The hazards of partnership dissolution in Britain: a comparison of second and first marriages*

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Abstract

This paper investigates whether second marriages differ from first marriages in the dissolution risk and its determinants. Using data from British Household Panel Survey, a simultaneous hazard model for the risk of ending a first and a second marriage is estimated. Separately for men and women, the effects of predictors are compared across marriages. The model takes into account unobserved heterogeneity. Cross-equations unobserved heterogeneity is not statistically different from zero. Cohabitation before marriage affects first and second marriage dissolution risk differently. It increases the hazard of first marriage dissolution, but reduces the hazard of second marriage dissolution.

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1 Introduction

This paper investigates why marriages dissolve and compares the first and second marriages dissolution. It considers whether predictors have the same effect on the risk of first and second divorces.

The analysis has three motivation. First, two stylized facts emerge from UK Census data: (1) the percentage of divorces increased in the last decades, so more people are at risk of remarriage, and (2) re-marriage rate is higher then marriage rate, see Figure 1.[1] Second, while there are studies addressing the impact of partners' characteristics on the probability of divorce across cohort and over time, studies that explicitly analyse and compare first and second marriage are rare, especially for UK. Third, the combination of the retrospective and longitudinal data from the British Household Panel Survey (BHPS) provides an opportunity to look at a large sample of second marriages.

The paper follows the theoretical framework of Becker *et al.* (1977). In their seminal paper the authors suggest some of the key factors affecting the hazard of divorce and provide an economic framework to justify the association between these factors and marital dissolution. In particular the probability of divorce is smaller, the greater is the expected gain from marriage, and the smaller is the variance of the distribution of unexpected outcomes.[2]

The expected gain from marriage depends on several factors.[3] First the division of labour within the household (i.e. specialization) allows the exploitation of comparative advantage: men are more advantaged in the

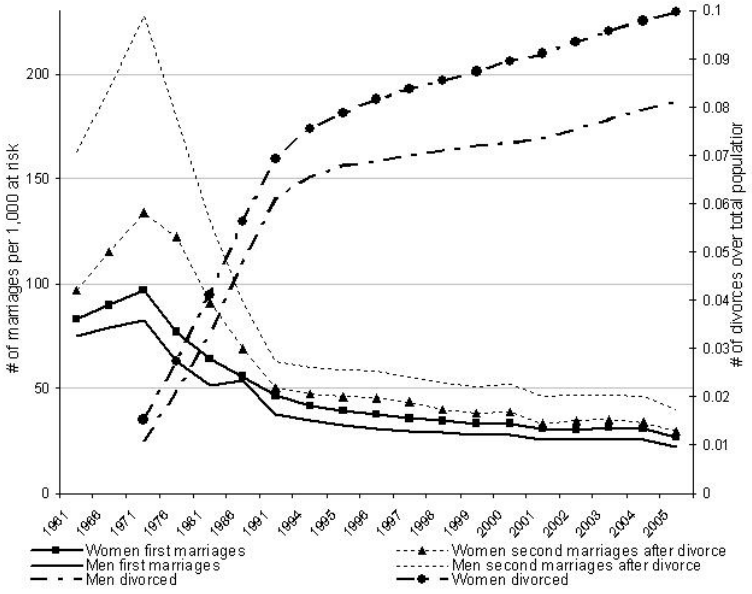
[1] These statistics can be found on the web site of the UK Office for National Statistics:http://www.statistics.gov.uk/statbase/explorer.asp

[2] See Becker (1977) p. 1143.

[3] See Weiss (1997) for a survey.

labour market while women more in home production. Each partner can specialize in one production and use his/her capital more efficiently. With increasing returns there are obvious gain from marriage because producing two meals instead of one does not require double the input. Within a marriage partners can share collective (non-rival) goods because the husband's enjoyment from consuming the public good does not effect the wife's enjoyment. Usually children have been seen as one of this good as well as a marital specific capital. There are advantages, then, raising children within the two parent family: child care and child expenditure are more efficient decisions if taken by both parents together. Within a marriage partners can coordinate investment activities. For example, they will invest in the schooling of the person with the higher rate of return while the other person will work in the market and finances the investment. Finally when partners are risk averse they can be made better off marrying given that their incomes

Figure 1: Divorce, marriage and remarriage rates in Britain, 1961-2006



Note: Own calculations from ONS Historical Database.

are not perfectly correlated.

The variance of the distribution of unexpected outcomes depends mainly on partners' expectations. The higher the deviation between actual and expected value the higher is the probability of divorce. But if the gains from marriage are large, small shocks will not destabilize a union.

The size of the gain from marriage and the impact of unexpected outcomes depend on the characteristics of each partner and the quality of their match. Becker (1991) provides an analysis of optimal marital sorting stating that, for all traits which are not good substitutes in the production of commodity income, predominates a positive assortative mating. Education, for instance, is a complementary trait. So, if spouses differ significantly, the gains from marriage are lower and the probability of divorce is higher.[4]

Recently scholars have updated Becker's theoretical studies by looking at multiple equilibria in the framework of optimal marital sorting (Burdett and Coles, 1997 and 1998) or allowing for a 'learning by doing' setting (Bougheas and Georgellis,1998).

A lot of researchers have 'tested' Becker and colleagues hypotheses. These studies provide the set of characteristics used as determinants of the hazard of divorce in this analysis. Previous empirical research can be divided into two strands. The first describes forces (old and new) driving divorce and focus on key determinants affecting the hazard of marital dissolution.

Factors such as religion (Lehrer and Chiswick, 1993), cohabitation before marrying (Haskey, 1999; Berrington and Diamond, 1999), divorce costs (Bougheas and Georgellis, 1998), unexpected changes in economic circumstances (Weiss and Willis, 1997; Böheim and Ermisch, 2001), age at marriage (Lehrer, 2006), education and assortative mating (Chan and Halpin, 2003),

[4]Becker *at al.* (1977) also provide empirical evidence for these.

previous partnership experience (Steele et al. 2006) are generally associated with the likelihood of marital dissolution. There is consensus on the effects of most of the determinants of marital dissolution: age at marriage, having religion beliefs and having children within current marriage are negatively related to the hazard of divorce, cohabitation before marriage and being in a young cohort are factors positively associated with the hazard of marital dissolution. However, lately some authors have found systematic change of some characteristics on marital dissolution over time (Chan and Halpin, 2005, Böheim and Ermisch, 2001): children have always been seen as stabilising factor for marriage but the recent evidence shows that the presence of children increases the hazard of divorce; having cohabited before marrying increased the hazard of partner dissolution but it seems to be no longer the case. Finally, Stevenson and Wolfers (2007) look at trends in marriage and divorce behaviour and new driving forces. Over the last 150 years divorce rates have risen, age at marriage as well as and cohabitation has emerged as an important precursor or substitute for marriage (it is much more common among divorcees). Some of the factors explaining this phenomenon are the following: the rise of the birth control pill and women's control over their own fertility; sharp changes in wage structure including a rise in inequality and partial closing of the gender gap; dramatic changes in home production technologies; and the emergence of the internet as a new technology that change the marriage market.

