014, Mynarska et al. 2015; Riederer et al. 2017).

Single parenthood encompasses not only mothers whose partnership has been dissolved but also women who had given birth before they ever entered a union, if any. In particular, pre-union childbearing is elevated in Great Britain compared to many other European countries, but according to our microsimulation output, the share of all British mothers ever experiencing a pre-union birth would slightly rise across cohorts. In contrast, pre-union childbearing is expected to be stable at a low level in Italy.

However, the share of mothers having a union disruption is expected to strongly increase across cohorts for both countries, even exceeding 40 per cent of all mothers in Great Britain. Due the spread of cohabitation, the increase is not only brought by rising divorce rates but also by separations of unmarried cohabitation, which displayed a dissolution risk around two to five times higher than married couples in the regressions. Similarly, reconstituted families face higher disruption rates than partnerships with children only born in the current union, according to our estimates.

Lastly, large families were identified to be closer to vulnerability and social exclusion (Philipov et al. 2014, p.28). Our microsimulation results yielded that the number of women having three or more children actually declines across cohorts for both countries and regardless whether a union dissolution occurs or not. However, our analysis demonstrates that the share of women in a stepfamily constellation will increase among women in large families. Even more, the estimated share of women in stepfamilies might be underestimated as we do not model the market of men with whom separated women repartner. If they form new partnerships with fathers, the share of reconstituted families might be larger. On the other hand, if the combined parity is higher, the stepfamily couple will be less likely to have another child. In general, our simulation results are based on the experience of women only. Thomson et al. (2012) argue that the primary difference which might be expected between the transition rates of the simulation model is that the presence of children might inhibit repartnering and childbearing in subsequent unions less for fathers as children are less likely to live with their father after separation, Hence, a simulation for men with high rates of separation and repartnering might produce as many or more children than for men who do not separate or repartner, as has been found to some extent for remarried men in Europe (van Bavel et al. 2012).

Finally, the use of microsimulation techniques enabled us to explore the topic of partnership dynamics and childbearing in an innovative and holistic way. Differently from previous research, we explicitly address the interdependencies of the family life course transitions and eventually produce simulated completed fertility under different family pathways. This approach is particularly relevant in policy settings where it is necessary to provide policy makers with straightforward indicators.

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# Appendix A

**Table A.1:** Estimated relative risks for conception of first birth, Italy

| | | Base model | Education model |
|---|---|---|---|
| Union status | | | |
| | Never in union | 0.032*** | 0.035*** |
| | First cohabitation | 0.323*** | 0.339*** |
| | First marriage | 1 | 1 |
| | After first union | 0.059*** | 0.060*** |
| | Second cohabitation | 0.432*** | 0.437*** |
| | Second marriage | 0.863 | 0.917 |
| | After second unions | 0.142*** | 0.142*** |
| Union duration | | 0.234*** | 0.227*** |
| Union duration x birth cohort | | | |
| | 1940-49 | 0.616*** | 0.606*** |
| | 1950-59 | 1 | 1 |
| | 1960-69 | 1.593*** | 1.609*** |
| | 1970-93 | 2.032*** | 2.076*** |
| Never in union x birth cohort | | | |
| | 1940-49 | 0.826*** | 0.806*** |
| | 1950-59 | | 1 |
| | 1960-69 | 0.788*** | 0.794*** |
| | 1970-79 | 0.658*** | 0.702*** |
| | 1980-93 | 0.537*** | 0.617*** |
| Education | | | |
| | Low | | 1.264*** |
| | Medium | | 1 |
| | High | | 1.073*** |
| Enrolment | | | |
| | Enrolled | | 0.481*** |
| | Left school | | 1 |
| Subjects | | 30,255 | 30,255 |
| df | | 24 | 27 |
| Log-likelihood | | -50,587 | -50,202 |
| BIC | | 101,421 | 100,682 |

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Relative risk of birth cohort is incorporated in estimated values of the cohort-specific baseline hazard rate in Table A.2.

