

A Service of



Leibniz-Informationszentrum Wirtschaft Leibniz Information Centre for Economics

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

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

Vienna Institute of Demography Working Papers, No. 08/2017

Provided in Cooperation with: Vienna Institute of Demography (VID), Austrian Academy of Sciences

Suggested Citation: Winkler-Dworak, Maria; Beaujouan, Eva; Di Giulio, Paola; Spielauer, Martin (2017) : Union Instability and Fertility: A Microsimulation Model for Italy and Great Britain, Vienna Institute of Demography Working Papers, No. 08/2017, Austrian Academy of Sciences (ÖAW), Vienna Institute of Demography (VID), Vienna, https://doi.org/10.1553/0x003ccffe

This Version is available at: https://hdl.handle.net/10419/175540

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



WWW.ECONSTOR.EU



VIENNA INSTITUTE OF DEMOGRAPHY WORKING PAPERS

AUSTRIAN ACADEMY OF SCIENCES

08/2017

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

MARIA WINKLER-DWORAK, EVA BEAUJOUAN, PAOLA DI GIULIO AND MARTIN SPIELAUER

> Vienna Institute of Demography Austrian Academy of Sciences Welthandelsplatz 2, Level 2 | 1020 Wien, Österreich vid@oeaw.ac.at | www.oeaw.ac.at/vid



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.

Authors

Maria Winkler-Dworak (corresponding author), Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography/Austrian Academy of Sciences. Email: <u>maria.winkler-dworak@oeaw.ac.at</u>

Eva Beaujouan, Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography/Austrian Academy of Sciences. Email: <u>eva.beaujouan@oeaw.ac.at</u>

Paola Di Giulio, Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography/Austrian Academy of Sciences. Email: <u>paola.digiulio@oeaw.ac.at</u>

Martin Spielauer, Austrian Institute of Economic Research. Email: <u>martin.spielaeuer@wifo.ac.at</u>

Acknowledgements

The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 320116 for the research project FamiliesAndSocieties. Eva Beaujouan's research was supported by the

European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC Grant agreement n° 284238 (EURREP). We thank the Non-marital Childbearing Network (www.nonmarital.org) and the Italian National Statistical Institute (Istat) for providing data from the surveys on "Famiglia, soggetti sociali e condizione dell'infanzia" 2003 and 2009. Istat is not responsible for any results obtained from the data. We are also grateful for the provision of the British General Household Survey ESRC CPC series, which was constructed and made available by the ESRC Centre for Population Change. Moreover, we are thankful to Statistics Canada for the use of the Modgen software.

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.

Argument	Validity	Mean Net	Index of
	Score	Impact	Disagreement
'More young adult years enrolled in education and	0.78	-0.26	0.03
training'			
'Delayed childbearing yet more common'	0.75	-0.23	0.12
'Partnership dissolution and repartnering more	0.73	0.00	0.85
common'			
Source: Baston et al. (2014) Zoman (2014)			

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

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.

		Italy		(Great Britai	n
	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%

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

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 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 durationcohort 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.

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	
		Gre	eat Britain			
Intact	2.25	2.19	2.18	2.08	2.09	
Dissolved	2.02	1.92	1.91	1.77	1.72	

Table 3: Expected completed fertility by union dissolution and cohort

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.

By cohort age-specific birth/union rates						
		1940-49	1950-59	1960-69	1970-79	1980-
						93/4
		Italy				
1 st births befor	e 1 st union	2.32	2.08	2.00	1.97	1.98
1 st births in/aft	er first union	2.14	2.00	1.94	1.96	1.95
Separations oc	cur 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
		Creat Pr	itain			
1st binths bofon	a 1st union		11.alli 2.20	2 4 2	2.44	∩ 40
1 st births befor	e 1 st union	2.44 2.20	2.39	2.43	2.44 2.10	2.42
		2.30	2.22	2.10	2.10	2.08
Separations oc	cur while/with	0.00	0.07	1 10	1.00	1.07
Childless	Separated	0.92	0.97	1.10	1.03	1.06
0 1.11	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
T 1.11	Union intact	2.33	2.28	2.26	2.20	2.20
I wo 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	s 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

Table 4: Simulated births in populations with varying union experience

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).