The second strand of the literature deals with remarriage process and the comparison between first and higher order marriages. Studies based on US data find contradicting result. McCarthy (1978), using the National Survey of Families Growth, shows that the characteristics that affect the probability of dissolving a first marriage are less important in a second marriage.

Castro Martin and Bumpass (1989) survey papers on marital instability and look at the difference between first and second marriages. They state that net of compositional differences with respect to education and age at first marriage remarriages have no higher risk of disruption than first ones. Differently Cuningham Clarke and Foley Wilson (1994) find that remarriages are more likely to end in divorce than first marriages in the earlier years. Given the inverse relationship between age at marriage and marital dissolution, older age composition of men and women in remarriages offsets the disruptive effect of previous marriages. Beaujouan (2007) compares second and higher unions in France with first ones. She finds that, controlling for social background, union status and fertility, second unions are not as likely to dissolve as first unions. She also tests for unobserved heterogeneity and she finds second unions last longer. Finally, there are no studies that directly address this issue for UK.

The following paper explicitly look at the effect of some characteristics on first and second marriage disruption. It takes into account unobserved heterogeneity and it also allows the correlation of unobserved heterogeneities across processes when estimating a simultaneous hazard model. The effect of a characteristics on the risk of marriage dissolution depends on whether the first or second marriage is considered. The main difference across marriages is given by the cohabitation prior the marriage: first marriages are shorter for people who have cohabited before their marriage while second marriages are longer for people who have cohabited with their future spouse before the marriage.

The paper is structured as follows. The next section describe the data and the samples. In the third section the method is presented. The fourth section reports the estimates are presented. Last section concludes.

2 Data and descriptive statistics

The selection of the sample is based on family history data from the BHPS, a combination of retrospective histories and panel information.[5]

All the analysis is based on partnership defined by a legal marriage. Cohabiting partnership are not considered as marriages here.

There are potential different estimation samples, depending on the definition of (1) first and second marriage, (2) duration, and (3) on which set of covariates is used. In this section I describe the implication of these three sample selections.

2.1 First vs. second marriages

The first selection criterion is based on the distinction between first and second marriage. First marriages sample (1) consists of all individuals at risk of ending first legal marriage (i.e. all individuals get legally married); second marriages sample (2) consists of all individuals at risk of ending second legal marriage (i.e. all individuals get legally married then they separate or become widows and then they get legally re-married).

People in sample (2) are included in sample (1). Number of men and women and their percentage into the samples are reported in Table 1.

Table 1: First and second marriage samples

	First marriage		Second marriage	
	Men	Women	Men	Women
Percentage	44.77	55.23	42.27	57.73
No.of observations	7,036	8,680	727	993

[5]See Pronzato (2007).

2.2 Duration

The second selection criterion is based on the definition of the spell length (i.e. duration).

Let t_0 be the first time individuals are observed in the sample. At t_0 they are all married. Let t_1 be the separation date for those individuals. Let t_2 be the starting date of the second marriage and t_3 the separation date of the second marriage. The duration of a marriage is time until separation and it is calculated in months. It is given by separation date minus the starting date (i.e. $t_1 - t_0$ for first marriage and $t_3 - t_2$ for second marriages). The diagram on Figure 2 shows the construction of the dependent variable (the duration) for sample (1) and (2).

Figure 2: Duration construction for first and second marriages

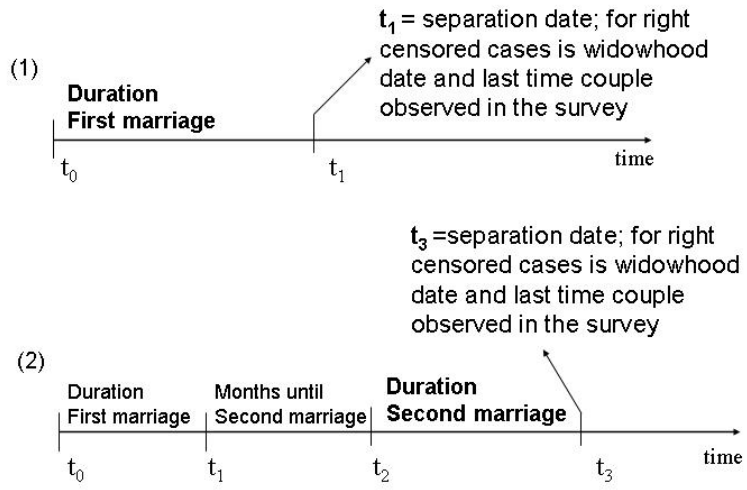
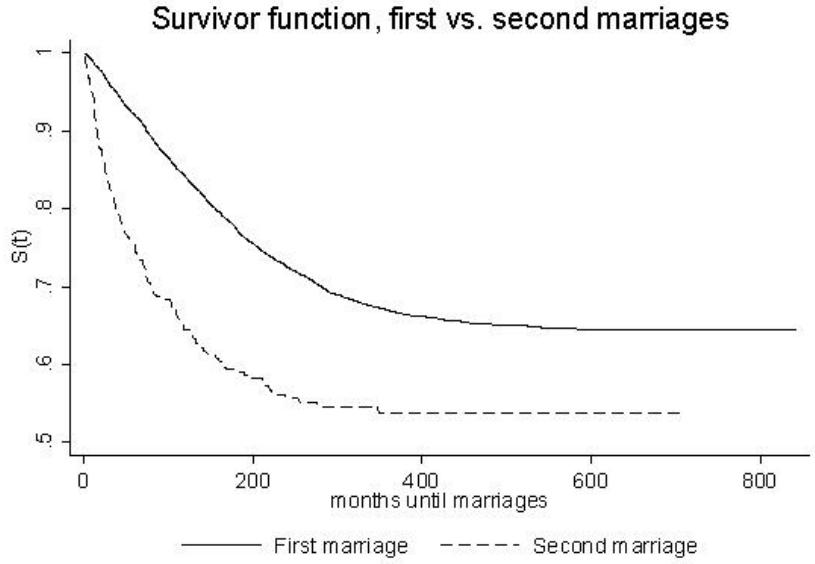


Figure 3 plots the Kaplan-Meier estimates of survival functions distinguish between first and second marriages. There is no median duration within the sample range for elapsed duration. This is an indication of very

long spells both for first and second marriages.