**Table A.2:** Estimated cohort-specific baseline hazard of conceiving a first birth, Italy

| | Base model | | | | | Education model | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Age | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93 | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93 |
| 15-16 | 0.151 | 0.190 | 0.170 | 0.111 | 0.114 | 0.136 | 0.183 | 0.173 | 0.117 | 0.118 |
| 16-17 | 0.319 | 0.377 | 0.329 | 0.221 | 0.225 | 0.281 | 0.354 | 0.324 | 0.225 | 0.227 |
| 17-18 | 0.554 | 0.613 | 0.522 | 0.360 | 0.367 | 0.478 | 0.564 | 0.500 | 0.356 | 0.358 |
| 18-19 | 0.740 | 0.768 | 0.638 | 0.451 | 0.461 | 0.619 | 0.684 | 0.588 | 0.429 | 0.432 |
| 19-20 | 0.923 | 0.898 | 0.727 | 0.529 | 0.540 | 0.756 | 0.784 | 0.654 | 0.489 | 0.492 |
| 20-21 | 0.937 | 0.855 | 0.676 | 0.505 | 0.516 | 0.772 | 0.750 | 0.608 | 0.465 | 0.468 |
| 21-22 | 0.980 | 0.839 | 0.647 | 0.496 | 0.507 | 0.818 | 0.744 | 0.585 | 0.459 | 0.462 |
| 22-23 | 0.990 | 0.794 | 0.597 | 0.471 | 0.481 | 0.834 | 0.711 | 0.543 | 0.436 | 0.439 |
| 23-24 | 0.996 | 0.750 | 0.550 | 0.446 | 0.455 | 0.852 | 0.680 | 0.504 | 0.415 | 0.417 |
| 24-25 | 0.944 | 0.667 | 0.477 | 0.397 | 0.405 | 0.815 | 0.610 | 0.438 | 0.369 | 0.372 |
| 25-26 | 0.958 | 0.682 | 0.501 | 0.431 | 0.440 | 0.832 | 0.626 | 0.464 | 0.403 | 0.405 |
| 26-28 | 0.908 | 0.652 | 0.493 | 0.437 | 0.446 | 0.797 | 0.604 | 0.460 | 0.412 | 0.415 |
| 28-30 | 0.852 | 0.621 | 0.498 | 0.470 | 0.480 | 0.754 | 0.578 | 0.467 | 0.444 | 0.447 |
| 30-32 | 0.792 | 0.586 | 0.497 | 0.500 | 0.510 | 0.698 | 0.541 | 0.464 | 0.468 | 0.471 |
| 32-34 | 0.631 | 0.475 | 0.426 | 0.456 | 0.466 | 0.556 | 0.436 | 0.397 | 0.424 | 0.427 |
| 34-36 | 0.552 | 0.422 | 0.400 | 0.457 | 0.466 | 0.484 | 0.385 | 0.371 | 0.421 | 0.424 |
| 36-38 | 0.368 | 0.286 | 0.287 | 0.349 | 0.356 | 0.321 | 0.258 | 0.264 | 0.318 | 0.320 |
| 38-41 | 0.208 | 0.164 | 0.174 | 0.225 | 0.230 | 0.181 | 0.147 | 0.159 | 0.204 | 0.205 |
| 41-43 | 0.105 | 0.085 | 0.099 | 0.140 | 0.143 | 0.092 | 0.076 | 0.090 | 0.126 | 0.127 |
| 43-49 | 0.010 | 0.008 | 0.010 | 0.015 | 0.016 | 0.009 | 0.007 | 0.009 | 0.014 | 0.014 |

**Table A.3:** Estimated relative risk of conceiving a second birth, Italy

| | Base model | Education model |
|---|---|---|
| Union/birth history | | |
| Not in union | 0.249*** | 0.248*** |
| In first-birth union | 1 | 1 |
| In union, 1st birth before union | 1.700*** | 1.703*** |
| In union, 1st birth in previous union | 1.217*** | 1.217*** |
| Education | | |
| Low | | 1.043** |
| Medium | | 1 |
| High | | 1.301*** |
| Enrolment | | |
| Enrolled | | 1.003 |
| Left school | | 1 |
| Subjects | 19,232 | 19,232 |
| Df | 23 | 26 |
| Log-likelihood | -38,305 | -38,270 |
| BIC | 76,838 | 76,796 |

* p < 0.1, ** p < 0.05, *** p < 0.01

Note: Relative risk of age of woman by cohort is tabulated in Table A.4 and relative risk of birth cohort is incorporated in estimated values of the cohort-specific baseline hazard rate in Table A.5.