		By cohort age-specific birth and union rates					
		1940-49	1950-59	1960-69	1970-79	1980-	
		1,10 1,	1,00 0,	1700 07	177077	93/4	
First unions at age	e < 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	20+						
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 s	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 s	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	

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

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

		By cohort age-specific birth and union rates					
		1940-49	1950-59	1960-69	1970-79	1980-	
						93/4	
First unions at ag	ze < 30					· ·	
Separations occu	r 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 ag	se 30+						
Separations occu	, r 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 ag	e < 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 ag	e 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	

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

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



Italy

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-ofunion 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.

References

- Aassve, A., Burgess, S., Propper, C. & Matt Dickson. (2006). Employment, Family Union and Childbearing Decisions in Great Britain. *Journal of the Royal Statistical Society. Series* A (Statistics in Society), 169(4), 781-804.
- Albertini, M. & Dronkers, J. (2009). Effects of Divorce on Children's Educational Attainment in a Mediterranean and Catholic Society. *European Societies*, 11(1), 137-159.
- Amato, P.R. (2000). The Consequences of Divorce for Adults and Children. *Journal of Marriage and Family*, 62(4), 1269-1287.
- Amato, P.R. (2010). Research on Divorce: Continuing Trends and New Developments. *Journal of Marriage and Family*, 72(3), 650-666
- Amato, P.R. & James, S. (2010). Divorce in Europe and the United States: Commonalities and Differences across Nations. *Family Science*, 1(1), 2-13.
- Astone, N., Nathanson, C., Schoen, R., & Kim, Y. (1999). Family Demography, Social Theory, and Investment in Social Capital. *Population and Development Review*, 25(1), 1-31.
- Baizán, P., Aassve, A., & Billari, F. (2003). Cohabitation, Marriage, and First Birth: The Interrelationship of Family Formation Events in Spain. *European Journal of Population / Revue Européenne de Démographie*, 19(2), 147-169.
- Baizán, P., Aassve, A., & Billari, F. (2004). The Interrelations between Cohabitation, Marriage and First Birth in Germany and Sweden. *Population and Environment*, 25(6), 531-561.
- Barlow, A. & Probert, R. (2004). Regulating Marriage and Cohabitation: Changing Family Values and Policies in Europe and North America-An Introductory Critique. *Law & Policy*, *26*(1), 1–11.
- Basten, S., Sobotka, T. & Zeman, K. (2014). Future Fertility in Low Fertility Countries. Pages 39–146 in Lutz W., Butz W.P., KC S., (Eds.) World Population & Human Capital in the Twenty-first Century. Oxford, UK: Oxford University Press.
- Beaujouan, É. (2010). How is fertility affected by separation and repartnering? *Population and Societies* 464.
- Beaujouan, É. (2011). La fécondité des deuxièmes unions en France : âges des conjoints et autres facteurs. *Population*, vol. 66(2), 239-273.
- Beaujouan, E. & Solaz, A. (2008). Childbearing after separation: Do second unions make up for missing births? Evidence from France. *Documents de travail* #155. Paris, France: Institut national d'études démographiques.
- Beaujouan, É., Winkler-Dworak, M. & Berrington A. (2015). Union dynamics and fertility in Great Britain. Unpublished manuscript.
- Beaujouan, É., Berrington, A., Lyons-Amos, M. & Ní Bhrolcháin, M. (2014). User Guide to the Centre for Population Change GHS database 1979–2009. ESRC Centre for Population Change Working Paper, 47.