Figure 3: Kaplan-Meier empirical survival functions for first and second marriages.



In the data some issues arise. For each individual, I know the starting date of the marriage (with the correspondent left censoring indicator), the ending date and whether the individuals are separated or divorced. For both separated and divorcees the ending date of the marriage will be the separation date. However, when this is not available, I use 18 months before divorce date.[6]

I follow all the individuals until the end of the survey so I could not see for all of them the transition to the event: it could be that the event has not yet occurred or it will never occur. These observations are right-censored, the spell length will be equal to starting data of the marriage minus the date when they are last observed. I also include in the right-censored case the

[6]Eighteen months is the average time that takes to get divorce from separation in the data and also quite plausible as legal length from separation to divorce.

widows and the spell length will be equal to starting data of the marriage minus the widowhood date.

Before t_0 (as well as between t_1 and t_2) individuals may have cohabited and they may have experienced a cohabitation dissolution. These cases are not considered as I only look at first and second legal marriages.[7]

Finally, some individuals experience cohabitation before marrying: i.e. they cohabit with their future spouse before the marriage. The issue, here, regards whether consider the spell starting at the beginning of the cohabitation or at the beginning of the legal marriage. The paper defines the dependent variable according to the literature i.e. duration of legal marriage without considering the cohabitation spell length.

For each individual a failure indicator is calculated. It takes value one if the marriage ended in divorce or separation and zero otherwise.[8]

2.3 Explanatory variables

The third selection criterion depends on the set of covariates used in the analysis. The main implication is that the sample size is different depending on the regressors used. I construct the samples looking at the retrospective history in the BHPS, however when any partner variables is used (partner education or partner age) sample size reduces a lot because these are panel information.

The explanatory variables are chosen according to the literature on marriage dissolution. I divide them in three categories: (1) partners' characteristics (i.e. birth cohort, age at marriage, education etc.); (2) couple's characteristics (i.e. having cohabited before getting married, difference in age etc.) and (3) characteristics prior the second marriage (i.e. time un-

[7] However I will include in the covariates set a control for that

[8] It is zero for the right-censored observation.

til second marriage, whether first marriage ended in divorce or widowhood, etc.) available only for the second sample. For a full description of them and of their implications for estimates see Appendix A and B.

The covariates are time in-varying and are observed at the beginning of the marriage.

Some demographic characteristics for first and second marriage sample are reported in Table 2 and 3 both for men and women. [9]

The proportions and the means are presented for, respectively, dichotomous and continuous variable. I also test for whether the differences across marriages are statistically different from zero.

The two samples are different. Compared to people in first marriages, people in second marriages are older but drawn from more recent marriage cohorts (Table 2). They are more likely to cohabit and to divorce (Table 3).

Table 2: First and second marriage samples (means)

	Women				**Men**			
	First	**Second**	**Diff**		**First**	**Second**	**Diff**	
Year of birth	1948	1947	1		1947	1945	2	**
Year of marriage	1980	1985	-5	**	1984	1985	-1	*
Age at marriage	32	38	-6	**	36	40	-4	**
No. observations	8,680	993			7,036	727		

Note: $* : p < 0.05$; $** : p < 0.01$

[9] Descriptive statistics in this section are based on a sample of all individuals for whom I have the duration variable. In Appendix A I will consider a second sample that consists of all individuals (9,056 observations for first marriage and 1,152 for second marriage) for whom I have both the duration and the partner variables.

Table 3: First and second marriage samples (column percentage)

	Women				Men			
	First	**Second**	**Diff**		**First**	**Second**	**Diff**	
Born on/before 31dec45	41.6	38.2	3.4		42.8	47.5	-4.6	*
Born after 31dec45	58.4	61.8			57.2	52.5		
Right censored	78.6	74.1	4.5	*	82.7	73.9	8.8	*
Divorce/Separation	21.4	25.9			17.4	26.1		
Directly married	85.1	46.1	39.0	*	83.6	44.7	38.9	*
Pre cohabited	14.9	53.9			16.4	55.3		
No. observations	8,680	993			7,036	727		

Note: $*: p < 0.05$; $**: p < 0.01$

3 Methods

The methodology used in this paper aims to capture the simultaneous relationships between first and second marriage dissolution. The model is characterized by two equations for both men and women. Let $\theta_1 i(t)$ be the hazard of first marital separation at duration t for any woman (or man) i ($\forall i = 1, ..., N_1$), and $\theta_2 j(t)$ the hazard of second marital dissolution at duration t for any woman (or man) j ($\forall j = 1, ..., N_2$), where N_1 includes N_2. The multiprocess model for the two marital dissolutions can be written:

$$ln\theta_{1i}(t) = \alpha_1 T_{1i}(t) + \beta_1 P_{1i} + \gamma_1 C_{1i} + u_{1i} \tag{1}$$

$$ln\theta_{2j}(t) = \alpha_2 T_{2j}(t) + \beta_2 P_{2j} + \gamma_2 C_{2j} + \lambda_2 F_{2j} + u_{2j} \tag{2}$$

where

$$u_{1i}, u_{2j} \sim BVN(0, 0; {\sigma_i}^2, {\sigma_j}^2; \rho)$$

The baseline log-hazard functions are $T_{1i}(t)$ and $T_{2j}(t)$ respectively for first and second marriage duration. These are specified as linear splines with knots at 12, 72 and 120 months.

The explanatory variables are chosen looking at the literature on marriage dissolution, P_i is a vector summarizing partners characteristics, C_i couple characteristics and F_i first marriage characteristics (they are fully described in Appendix A).