**Table A.4:** Estimated cohort-specific relative risk of age of woman on conception of second birth, Italy

| | Base model | | | | Education model | | | |
|---|---|---|---|---|---|---|---|---|
| Age of woman | 1940-49 | 1950-59 | 1960-69 | 1970-93 | 1940-49 | 1950-59 | 1960-69 | 1970-93 |
| 15-19 | 1.41 | 1.54 | 1.49 | 1.01 | 1.42 | 1.56 | 1.49 | 1.01 |
| 20-24 | 1.17 | 1.22 | 1.20 | 0.99 | 1.18 | 1.23 | 1.21 | 0.99 |
| 25-29 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 30-34 | 0.69 | 0.85 | 0.97 | 1.11 | 0.68 | 0.84 | 0.95 | 1.08 |
| 35-39 | 0.38 | 0.58 | 0.76 | 0.99 | 0.38 | 0.56 | 0.73 | 0.94 |
| 40-49 | 0.07 | 0.13 | 0.19 | 0.28 | 0.07 | 0.12 | 0.18 | 0.26 |

**Table A.5:** Estimated cohort-specific baseline hazard rate of conceiving a second child, Italy

| | Base model | | | | Education model | | | |
|---|---|---|---|---|---|---|---|---|
| Age of first child | 1940-49 | 1950-59 | 1960-69 | 1970-93 | 1940-49 | 1950-59 | 1960-69 | 1970-93 |
| 0-1 | 0.152 | 0.097 | 0.083 | 0.084 | 0.145 | 0.092 | 0.080 | 0.080 |
| 1-2 | 0.232 | 0.164 | 0.149 | 0.159 | 0.222 | 0.156 | 0.144 | 0.153 |
| 2-3 | 0.251 | 0.197 | 0.189 | 0.214 | 0.241 | 0.188 | 0.183 | 0.207 |
| 3-4 | 0.262 | 0.227 | 0.232 | 0.277 | 0.251 | 0.218 | 0.225 | 0.270 |
| 4-5 | 0.233 | 0.203 | 0.209 | 0.248 | 0.224 | 0.196 | 0.203 | 0.242 |
| 5-6 | 0.181 | 0.157 | 0.163 | 0.192 | 0.173 | 0.152 | 0.160 | 0.187 |
| 6-7 | 0.157 | 0.137 | 0.144 | 0.168 | 0.151 | 0.133 | 0.141 | 0.164 |
| 7-8 | 0.136 | 0.119 | 0.126 | 0.145 | 0.131 | 0.116 | 0.123 | 0.142 |
| 8-10 | 0.096 | 0.084 | 0.090 | 0.103 | 0.093 | 0.083 | 0.089 | 0.101 |
| 10-15 | 0.048 | 0.042 | 0.046 | 0.052 | 0.047 | 0.042 | 0.046 | 0.051 |
| 15-20 | 0.024 | 0.021 | 0.024 | 0.026 | 0.023 | 0.021 | 0.024 | 0.026 |
| 20-34 | 0.010 | 0.009 | 0.010 | 0.011 | 0.009 | 0.009 | 0.010 | 0.010 |

**Table A.6:** Estimated relative risk of conceiving a third birth, Italy

| | Base model | Education model |
|---|---|---|
| Union/birth history | | |
| Not in union | 0.617*** | 0.626*** |
| In first-birth union | 1 | 1 |
| In 2nd-birth union, 1st birth before union | 1.259*** | 1.256*** |
| In union, all births before union | 2.769*** | 2.735*** |
| Birth Cohort | | |
| 1940-49 | 1.258*** | 1.223*** |
| 1950-59 | 1 | 1 |
| 1960-69 | 0.999 | 1.017 |
| 1970-93 | 1.209** | 1.242** |
| Education | | |
| Low | | 1.246*** |
| Medium | | 1 |
| High | | 1.449*** |
| Subjects | 13,100 | 13,100 |
| df | 16 | 18 |
| Log-likelihood | -15,567 | -15,549 |
| BIC | 31,286 | 31,268 |

* p < 0.1, ** p < 0.05, *** p < 0.01

Note: Relative risk of age of woman by cohort is tabulated in Table A.7.