- Bélanger, A., Morency, J.-D. & Spielauer, M. (2010). A Microsimulation model to study the interaction between fertility and union formation and dissolution: An application to Canada and Quebec. *Canadian Studies in Population*, 37(3–4), 339–373.
- Berrington, A., Beaujouan, É., Lyons-Amos, M. & Ní Bhrolcháin, M. (2011). Evaluation of the Partnership Histories in the Centre for Population Change GHS Time Series Dataset. ESRC Centre for Population Change Working Paper, 12.
- Billari, F. (2005). Partnership, childbearing and parenting: Trends of the 1990s. In UNECE and UNFPA (2005), *The new demographic regime. Population challenges and policy responses*, New York/Geneva: United Nations. pp. 63–94.
- Broström, G. (2014). eha: Event History Analysis. <u>http://cran.r-project.org/web/packages/eha/index.html</u>
- Coleman, J. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, *94*, S95-S120.
- de Graaf, P. & Kalmijn, M. (2006). Change and Stability in the Social Determinants of Divorce: A Comparison of Marriage Cohorts in the Netherlands. *European Sociological Review*, 22 (5): 561-572. doi: 10.1093/esr/jcl010
- Friedman, D., Hechter, M., & Kanazawa, S. (1994). A Theory of the Value of Children. *Demography*, 31(3), 375-401.
- Gabrielli, G. & Hoem, J.M. (2010). Italy's non-negligible cohabitational unions. *European Journal of Population*, 26(1), 33-46.
- Gabrielli, G. & Vignoli, D. (2013). The Breaking-Down of Marriage in Italy: Trends and Trendsetters. *Population Review*, 52(1), 87-109.
- Garriga, A. & Härkönen, J. (2009). The effects of marital instability on children's wellbeing and intergenerational relations. *EQUALSOC State-of-the-art report*. Universitat Pompeu Fabra and Stockholm University.
- Griffith, J., Koo, H., & Suchindran, C. (1985). Childbearing and Family in Remarriage. *Demography*, 22(1), 73-88.
- Guetto, R., Mancosu, M., Scherer, S., & Torricelli, G. (2016). The spreading of cohabitation as a diffusion process: Evidence from Italy. *European Journal of Population*, 1-26.
- Guzzo, K.B. (2017). Is Stepfamily Status Associated with Cohabiting and Married Women's Fertility Behaviors? *Demography*, 54, 45-70.
- Härkönen, J., Bernardi, F. & Boertien, D. (2017). Family Dynamics and Child Outcomes: An Overview of Research and Open Questions. *European Journal of Population* 33(2), 163-184.
- Henz, U., & Thomson, E. (2005). Union Stability and Stepfamily Fertility in Austria, Finland, France & West Germany. European Journal of Population / Revue Européenne De Démographie, 21(1), 3-29.
- Hobcraft, J. & Kiernan, K. (1995). Becoming a parent in Europe. Plenary paper for European Population Conference. In: *EAPS/IUSSP Proceedings of European Population Conference Milan, September.* 27-65. (Also available as STICERD Discussion Paper No 116).

Kiernan, K. (1999). *Childbearing outside marriage in Western Europe*. Population Trends 98, 11–20.

- Kiernan, K. (2004). Changing European families. In Scott, J., Treas, J. & Richards, M., (Eds.) *The Blackwell Companion to the sociology of families*, pages 17–33. Malden, MA: Blackwell Publishing.
- Klüsener, S., Perelli-Harris, B. & Sánchez Gassen, N. (2012). "Spatial Aspects of the Rise of Nonmarital Fertility Across Europe Since 1960: The Role of States and Regions in Shaping Patterns of Change", European Journal of Population – Revue européenne de Démographie, 29(2), 137–165.
- Kravdal, Ø. & Rindfuss, R. R. (2007). Changing relationships between education and fertility – a study of women and men born 1940–64. *American Sociological Review*, 73(11), 854–873.
- Lesthaeghe, R.J. (1995). Second Demographic Transition in Western Countries: An Interpretation. In: Oppenheim Mason, K. and Jensen, A.-M. (Eds) *Gender and Family Change in Industrialized Countries*, pp. 17–62. Oxford: Clarendon Press.
- Lesthaeghe, R.J. (2010). The Unfolding Story of the Second Demographic Transition. *Population and Development Review*, 36; 211–51.
- Liefbroer, A. C. & Billari, F. C. (2010), Bringing norms back in: a theoretical and empirical discussion of their importance for understanding demographic behaviour. *Population*, *Space, Place*, 16: 287–305. doi:10.1002/psp.552
- Lillard, L., & Waite, L. (1993). A Joint Model of Marital Childbearing and Marital Disruption. *Demography*, 30(4), 653-681.
- Lutz, W. (2007). The Future of Human Reproduction: Will Birth Rates Recover or Continue to Fall? *Ageing Horizons* 7; 15–24.
- Lutz W., Butz W.P. & KC S., (Eds.) (2014) World Population & Human Capital in the Twentyfirst Century. Oxford, UK: Oxford University Press.
- Lyngstad, T. H. & Jalovaara, M. (2010). A review of the antecedents of union dissolution. *Demographic Research*, *23*, 257–291.
- Malpas, N. & Lambert, P.V. (1993). *The Europeans and the Family. Results of an opinion survey.* Brussels: Commission of the European Communities.
- Marini, M. M. (1978). The transition to adulthood: Sex differences in educational attainment and age at marriage. *American Sociological Review*, 43(4), 483–507.
- McLanahan, S., Tach, L., & Schneider, D. (2013). The Causal Effects of Father Absence. *Annual Review of Sociology*, 39, 399-427.
- Meggiolaro, S. & Ongaro, F. (2010). The implications of marital instability for a woman's fertility: Empirical evidence from Italy, *Demographic Research* 23, 963–996.
- Mynarska, M., Riederer B., Jaschinski, I. & Krivanek, D., Neyer, G., & Oláh, L.Sz. (2015). Vulnerability of families with children: Major risks, future challenges, and policy recommendations. *FamiliesAndSocieties Working Paper No.* 49.
- Ní Bhrolcháin, M., & Beaujouan, É. (2011). Uncertainty in fertility intentions in Britain, 1979-2007. *Vienna Yearbook of Population Research*, 9, 99-129.