To take into account unobserved heterogeneity between individuals, the model includes u_{1i} and u_{2j} that are individual components that capture the effects of unmeasured risk factors which are not included in the model. It is assumed they are constant over time. Moreover these factor are a source of correlation across equations. The two hazard equations are linked by

allowing these random effects to be correlated: ρ. The model assumes that the random effects follow a bivariate normal distribution with zero mean, to be estimated are the two marginal standard deviation and the correlation.

3.1 Implications of the estimation procedure

The estimation procedure has some restrictions which affect the results.

First, the baseline log-hazard patterns ($T_{1i}(t)$ and $T_{2j}(t)$) are constrained to be a linear spline. The numbers of the knots are flexible and they can be specified according to the literature or the raw data. A spline transformation offers a convenient way to assume that the effect may be linear over a certain range and again linear (but with different slope) over the next range and so on. I specify three knots for the linear spline obtaining four different slope parameters. A linear log-hazard model without knots is also estimated and results are compared (Table 13 reported in Appendix B).[10] A non-parametric estimation procedure (e.g. a Cox model) could also have been used in this context because the main aim of the paper, in fact, is to look at how determinants affect first and second divorces. The estimation of the baseline hazard is not the main aim here.

Second, when estimating multiple processes repeated outcomes may not be independent. Failure to account for this has several consequences such as an underestimation of the proportionate response of the hazard to a change in a regressor and/or a upward bias of negative duration pattern.[11] Therefore, the model includes unobserved heterogeneity in each equation plus correlation. The unobserved heterogeneity is assumed to be specific to the individual so its value must be constant across all marriages of any one in-

[10] A likelihood ratio test comparing those models with model in Table 5 rejects the restrictions that duration dependence parameters are zero.

[11] Jenkins S.P.,2005

dividual. The estimation procedure integrates out these effects. The larger the number of integration points the more accurate the approximation, but heterogeneity is constrained to follow a bivariate normal distribution. Alternative parametrizations of the unobserved heterogeneity are a set of mass points or gamma distribution. The correlation (ρ) between unobserved heterogeneities across first and second divorces is also estimated. If ρ is not statistically different from zero a model where estimating the hazard of first and second divorce separately, but allowing for marginal unobserved heterogeneity, is to be preferred. We test this hypothesis with a t-test and a maximum likelihood ratio test.

Finally to take into account the selection into second marriages I estimated three equations jointly i.e. the hazard of first and second marriage dissolution plus the hazard of second marriage formation. The model includes unobserved heterogeneity in each equation and correlations between them.

4 Estimates

The estimates (coefficients and the hazard ratios) for the hazard of first and second marriage dissolution are presented in Table 5. A summary of all the steps followed in the estimation strategy is reported in Table 4. First, a simultaneous hazard model was estimated: the correlation between unobserved heterogeneities (ρ) is not statistically different from zero (Table 10 – Appendix B) and a likelihood ratio test does not reject the null hypothesis that $\rho = 0$ when comparing the simultaneous (unrestricted) and the separate (restricted) model (see table 4). Therefore results for the independent equations model for first and second marriages dissolution (both for men

and women) are presented in Table 5.[12] Moreover, an independent equations model with duration dependence without knots in the linear spline is estimated and results compared with the former (see Tables 4 and 13 – Appendix B)

Looking first at the estimates for the hazard of ending first marriage, I find all the associations being in line with the previous empirical research, the theoretical framework (see Introduction) and similar both for men and women (columns 'First' in Table 5).

Those at greater risk of divorce are men and women born after 31st December 1945, cohabiting before current marriage and being religious. Individuals who delay entry into marriage are less likely to divorce (around 13% less likely, both for men and women, any additional year, see column 'HR' in Table 5). This is because persons marrying young have greater search costs and are less informed about themselves theirs mates and the marriage market. However beyond later ages (the turning point is around 40 for first marriages and 45 for second) further waiting has the opposite effect on marital dissolution: persons continuing to be unmarried reduce the minimum acceptable offer and this raises the hazard of marriage, but given that the higher the age the lower the threshold of the acceptable offer those marriages are more likely to end in divorce.

Children within marriage are 'marital-specific capital' (Becker *et al.*, 1977). The accumulation of this type of capital raises the expected gain from marriage lowering the hazard of divorce (men are 50% less likely to divorce if they have children within the current marriage, the corresponding figure for women is 39%) because this is less valuable when single. However 'marital-specific capital' would increase with duration of marriage and a

[12] Appendix B presents estimates with the full set of explanatory variables and simultaneous specifications of piecewise hazard model for dissolution of first and second marriages.

Table 4: Likelihood ratio tests

Model	**Duration dependence**	**Table**	**Log Likelihood**	
			Men	**Women**
1. Simultaneous with bivariate normal distributed heterogeneity.	Linear spline with knots at 12, 72 and 120 months	10	-10559.9	-15415
2. Independent with marginal heterogeneity.	Linear spline with knots at 12, 72 and 120 months	5	-10560.1	-15417
3. Independent with marginal heterogeneity.	Linear spline without knots	13	-10605	-15474
Log Likelihood Ratio Test Statistics				
	d.f.	χ^2 **(p=0.01)**	**Men**	**Women**
1 vs. 2	1	6.63	-0.136	-4.39
3 vs. 2	3	11.34	91.4552	113.2562

possible reverse causation could emerge in this case. On the other side, having kids before the current marriage reduce the probability of remarriage and raise the hazard of marriage dissolution because they prevent the search for mates and reduce the gain from marriage (men are 80% more likely to divorce if they have children before current marriage, the corresponding figure for women is 82%) .

If Becker's idea (i.e. positive assortative mating is an optimal choice when traits are not good substitutes in the household production) hold persons with higher-valued characteristics (e.g. more educated individual) gain more from marriage than to being single therefore the hazard of divorce reduces. However, the estimates on educational qualifications seem to have no effects on the hazard of divorce. This could be due to the confounding education effect. On one hand a marriage between highly educated individuals greater the gain because of spouses high level of market and non market skills, on the other hand the gain of marrying an high educated person could be lower given the less specialization between the spouses themselves.

The hazard of divorce tends to slightly decline as the duration of marriage increases[13] because of the accumulation of 'marital-specific capital'.