**Table A.7:** Estimated cohort-specific relative risk of age of woman on conception of third birth, Italy

| | Base Model | | | | Education Model | | | |
|---|---|---|---|---|---|---|---|---|
| Age of woman | 1940-49 | 1950-59 | 1960-69 | 1970-93 | 1940-49 | 1950-59 | 1960-69 | 1970-93 |
| 15-24 | 4.09 | 2.69 | 2.19 | 1.77 | 4.09 | 2.69 | 2.19 | 1.77 |
| 25-29 | 1.82 | 1.48 | 1.33 | 1.20 | 1.82 | 1.48 | 1.33 | 1.20 |
| 30-34 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 35-39 | 0.41 | 0.55 | 0.60 | 0.78 | 0.41 | 0.55 | 0.60 | 0.78 |
| 40-49 | 0.07 | 0.13 | 0.16 | 0.27 | 0.07 | 0.13 | 0.16 | 0.27 |

**Table A.8:** Estimated baseline hazard rate of conceiving a third child, Italy

| Age of second child | Base model | Education model |
|---|---|---|
| 0-1 | 0.023 | 0.020 |
| 1-2 | 0.035 | 0.030 |
| 2-3 | 0.038 | 0.032 |
| 3-4 | 0.041 | 0.035 |
| 4-5 | 0.037 | 0.032 |
| 5-6 | 0.038 | 0.032 |
| 6-7 | 0.032 | 0.027 |
| 7-8 | 0.032 | 0.027 |
| 8-10 | 0.030 | 0.025 |
| 10-15 | 0.020 | 0.017 |
| 15-34 | 0.005 | 0.005 |

**Table A.9:** Estimated relative risk of conceiving a fourth birth, Italy

| | Base model | Education model |
|---|---|---|
| Union/birth status | | |
| Not in union | 0.530*** | 0.532*** |
| In first-birth union | 1 | 1 |
| In 2nd-, 3rd-birth union, 1st birth before union | 0.956 | 0.964 |
| In 3rd-birth union, 1st and 2nd birth before current union | 2.185*** | 2.200*** |
| In union, all births before union | 2.233** | 2.248** |
| Birth cohort | | |
| 1940-49 | 1.576*** | 1.585*** |
| 1950-59 | 1 | 1 |
| 1960-93 | 1.185** | 1.187** |
| Age of mother | | |
| 15-24 | 4.381*** | 4.472*** |
| 25-29 | 1.987*** | 2.017*** |
| 30-34 | 1 | 1 |
| 35-39 | 0.494*** | 0.485*** |
| 40-49 | 0.114*** | 0.109*** |
| Education | | |
| Low | | 0.988 |
| Medium | | 1 |
| High | | 1.497** |
| Subjects | 3,652 | 3,652 |
| Df | 10 | 12 |
| Log-likelihood | -3,607 | -3,605 |
| BIC | 7,296 | 7,309 |

* p < 0.1, ** p < 0.05, *** p < 0.01

**Table A.10:** Estimated baseline hazard rate of conceiving a fourth child, Italy

| Age of third child | Base model | Education model |
|---|---|---|
| 0-1 | 0.021 | 0.021 |
| 1-2 | 0.025 | 0.025 |
| 2-3 | 0.032 | 0.032 |
| 3-5 | 0.030 | 0.029 |
| 5-8 | 0.027 | 0.027 |
| 8-10 | 0.027 | 0.027 |
| 10-15 | 0.014 | 0.014 |
| 15-20 | 0.007 | 0.007 |
| 20-34 | 0.004 | 0.004 |

**Table A.11:** Estimated relative competing risk of entering a first cohabitation or marriage, Italy

| | Base model | | Education model | |
|---|---|---|---|---|
| | Cohabitation | Marriage | Cohabitation | Marriage |
| Union/birth history | | | | |
| Childless | 1 | 1 | 1 | 1 |
| Pregnant with 1st child | 13.809*** | 22.318*** | 13.075*** | 19.939*** |
| One child | | | | |
| Age <=1 yr. | 8.750*** | 4.888*** | 8.456*** | 4.328*** |
| Age >1 yr. | 2.024*** | | 2.051*** | |
| Age 1-3 yrs. | | 1.537*** | | 1.362*** |
| Age 3-7 yrs. | | 0.886 | | 0.796** |
| Age >7 yrs. | | 0.667*** | | 0.631*** |
| Pregnant with 2nd or more child | 3.690*** | 6.494*** | 3.689*** | 5.593*** |
| Two and more children | 1.712** | 1.428*** | 1.796** | 1.281** |
| Birth Cohort | | | | |
| 1940-49 | 0.407*** | a | 0.408*** | a |
| 1950-59 | 1 | | 1 | |
| 1960-69 | 1.427*** | | 1.441*** | |
| 1970-79 | 2.212*** | | 2.299*** | |
| 1980-93 | 2.682*** | | 2.798*** | |
| Education | | | | |
| Low | | | 0.897*** | 1.292*** |
| Medium | | | 1 | 1 |
| High | | | 1.285*** | 1.180*** |
| Enrolment | | | | |
| Enrolled | | | 0.459*** | 0.298*** |
| Left school | | | 1 | 1 |
| Subjects | 30,255 | | 30,255 | |
| Events | 2,592 | 19,598 | 2,592 | 19,598 |
| df | 25 | | 31 | |
| Log-likelihood | -72,713 | | -71,407 | |
| BIC | 145,683 | | 143,133 | |