- Ní Bhrolcháin, M. & Beaujouan, É. (2013). Education and Cohabitation in Britain: A Return to Traditional Patterns? *Population and Development Review*, 39(3), 441–458.
- Ní Bhrolcháin, M., Beaujouan, É. & Murphy, M. (2011). Sources of error in reported childlessness in a continuous British household survey. *Population Studies*, 65(3), 305–318.
- Perelli-Harris, B., Kreyenfeld, M. & Kubisch, K. (2010a). "Harmonized histories: manual for the preparation of comparative fertility and union histories." *MPIDR Working Paper*.
- Perelli-Harris, B., Sigle-Rushton, W., Kreyenfeld, M., Lappegård, T., Keizer, R. & Berghammer, C. (2010b). The educational gradient of childbearing within cohabitation in Europe. *Population and development review*, 36(4), 775–801.
- Perelli-Harris, B. & Sánchez Gassen. N. (2012). "How Similar Are Cohabitation and Marriage? Legal Approaches to Cohabitation across Western Europe," *Population and Development Review* 38(3), 435–467.
- Philipov, D., Jaschinski, I., Vobecká, J., Di Giulio, P. & Fent, T. (2014). Report on the futures task force workshop. *FamiliesAndSocieties Working Paper 18*.
- Pinnelli, A., De Rose, A., Di Giulio, P. & Rosina, A. (2002). Interrelationships between partnership and fertility behaviour. In: Macura, M. and Beets, G. (Eds.) *Dynamics of fertility and partnership in Europe: Insights and lessons from comparative research.* Vol. I, pages 77–98. New York/Geneva: United Nations.
- Prioux, F. (2003). Age at first union in France: a two-stage process of change. *Population* (*English edition*), 58.
- Rendall, M. S., Aracil, E., Bagavos, C., Couet, C., Derose, A., Di Giulio, P., Lappegård T., Robert-Bobée I., Rønsen M., Smallwood S. & Verropoulou, G. (2010). Increasingly heterogeneous ages at first birth by education in Southern European and Anglo-American family-policy regimes: A seven-country comparison by birth cohort. *Population Studies*, 64(3), 209–27.
- Riederer, B., Mynarska, M., Winkler-Dworak, M., Fent, T., Rengs, B., & Philipov, D. (2017). Future of families in times of multi-faceted societal changes: a foresight approach. *FamilesAndSocieties Working Paper* No. 66.
- Rijken, A., & Liefbroer, A. (2009). The Influence of Partner Relationship Quality on Fertility / L'influence de la qualité de la relation avec le partenaire sur la fécondité. *European Journal of Population / Revue Européenne De Démographie*, 25(1), 27-44.
- Rosina, A. & Fraboni, R. (2004). Is marriage losing its centrality in Italy? *Demographic Research* 11(6), 149–172.
- Sigle-Rushton, W. and McLanahan, S. (2004) Father Absence and Child Well-Being: A Critical Review. In Moynihan, D.P., Smeeding, T.M. & Rainwater, L. (eds), *The Future of the Family*. New York: Russel Sage Foundation.
- Spéder, Z., & Kapitány, B. (2009). How are Time-Dependent Childbearing Intentions Realized? Realization, Postponement, Abandonment, Bringing Forward / Les intentions de fécondité sont-elles réalisées dans le délai prévu? Réalisation, report,