Finally, the divorce rate at year of marriage is positively correlated with the hazard of dissolution: the higher the divorce rate the higher is the hazard of marital breakdown.

The effect of cohort and children dummy seem to be, amongst the covariates, the strongest (Table 5): the hazard of first marriage dissolution of a man born after 31st December 1945 is 67% higher than the hazard of a men born before that day (the corresponding figure for women is even

[13]However in the first two year the hazard of marriage dissolution increase: e.g. men in the first two years of marriage have 4.6% chances more to divorce while 0.06% chances less to divorce from the second to the fifth years and so on

higher: 110%). Having a child before the current marriage increase by 80% the hazard of marriage dissolution compared with an individual that does not have a child (this figure applies both to men and women).

The paper aimed to look at whether first and second divorces differ. The findings actually show some striking differences. Cohort dummy (both for men and women) and age at marriage (for men) have no effect on second marriage dissolution. Surprisingly, having children within or before the current marriage does not effect the hazard of second marriage dissolution as well. This last result could be driven by two facts. First there are fewer children within second marriages than within first marriages. Women in second marriages are older than women in first marriages so they can be at the end of their child-bearing years. Second, some authors found the association between children and hazard of divorce has changed in the last decade: children nowadays are no longer stabilizing marriages i.e. they do no decrease the hazard of divorce anymore. So second marriages are drawn from more recent marriage cohorts and they can be affected by this change.[14]

Consistent with the literature (Haskey, 1999; Berrington and Diamond, 1999 and Ermisch, 2004) cohabiting before marrying increases the hazard of divorce. This finding has been viewed as the result of selection bias (Lillard *et al.* 1995): people who cohabit before marrying are different from the people who get married directly. The first individuals may be the ones more prone to divorce. An additional argument may be that people who cohabit before marriage have longer partnership durations (i.e. cohabitation spell plus marriage spell) than people directly marrying and the hazard of divorce increase with time spent together above all in the first years. I find the association between cohabitation before marriage and the hazard of divorce

[14]See Chan and Halpin (2002) and Böheim and Ermisch (2001).

Table 5: Coefficients (β) and hazard ratios (HR) for four independent models (i.e. first/second divorces and men/women). Duration dependence is a linear spline.

	Men									**Women**								
	First			**Second**						**First**			**Second**					
	(1)			(1)			(2)			(1)			(1)			(2)		
	HR	β		HR	β		HR	β		HR	β		HR	β		HR	β	
Marriage duration 0-2yrs	1.046	0.045	***	1.045	0.044		1.039	0.0381		1.032	0.031	***	1.005	0.005		1.001	0.001	
Marriage duration 2-5yrs	0.994	-0.006	*	0.982	-0.018	*	0.980	-0.02	**	1.001	0.001		1.007	0.007		1.006	0.006	
Marriage duration 5-10yrs	1.008	0.008	***	1.020	0.020	**	1.019	0.0191	**	1.005	0.005	**	1.008	0.008		1.006	0.006	
Marriage duration 10yrs+	0.996	-0.004	***	0.998	-0.002		0.997	-0.003		0.997	-0.003	***	0.995	-0.005		0.995	-0.006	*
Born after 31stDec45	1.674	0.515	***	1.277	0.244		1.280	0.2471		2.154	0.767	***	0.754	-0.282		0.776	-0.254	
Cohabit before CM†	1.339	0.292	***	0.437	-0.827	*	0.143	-1.943	**	1.188	0.172	**	0.376	-0.979	**	0.189	-1.667	**
Age at CM	0.871	-0.138	***	0.926	-0.077		0.931	-0.071		0.862	-0.149	***	0.824	-0.194	*	0.836	-0.179	**
Age at CM squared	1.088	0.085	**	1.027	0.027		1.026	0.0257		1.092	0.088	**	1.165	0.153	*	1.172	0.158	*
First degree or higher	0.812	-0.208		1.027	0.027		0.916	-0.088		1.015	0.015		1.341	0.294		1.310	0.270	
A-level or equivalent	1.049	0.048		0.999	-0.001		0.919	-0.085		1.021	0.021		1.170	0.157		1.116	0.110	
O level	1.139	0.130		0.740	-0.302		0.699	-0.359		1.042	0.041		0.834	-0.181		0.827	-0.191	
Lower than O level	1.019	0.019		0.948	-0.054		0.580	-0.545		0.970	-0.031		1.032	0.031		0.975	-0.025	
Divorce rate	1.015	0.015	***	1.045	0.044	*	1.042	0.0412	**	1.023	0.023	***	1.055	0.054	**	1.044	0.043	**
Has kids before CM	1.797	0.586	***	2.048	0.717		1.967	0.6765		1.822	0.600	***	1.965	0.676		1.783	0.578	
Has kids within CM	0.503	-0.688	***	0.723	-0.325		0.688	-0.374		0.617	-0.483	***	0.761	-0.273		0.791	-0.234	
No religion belief	1.197	0.180	***	0.933	-0.069		0.996	-0.004		1.240	0.215	***	1.187	0.171		1.081	0.078	
FM♯ ended in divorce							1.066	0.0638								2.666	0.981	*
No partnership between CM							0.257	-1.36	*							0.459	-0.778	
Months until CM							0.996	-0.004								0.999	-0.001	
Cohabit before FM							0.803	-0.219								1.369	0.314	
Age at FM							1.047	0.0458								0.960	-0.040	
Age at FM squared							0.97	-0.035								1.064	0.062	
σ		0.713	**		1.482			-5.879	**		0.551	***		1.552			-3.578	**
Constant		-5.20	***		-6.72	***					-5.38	***		-4.35	***			
Log Likelihood		-9224			-1336			-1331			-13596			-1822			-1814	

Note: † CM stands for current marriage, ♯ FM stands for first marriage $* : p < 0.1$; $** : p < 0.05$; $*** : p < 0.01$

is negative for second marriages. Cohabitation can be seen as a period of learning about partner characteristics and expectations. So controlling for selection, people getting married after they have cohabited with their future spouse, have a hazard that declines. Second marriage sample is much more homogenous than first marriage sample:they all experienced a divorce, they mainly cohabit before marrying.[15] That's explains why cohabition before marriage is associated with a lower hazard of second divorce.