* p < 0.1, ** p < 0.05, *** p < 0.01

Note: Relative risk of birth cohort is incorporated in non-proportional baseline hazard by cohort (see Table A.12).

**Table A.12:** Estimated baseline hazard rate of entering a cohabitation or marriage (by cohort), Italy

| | Base model | | | | | | Education model | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cohabitation | Marriage | | | | | Cohabitation | Marriage | | | | |
| Age | Baseline | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93 | Baseline | 1940-49 | 1950-59 | 1960-69 | 1970-79 | 1980-93 |
| 15-16 | 0.001 | 0.005 | 0.007 | 0.004 | 0.001 | 0.001 | 0.001 | 0.005 | 0.008 | 0.005 | 0.002 | 0.002 |
| 16-17 | 0.001 | 0.010 | 0.014 | 0.008 | 0.002 | 0.002 | 0.002 | 0.010 | 0.016 | 0.009 | 0.003 | 0.003 |
| 17-18 | 0.002 | 0.025 | 0.032 | 0.018 | 0.006 | 0.006 | 0.003 | 0.024 | 0.035 | 0.021 | 0.008 | 0.008 |
| 18-19 | 0.003 | 0.047 | 0.055 | 0.032 | 0.011 | 0.011 | 0.004 | 0.044 | 0.058 | 0.036 | 0.014 | 0.014 |
| 19-20 | 0.003 | 0.069 | 0.076 | 0.045 | 0.017 | 0.017 | 0.004 | 0.063 | 0.077 | 0.048 | 0.020 | 0.020 |
| 20-21 | 0.004 | 0.104 | 0.106 | 0.066 | 0.025 | 0.025 | 0.005 | 0.093 | 0.105 | 0.068 | 0.030 | 0.030 |
| 21-22 | 0.005 | 0.129 | 0.123 | 0.079 | 0.033 | 0.033 | 0.005 | 0.117 | 0.122 | 0.081 | 0.037 | 0.037 |
| 22-23 | 0.005 | 0.144 | 0.128 | 0.085 | 0.037 | 0.037 | 0.006 | 0.133 | 0.128 | 0.087 | 0.042 | 0.042 |
| 23-24 | 0.008 | 0.176 | 0.157 | 0.108 | 0.053 | 0.053 | 0.009 | 0.163 | 0.156 | 0.111 | 0.058 | 0.058 |
| 24-25 | 0.009 | 0.169 | 0.149 | 0.108 | 0.058 | 0.058 | 0.009 | 0.155 | 0.148 | 0.110 | 0.063 | 0.063 |
| 25-26 | 0.009 | 0.166 | 0.146 | 0.111 | 0.065 | 0.065 | 0.010 | 0.151 | 0.142 | 0.110 | 0.069 | 0.069 |
| 26-28 | 0.012 | 0.165 | 0.145 | 0.115 | 0.075 | 0.075 | 0.012 | 0.147 | 0.138 | 0.112 | 0.077 | 0.077 |
| 28-30 | 0.013 | 0.125 | 0.109 | 0.095 | 0.075 | 0.075 | 0.013 | 0.111 | 0.102 | 0.091 | 0.074 | 0.074 |
| 30-32 | 0.016 | 0.099 | 0.086 | 0.082 | 0.078 | 0.078 | 0.016 | 0.086 | 0.079 | 0.077 | 0.074 | 0.074 |
| 32-34 | 0.014 | 0.072 | 0.062 | 0.065 | 0.076 | 0.076 | 0.014 | 0.063 | 0.057 | 0.061 | 0.070 | 0.070 |
| 34-36 | 0.012 | 0.051 | 0.044 | 0.051 | 0.071 | 0.071 | 0.012 | 0.045 | 0.040 | 0.046 | 0.064 | 0.064 |
| 36-38 | 0.012 | 0.035 | 0.030 | 0.038 | 0.064 | 0.064 | 0.012 | 0.030 | 0.027 | 0.034 | 0.056 | 0.056 |
| 38-40 | 0.010 | 0.020 | 0.017 | 0.024 | 0.049 | 0.049 | 0.010 | 0.017 | 0.015 | 0.021 | 0.041 | 0.041 |
| 40-49 | 0.006 | 0.013 | 0.011 | 0.017 | 0.043 | 0.043 | 0.006 | 0.012 | 0.010 | 0.015 | 0.035 | 0.035 |