abandon, avancement. *European Journal of Population / Revue Européenne De Démographie*, 25(4), 503-523.

- Stewart, S. (2002). The Effect of Stepchildren on Childbearing Intentions and Births. *Demography*, 39(1), 181-197.
- Statistics Canada. (2009). Modgen. Retrieved from <u>http://www.statcan.gc.ca/microsimulation/modgen/modgen-eng.htm</u>.
- Testa, M. (2007). Childbearing preferences and family issues in Europe: Evidence from the Eurobarometer 2006 survey. *Vienna Yearbook of Population Research*, *5*, 357-379.
- Thomson, E. (2004). Stepfamilies and childbearing desires in Europe. *Demographic Research*, 3, 116-134.
- Thomson E., Hoem J.M., Vikat A., Prskawetz A., Buber I., Toulemon L., Henz U., Godecker A.L., Kantorova V. (2002). Childbearing in Stepfamilies: How Parity Matters. In Klijzing E, Corijn M (eds), *Fertility and Partnership in Europe: Findings and Lessons from Comparative Research*. Volume II. Geneva/New York: United Nations.
- Thomson, E., Lappegård, T., Carlson, M. Evans, A., & Gray, E. (2014). Childbearing across Partnerships in Australia, the United States, Norway, and Sweden. *Demography*, 51(2), 485-508.
- Thomson, E., Winkler-Dworak, M., Spielauer, M. & Prskawetz, A. (2012). Union instability as an engine of fertility? A microsimulation model for France. *Demography* 49(1): 175–195.
- Thornton, A. (1978). Marital Dissolution, Remarriage, and Childbearing. *Demography*, 15(3), 361-380.
- Thornton, A. & Young-DeMarco, L. (2001). Four decades of trends in attitudes toward family issues in the United States: The 1960s through the 1990s. *Journal of marriage and family*, 63(November), 1009–1037.
- Torr, B. M. (2011). The Changing Relationship between Education and Marriage in the United States, 1940–2000. *Journal of Family History*, *36*(4), 483–503.
- van Bavel, J., Jansen M. & Wijckmans, B. (2012). Has Divorce Become a Pro-Natal Force in Europe at the Turn of the 21st Century? *Population Research and Policy Review* 31(5), 751–775.
- van de Kaa, D.J. (1987). Europe's Second Demographic Transition. *Population Bulletin*, 42: 1–59.
- Vignoli, D. & Ferro, I. (2009) Rising Marital Disruption in Italy and Its Correlates. *Demographic Research* 20(4), 11-36.
- Vikat, A., Thomson, E., & Hoem, J. (1999). Stepfamily Fertility in Contemporary Sweden: The Impact of Childbearing before the Current Union. *Population Studies*, 53(2), 211-225.

Zeman, K. (2014). Personal communication.

Appendix A

		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

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

* p < 0.1, ** p < 0.05, *** p < 0.01Note: Relative risk of birth cohort is incorporated in estimated values of the cohort-specific baseline hazard rate in Table A.2.

	Base model						Edu	cation m	odel	
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.2: Estimated cohort-specific baseline hazard of conceiving a first birth, Italy

	Base model	Education model
Union/birth history		
Not in union	0.249***	0.248***
In first-birth union	1	1
In union, 1 st birth before union	1.700***	1.703***
In union, 1 st 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

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

* 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

	Base model				Education model			
Age of first	1940-	1950-	1960-	1970-	1940-	1950-	1960-	1970-
child	49	59	69	93	49	59	69	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.5: Estimated cohort-specific baseline hazard rate of conceiving a second child, Italy

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 2 nd -birth union, 1 st 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.