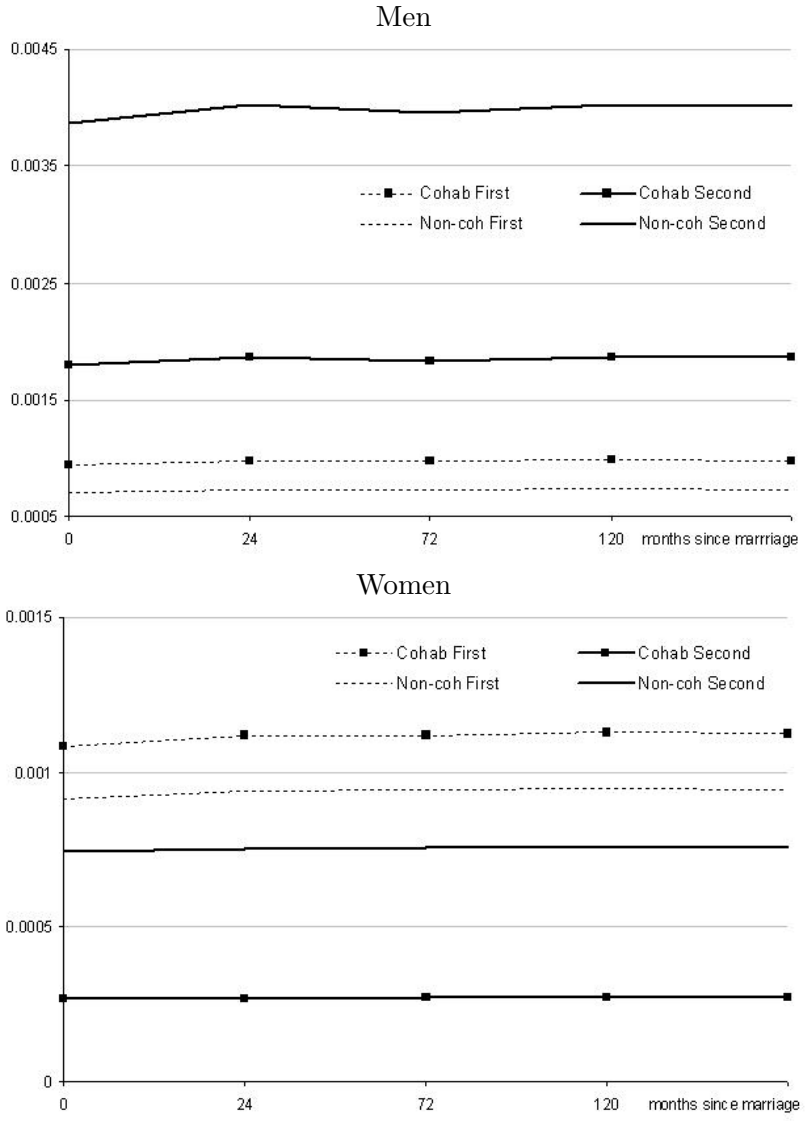
In Figures 4 the estimated hazard functions are plotted. The hazard functions in both figures are calculated for a man and a women born after 31st December 1945, aged 22 years old at the time of marriage, with educational qualification lower than O level, without children before the current marriage but with children within the current marriage, with no religion beliefs and with the divorce rate at 3.7% (this values are modal values for sample of first marriages).

I also distinguish between those who cohabit before the current marriage (continuous lines) and those who do not (dashed lines). Duration dependence is specified as linear spline with knots at 24, 72 and 120 months.

The hazard functions are quite flat. Nevertheless the figures have some implications for marriage duration. There is a striking difference between first and second hazard of divorce when persons do not cohabit before getting marry. In particular, both for men and women, the hazard of divorce is much higher for second marriage. Moreover, whether a person cohabit or not makes a difference in second marriages more than in first marriage (the red lines are more close than the black ones). For women, regardless cohabitation, the hazard of second marriage dissolution is higher than the one for first marriage, (black lines higher then red ones) corresponding result

[15] A result of this homogeneity could also be the fact that the unobserved heterogenity for second marriage is not statistically different from zero

Figure 4: Hazard function for first and second marriages, men and women cohabiting and non cohabiting (before marrying)



Note: Covariates set as follows: born after 31st December 1945, aged 22 yrs old, lower than O level of education, divorce rate at 3.7%, without children before the current marriage, but with children within the current marriage, with no religion beliefs.

for men are not available.

4.1 Robustness checks

The results described above and shown in Table 5 do not change when estimating the model simultaneously allowing for unobserved heterogeneity correlated across processes. Moreover the key results do not change also when including first marriage variables (i.e. months until second marriage, first divorced vs. widowed, age at first marriage, cohabitation before first marriage). (Tables of estimates reported in Appendix B).

The specification reported in Table 5 was also estimated with a different (restricted) sample. This consists of all individuals for whom I have non-missing data on both the duration variable and the partner variable (i.e. all persons within the panel so in this case only panel information are used). With this sample I also estimate the model including partner variables (i.e. homogamy, partner age at marriage, difference in age) and in both cases, although sample size reduces a lot, the key results (reported above) are unchanged.

5 Conclusion

The aim of the paper was to fill the gap in the literature of divorce describing second marriage dissolution and comparing second to first marriages in UK.

The research questions were: which are the factors affecting marital dissolution? Do predictors have the same effect on first and second marital instability?

My analysis shows that there are important differences between first and second marriages and the impact of a characteristic on the risk of marriage dissolution depends on whether the first or second marriage is considered.

The most interesting difference is the association between cohabitation before marriage and the hazard of divorce. First marriages are shorter (34% for men and 19% for women chances more to divorce) for people who cohabited before their marriage. Second marriages are longer (55% for men/ and 62% for women chances less to divorce) for people cohabited with their future spouse before the marriage.

Moreover first marriages are longer (50% for men and 39% for women chances less to divorce) for people who have a child within the first marriage, while they are shorter (80% for men and 82% for women chances more to divorce) for people who have a child before the first marriage. For second marriages no corresponding result.