**Table A.13:** Estimated relative competing risk of marrying or separating in a first cohabitation, Italy

| | Base model | | Education model | |
|---|---|---|---|---|
| | Marriage | Separation | Marriage | Separation |
| Union/birth history | | | | |
| Childless | 1 | 1 | 1 | 1 |
| No shared birth | 0.758** | 0.633** | 0.790* | 0.699* |
| One or more shared births | 0.629* | 0.186*** | 0.671* | 0.212** |
| All births shared | 0.885* | 0.536*** | 0.892* | 0.563*** |
| Pregnancy | | | | |
| Not pregnant | 1 | 1 | 1 | 1 |
| Pregnant | 2.911*** | 0.405*** | 2.911*** | 0.422*** |
| Age of mother | | | | |
| 15-19 | 1.138 | 1.080 | 1.315*** | 1.278 |
| 20-24 | 1.074 | 1.095 | 1.167** | 1.154 |
| 25-29 | 1 | | 1 | 1 |
| 30-34 | 0.890* | 1.112 | 0.842** | 1.094 |
| 35-39 | 0.716*** | 1.190 | 0.656*** | 1.157 |
| 40-44 | 0.581*** | 1.142 | 0.525*** | 1.109 |
| 45-49 | 0.474*** | 1.222 | 0.418*** | 1.190 |
| Birth Cohort | | | | |
| 1940-49 | 0.831* | 0.723* | 0.852* | 0.770 |
| 1950-59 | 1 | 1 | 1 | 1 |
| 1960-69 | 1.054 | 1.074 | 1.039 | 1.092 |
| 1970-79 | 0.942 | 1.424*** | 0.911 | 1.425*** |
| 1980-93 | 0.811** | 1.377** | 0.783** | 1.386** |
| Education | | | | |
| Low | | | 0.889** | 0.750*** |
| Medium | | | 1 | 1 |
| High | | | 1.353*** | 1.129 |
| Enrolment | | | | |
| Enrolled | | | 0.625*** | 1.189 |
| Left school | | | 1 | 1 |
| Subjects | 2,592 | | 2,592 | |
| Events | 1,374 | 595 | 1,374 | 595 |
| df | 28 | | 34 | |
| Log-likelihood | -6,045 | | -6,020 | |
| BIC | 12,311 | | 12,307 | |

* p < 0.1, ** p < 0.05, *** p < 0.01

**Table A.14:** Estimated baseline hazard rate of marrying or separating in a first cohabitation, Italy

| | Base model | | Education model | |
|---|---|---|---|---|
| Union duration | Marriage | Separation | Marriage | Separation |
| 0-2 | 0.169 | 0.056 | 0.173 | 0.056 |
| 2-4 | 0.151 | 0.071 | 0.156 | 0.073 |
| 4-6 | 0.140 | 0.084 | 0.147 | 0.088 |
| 6-8 | 0.085 | 0.055 | 0.091 | 0.058 |
| 8-10 | 0.094 | 0.026 | 0.101 | 0.028 |
| 10-15 | 0.110 | 0.046 | 0.121 | 0.050 |
| 15-34 | 0.070 | 0.046 | 0.081 | 0.051 |