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

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

	Base model	Education model
Union/birth status		
Not in union	0.530***	0.532***
In first-birth union	1	1
In 2 nd -, 3 rd -birth union, 1 st birth before union	0.956	0.964
In 3^{rd} -birth union, 1^{st} and 2^{nd} 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

Table A.9: Estimated relative risk of conceiving a fourth birth, 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.10: Estimated baseline hazard rate of conceiving a fourth child, 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***	а	0.408***	а
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	

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

* 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).

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

	Base model		Education mo	del
	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	2,59	92	2,59	92
Events	1,374	595	1,374	595
df		28	3	34
Log-likelihood	-6,04	15	-6,020	
BIC	12,3	11	12,307	

Table A.13: Estimated relative competing risk 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.14: Estimated baseline hazard rate of marrying or separating in a first cohabitation, Italy

			Base model	Education model
Union/birth h	nistory			
	Childless		1	1
	No shared birth		1.436***	1.523***
	One or more share	red 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-likelihoo	d		-10,931	-10,857
BIC			22,002	21.883

Table A.15: Estimated relative risk 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.16: Estimated baseline hazard rate of separation of a first marital union, Italy

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

		Base model		Education model	
		Cohabitation	Marriage	Cohabitation	Marriage
Unio	n/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*
Preg	nancy				
	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***
Educ	ation				
	Low			1.063	0.802
	Medium			1	1
	High			1.094	0.880
Subje	ects	3,076		3,076	
Even	ts	728	166	728	166
df		24		28	
Log-l	likelihood	-3,914		-3,913	
BIC		8,021		8,051	

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

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	Э	3,118	Э	3,123

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

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

		Base model	Education model
Union/birth his	story		
	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

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

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

VIENNA INSTITUTE OF DEMOGRAPHY

Working Papers

Testa, Maria Rita and Francesco Rampazzo, *Intentions and Childbearing*, VID Working Paper 7/2017.

Al Zalak, Zakarya and Anne Goujon, *Assessment of the data quality in Demographic and Health Surveys in Egypt*, VID Working Paper 6/2017.

Muttarak, Raya, Potential Implications of China's 'One Belt, One Road' Strategies on Chinese International Migration, VID Working Paper 5/2017.

Freitas, Rita and Maria Rita Testa, *Fertility Desires, Intentions and Behaviour: A Comparative Analysis of Their Consistency*, VID Working Paper 4/2017.

Zeman, Krystof, Eva Beaujouan, Zuzanna Brzozowska and Tomas Sobotka, *Cohort fertility decline in low fertility countries: decomposition using parity progression ratios*, VID Working Paper 3/2017 and Human Fertility Database Research Report 2017-003.

Beaujouan, Éva and Tomáš Sobotka, *Late Motherhood in Low-Fertility Countries: Reproductive Intentions, Trends and Consequences,* VID Working Paper 2/2017 and Human Fertility Database Research Report HFD RR-2017-002.

Sobotka, Tomáš, Post-Transitional Fertility: Childbearing Postponement and the Shift to Low and Unstable Fertility Levels, VID Working Paper 1/2017 and Human Fertility Database Research Report HFD RR-2017-001.

Al Hessan, Mohammed, Stephanie Bengtsson, Judith Kohlenberger, *Understanding the Syrian Educational System in a Context of Crisis*, VID Working Paper 9/2016.

Riederer, Bernhard and Isabella Buber-Ennser, *Realisation of Fertility Intentions in Austria and Hungary: Are Capitals Different?*, VID Working Paper 8/2016.

Barakat, Bilal, *Generalised Poisson Distributions for Modelling Parity*, VID Working Paper 7/2016.

Kohlenberger, Judith, Isabella Buber-Ennser, Bernhard Rengs and Zakarya Al Zalak,

A Social Survey on Asylum Seekers in and around Vienna in Fall 2015: Methodological Approach and Field Observations, VID Working Paper 6/2016.

Barakat, Bilal and Robin Shields, Just Another level? Comparing Quantitative Patterns of Global School and Higher Education Expansion, VID Working Paper 5/2016.

The Vienna Institute of Demography Working Paper Series receives only limited review. Views or opinions expressed herein are entirely those of the authors.