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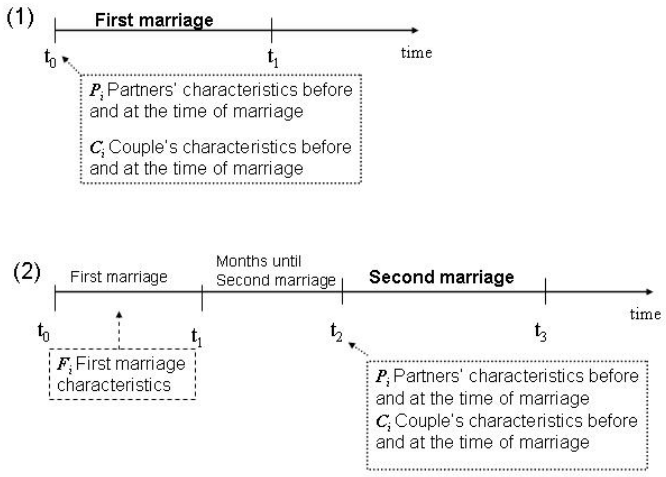
Appendix A

I consider three type of covariates and they are observed at the beginning of each marriage as Figure 5 describe.

Figure 5: Covariates and duration of first and second marriages



Let P_i be the first set of coovariates describing the partners' characteristics. P_i will include a cohort dummy (whether s/he is born on or before the 31st December 1945), education dummies (whether s/he has lower then O-level, O-level, A-level or First degree and higher education qualification, the reference category will be no education), a religion dummy (whether s/he has religious belief) and whether s/he had children before the current marriage.

Let C_i be the second set of coovariates describing couple's characteristics. C_i will include a cohabitation dummy (whether the couple experiences a cohabitation before marrying), the age at marriage (collected both for respondent and partner), homogamy dummies ('upwards' describing the respondent has higher level of education then the partner and 'downwards'

being the opposite, the reference category will be homogamy i.e. same level of education), whether the respondent is older than the partner and whether there are children within the current marriage

Let F_i be characteristics of first marriage and, of course, they are included only in the second marriage equation. F_i includes whether first marriage ends in divorce rather than widowhood, months until second marriage, whether respondent had other partnership experiences between first and second marriage, age at first marriage and whether the respondent have had a cohabitation before first marriage.

Finally I also include the national divorce rate at the year of the marriage to take into account the trend of divorce rate. It is constructed use ONS data and it is the ratio between the number of divorce and the number of the marriages in each year.[16]

P_i and F_i are available for each individual in the sample. When C_i is included in the regressions, the sample is smaller as I use both partners information that are available only from the panel.

Descriptives statistics for the four estimation samples are shown in Table 6 – 9. I distinguish between full sample of first and second marriages (all individual for whom I have duration variable), and reduced sample of first and second marriages (all individuals for whom I have both the duration variable and the partner variable).

[16]ONS data can be found at ..

Table 6: Descriptive statistics for full sample: first marriages, no. of observations 15,716

	Mean	**Standard Deviation**	**Min**	**Max**
Born after 31st December 1945	0.579	0.494	0	1
Cohabit before current marriage	0.156	0.363	0	1
Age at marriage	34.02	15.82	12	94
First degree or higher	0.099	0.298	0	1
A-level or equivalent	0.208	0.406	0	1
O level	0.228	0.419	0	1
Low then O level	0.152	0.359	0	1
No education	0.314	0.464	0	1
Divorce rate	37.26	20.60	0.3	57.8
Has children before current marriage	0.411	0.492	0	1
Has children within current marriage	0.827	0.379	0	1
No religion belief	0.331	0.470	0	1
Men	0.448	0.497	0	1

Table 7: Descriptive statistics for full sample: second marriages, no. of observations 1,707

	Mean	**Standard Deviation**	**Min**	**Max**
Born after 31st December 1945	0.580	0.493	0	1
Cohabit before current marriage	0.547	0.497	0	1
Age at marriage	38.73	10.92	20	95
First degree or higher	0.066	0.250	0	1
A-level or equivalent	0.207	0.406	0	1
O level	0.266	0.442	0	1
Low then O level	0.151	0.358	0	1
No education	0.308	0.462	0	1
Divorce rate	41.79	14.67	1.1	57.8
Has children before current marriage	0.800	0.400	0	1
Has children within current marriage	0.899	0.301	0	1
No religion belief	0.410	0.492	0	1
Men	0.419	0.494	0	1
Cohabit before first marriage	0.177	0.382	0	1
Age at first marriage	22.34	4.78	12	80
No partnership between marriages	0.426	0.495	0	1
First marriage ended in divorce	0.853	0.354	0	1
Months until second marriages	71.20	61.78	0	434.5

Table 8: Descriptive statistics for reduced sample: first marriages, no. of observations 9,056

	Mean	**Standard Deviation**	**Min**	**Max**
Born after 31st December 1945	0.664	0.472	0	1
Cohabit before current marriage	0.183	0.387	0	1
Age at current marriage	36.43	15.97	14	94
Partner age at current marriage	36.66	15.65	12	94
First degree or higher	0.129	0.336	0	1
A-level or equivalent	0.240	0.427	0	1
O level	0.241	0.427	0	1
Low then O level	0.147	0.354	0	1
No education	0.243	0.429	0	1
Divorce rate	43.45	17.73	0.8	57.8
Has children before current marriage	0.437	0.496	0	1
Has children within current marriage	0.796	0.403	0	1
No religion belief	0.352	0.478	0	1
Men	0.496	0.500	0	1
Homogamy	0.338	0.473	0	1
Upward	0.303	0.460	0	1
Downward	0.359	0.480	0	1
Respondent older then partner	0.426	0.494	0	1

Table 9: Descriptive statistics for reduced sample: second marriages, no. of observations 1,151

	Mean	**Standard Deviation**	**Min**	**Max**
Born after 31st December 1945	0.625	0.484	0	1
Cohabit before current marriage	0.638	0.481	0	1
Age at current marriage	38.80	10.42	20	80
Partner age at current marriage	37.01	11.19	17	77
First degree or higher	0.071	0.257	0	1
A-level or equivalent	0.219	0.414	0	1
O level	0.283	0.451	0	1
Low then O level	0.164	0.371	0	1
No education	0.262	0.439	0	1
Divorce rate	44.00	12.81	6.8	57.8
Has children before current marriage	0.786	0.410	0	1
Has children within current marriage	0.893	0.309	0	1
No religion belief	0.432	0.495	0	1
Men	0.468	0.499	0	1
Cohabit before first marriage	0.191	0.393	0	1
Age at first marriage	22.20	3.95	0	1
No partnership between marriages	0.337	0.473	0	1
First marriage ended in divorce	0.876	0.329	0	1
Months until second marriages	73.41	62.97	0	434.5
Homogamy	0.349	0.477	0	1
Upward	0.311	0.463	0	1
Downward	0.339	0.474	0	1
Respondent older then partner	0.581	0.493	0	1

Appendix B

The estimates for two different specifications of the simultaneous model separate for men and women are shown in the Table **??**.