**Table A.15:** Estimated relative risk of separation of a first marital union, Italy

| | | Base model | Education model |
|---|---|---|---|
| Union/birth history | | | |
| | Childless | 1 | 1 |
| | No shared birth | 1.436*** | 1.523*** |
| | One or more shared births | | |
| | Parity 2 | 0.467*** | 0.541*** |
| | Parity 3 | 0.751 | 0.941 |
| | All births shared | | |
| | Parity 1 | 0.499*** | 0.523*** |
| | Parity 2 | 0.287*** | 0.306*** |
| | Parity 3 | 0.257*** | 0.288*** |
| Pregnancy | | | |
| | Not pregnant | 1 | 1 |
| | Pregnant | 0.600*** | 0.613*** |
| Age | | | |
| | 15-19 | 1.283* | 1.608*** |
| | 20-24 | 1.132* | 1.262*** |
| | 25-29 | 1 | 1 |
| | 30-49 | 0.966 | 0.881** |
| Birth cohort | | | |
| | 1940-49 | 0.472*** | 0.524*** |
| | 1950-59 | 1 | 1 |
| | 1960-69 | 1.471*** | 1.440*** |
| | 1970-79 | 2.202*** | 2.101*** |
| | 1980-93 | 3.427*** | 3.227*** |
| Education | | | |
| | Low | | 0.615*** |
| | Medium | | 1 |
| | High | | 1.126* |
| Enrolment | | | |
| | Enrolled | | 2.126*** |
| | Left school | | 1 |
| Subjects | | 20,972 | 20,972 |
| Events | | 1,806 | 1,806 |
| df | | 14 | 17 |
| Log-likelihood | | -10,931 | -10,857 |
| BIC | | 22,002 | 21,883 |

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A.16:** Estimated baseline hazard rate of separation of a first marital union, Italy

| Marriage duration | Base model | Education model |
|---|---|---|
| 0-2 | 0.008 | 0.009 |
| 2-4 | 0.008 | 0.009 |
| 4-6 | 0.010 | 0.012 |
| 6-15 | 0.012 | 0.015 |
| 15-34 | 0.011 | 0.015 |

**Table A.17:** Estimated relative competing risk of entering a second cohabitation or marriage, Italy

| | Base model | | Education model | |
|---|---|---|---|---|
| | Cohabitation | Marriage | Cohabitation | Marriage |
| Union/birth history | | | | |
| Childless | 1 | 1 | 1 | 1 |
| All births in previous union | | | | |
| One child | 0.692*** | 0.448*** | 0.689*** | 0.464*** |
| Two children | 0.400*** | 0.421*** | 0.398*** | 0.437*** |
| Three children | 0.246*** | 0.447** | 0.245*** | 0.474* |
| At least one out of union | | | | |
| One child | 0.510*** | 0.627** | 0.508*** | 0.646* |
| Two children | 0.500*** | 0.742 | 0.496*** | 0.773 |
| Three children | 0.676* | 0.316* | 0.668* | 0.339* |
| Pregnancy | | | | |
| Not pregnant | 1 | 1 | 1 | 1 |
| Pregnant | 4.601*** | 12.519*** | 4.582*** | 12.711*** |
| Birth Cohort | | | | |
| 1940-49 | 0.829* | 0.600** | 0.822* | 0.623** |
| 1950-59 | 1 | 1 | 1 | 1 |
| 1960-69 | 1.343*** | 0.749* | 1.347*** | 0.739* |
| 1970-93 | 1.762*** | 0.997 | 1.771*** | 0.979 |
| Age | | | | |
| 15-29 | 1.436*** | 1.353* | 1.437*** | 1.375* |
| 30-39 | 1 | 1 | 1 | 1 |
| 40-49 | 0.574*** | 0.468*** | 0.574*** | 0.464*** |
| Education | | | | |
| Low | | | 1.063 | 0.802 |
| Medium | | | 1 | 1 |
| High | | | 1.094 | 0.880 |
| Subjects | 3,076 | | 3,076 | |
| Events | 728 | 166 | 728 | 166 |
| df | 24 | | 28 | |
| Log-likelihood | -3,914 | | -3,913 | |
| BIC | 8,021 | | 8,051 | |

* p < 0.1, ** p < 0.05, *** p < 0.01

**Table A.18:** Estimated baseline hazard rate of entering a second cohabitation or marriage, Italy

| | Base model | | Education model | |
|---|---|---|---|---|
| Time since end of first union | Cohabitation | Marriage | Cohabitation | Marriage |
| 0-2 | 0.042 | 0.006 | 0.041 | 0.007 |
| 2-4 | 0.045 | 0.014 | 0.043 | 0.015 |
| 4-6 | 0.045 | 0.014 | 0.044 | 0.015 |
| 6-8 | 0.036 | 0.017 | 0.035 | 0.018 |
| 8-15 | 0.028 | 0.018 | 0.027 | 0.020 |
| 15-20 | 0.029 | 0.024 | 0.028 | 0.027 |
| 20-25 | 0.034 | 0.013 | 0.033 | 0.014 |
| 25-34 | 0.034 | 0.000 | 0.033 | 0.000 |

**Table A.19:** Estimated relative competing risk of marrying or separating in second cohabitation, Italy

| | Base model | | Education model | |
|---|---|---|---|---|
| | Marriage | Separation | Marriage | Separation |
| Union/birth history | | | | |
| Childless | 1 | 1 | 1 | 1 |
| No shared birth | 0.809 | 0.617*** | 0.896 | 0.648** |
| One or more shared births | 0.922 | 0.398*** | 0.995 | 0.413*** |
| All births shared | 0.969 | 0.267*** | 1.019 | 0.273*** |
| Pregnancy | | | | |
| Not pregnant | 1 | 1 | 1 | 1 |
| Pregnant | 2.036*** | 0.083*** | 2.013*** | 0.082*** |
| Age of mother | | | | |
| 15-29 | 1.091 | 1.044 | 1.180 | 1.070 |
| 30-34 | 1 | 1 | 1 | 1 |
| 40-49 | 0.707** | 0.641** | 0.666** | 0.631** |
| Birth cohort | | | | |
| 1940-49 | 0.740* | 0.771 | 0.754 | 0.786 |
| 1950-59 | 1 | 1 | 1 | 1 |
| 1960-69 | 1.123 | 1.210 | 1.136 | 1.230 |
| 1970-93 | 0.989 | 1.395* | 0.992 | 1.419* |
| Education | | | | |
| Low | | | 0.611*** | 0.788* |
| Medium | | | 1 | 1 |
| High | | | 1.320* | 1.199 |
| Subjects | | 728 | | 728 |
| Events | 239 | 162 | 239 | 162 |
| df | | 18 | | 22 |
| Log-likelihood | | -1,500 | | -1,489 |
| BIC | | 3,118 | | 3,123 |

* p < 0.1, ** p < 0.05, *** p < 0.01

**Table A.20:** Estimated baseline hazard rate of marrying or separating in a second cohabitation, Italy

| | Base model | | Education model | |
|---|---|---|---|---|
| Union duration | Marriage | Separation | Marriage | Separation |
| 0-1 | 0.057 | 0.064 | 0.061 | 0.065 |
| 1-2 | 0.069 | 0.064 | 0.074 | 0.066 |
| 2-4 | 0.078 | 0.083 | 0.085 | 0.087 |
| 4-8 | 0.086 | 0.081 | 0.097 | 0.086 |
| 8-12 | 0.093 | 0.091 | 0.110 | 0.099 |
| 12-15 | 0.075 | 0.074 | 0.091 | 0.082 |
| 15-34 | 0.065 | 0.104 | 0.093 | 0.123 |

**Table A.21:** Estimated relative risk of separation of a second marital union, Italy

| | | Base model | Education model |
|---|---|---|---|
| Union/birth history | | | |
| | Childless | 1 | 1 |
| | No shared birth | 0.578 | 0.626 |
| | One or more shared births | 0.484* | 0.532* |
| | All births shared | 0.526* | 0.550* |
| Pregnancy | | | |
| | Not pregnant | 1 | 1 |
| | Pregnant | 0.241* | 0.241* |
| Age | | | |
| | 15-29 | 1.435 | 1.475 |
| | 30-39 | 1 | 1 |
| | 40-49 | 0.882 | 0.898 |
| Birth cohort | | | |
| | 1940-49 | 1.050 | 1.142 |
| | 1950-59 | 1 | 1 |
| | 1960-69 | 0.899 | 0.876 |
| | 1970-93 | 1.446 | 1.509 |
| Education | | | |
| | Low | | 0.711 |
| | Medium | | 1 |
| | High | | 1.236 |
| Subjects | | 405 | 405 |
| Events | | 42 | 42 |
| df | | 9 | 11 |
| Log-likelihood | | -214 | -213 |
| BIC | | 482 | 492 |

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Table A.22:** Estimated baseline hazard rate of separation of a second marital union, Italy

| Marriage duration | Base model | Education model |
|---|---|---|
| 0-1 | 0.041 | 0.041 |
| 1-2 | 0.030 | 0.031 |
| 2-4 | 0.024 | 0.024 |
| 4-7 | 0.015 | 0.015 |
| 7-10 | 0.015 | 0.015 |
| 10-15 | 0.018 | 0.018 |
| 15-34 | 0.010 | 0.009 |

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