Moreover estimates for the sample of all individuals for whom I have both the duration variable and partner variables are reported here (Table 11 and 12). In particular, I report specification (1) for comparison reason with the same specification for full sample. Specifications (2) includes additional variables both in equation 1 and 2 (i.e. C_i and F_i).

Finally estimates for a linear Gompertz model (i.e. a model where the baseline hazard is specified without knots) are also reported in Table 13.

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[]

Table 10: Simultaneous hazard model for first and second divorces

	Men									Women								
	First			Second						First			Second					
	(1)			(1)			(2)♭			(1)			(1)			(2)♭		
	HR	β		HR	β		HR	β		HR	β		HR	β		HR	β	
Marriage duration 0-2yrs	1.046	0.05	***	1.044	0.04		1.060	0.06	*	1.032	0.03	***	1.008	0.01		1.001	0.00	
Marriage duration 2-5yrs	0.994	-0.01	*	0.982	-0.02		0.987	-0.01		1.001	0.00		1.007	0.01		1.006	0.01	
Marriage duration 5-10yrs	1.008	0.01	***	1.020	0.02		1.022	0.02	***	1.005	0.01	**	1.008	0.01		1.006	0.01	
Marriage duration 10yrs+	0.996	0.00	***	0.998	0.00		0.999	0.00		0.997	0.00	***	0.995	-0.01		0.994	-0.01	*
Born after 31stDec45	1.672	0.51	***	1.240	0.21		1.306	0.27		2.142	0.76	***	0.858	-0.15		0.691	-0.37	
Cohabit before CM	1.338	0.29	***	0.443	-0.81	**	0.059	-2.82	***	1.186	0.17	**	0.346	-1.06	**	0.190	-1.66	**
Age at CM	0.871	-0.14	***	0.924	-0.08	*	0.905	-0.10		0.864	-0.15	***	0.831	-0.18	*	0.813	-0.21	**
Age squared at CM	1.089	0.09	**	1.026	0.03		1.048	0.05		1.091	0.09	**	1.165	0.15		1.198	0.18	**
First degree or higher	0.813	-0.21		1.046	0.05		0.989	-0.01		1.016	0.02		1.268	0.24		1.317	0.28	
A-level or equivalent	1.049	0.05		1.008	0.01		0.899	-0.11		1.022	0.02		1.138	0.13		1.115	0.11	
O level	1.139	0.13		0.747	-0.29		0.617	-0.48		1.044	0.04		0.797	-0.23		0.827	-0.19	
Lower than O level	1.018	0.02		0.591	-0.53		0.515	-0.66		0.972	-0.03		1.024	0.02		0.984	-0.02	
Divorce rate	1.015	0.02	***	1.046	0.05	**	1.051	0.05	**	1.023	0.02	***	1.058	0.06	**	1.043	0.04	**
Has kids before CM	1.801	0.59	***	2.007	0.70		2.532	0.93	*	1.805	0.59	***	2.124	0.75		1.722	0.54	
Has kids within CM	0.502	-0.69	***	0.731	-0.31		0.713	-0.34		0.621	-0.48	***	0.716	-0.33		0.837	-0.18	
No religion belief	1.198	0.18	***	0.930	-0.07		1.056	0.05		1.237	0.21	***	1.219	0.20		1.044	0.04	
First marriage ended in divorce							1.132	0.12								4.877	1.58	*
No partnership between marriages							0.117	-2.15	**							0.455	-0.79	
Months until second marriage							0.996	0.00								1.000	0.00	
Cohabit before first marriage							0.720	-0.33								1.320	0.28	
Age at first marriage							1.053	0.05								1.003	0.00	
Age at first squared							0.966	-0.03								1.022	0.02	
σ_u		0.71	**		1.46			1.89	**		0.52	**		1.65			1.32	
ρ					-0.13			-0.10						0.65			-0.88	
Constant		-5.19	***		-5.15	***		-6.04	*		-5.39	***		-5.15	***		-3.64	
Log Likelihood		-10560						-10556			-15415						-15410	

Note: ♭ Equation 1 in specification (2) has not been reported because it is similar to equation 1 in specification (1); $*: p < 0.1$; $**: p < 0.05$; $***: p < 0.01$

Table 11: Independent hazard models for first and second divorces with partner sample: men

	1						2					
	First			**Second**			**First**			**Second**		
	HR	β		HR	β		HR	β		HR	β	
Marriage duration 0-2yrs	1.076	0.07	***	1.121	0.11	*	1.066	0.06	***	1.121	0.11	
Marriage duration 2-5yrs	1.015	0.01	*	0.969	-0.03		1.008	0.01		0.970	-0.03	
Marriage duration 5-10yrs	1.018	0.02	***	1.036	0.04	**	1.014	0.01	*	1.037	0.04	**
Marriage duration 10yrs+	1.008	0.01	***	1.005	0.00		1.007	0.01	**	1.006	0.01	
Born after 31stDec45	3.205	1.16	***	1.018	0.02		2.760	1.02	**	1.270	0.24	
Cohabit before current marriage	1.569	0.45	**	0.886	-0.12		1.499	0.41	**	0.256	-1.36	*
Age at current marriage	0.904	-0.10		0.996	0.00		0.971	-0.03		1.026	0.03	
Age squared	1.045	0.04		0.939	-0.06		1.024	0.02		1.011	0.01	
First degree or higher	0.566	-0.57		0.917	-0.09		0.549	-0.60		1.266	0.24	
A-level or equivalent	0.928	-0.07		0.932	-0.07		0.849	-0.16		1.083	0.08	
O level	1.301	0.26		0.684	-0.38		1.094	0.09		0.772	-0.26	
Lower than O level	1.046	0.04		0.455	-0.79		0.928	-0.07		0.567	-0.57	
Divorce rate	1.147	0.14	***	1.124	0.12	***	1.130	0.12	***	1.144	0.13	***
Has kids before current marriage	3.984	1.38	***	0.903	-0.10		3.196	1.16	***	1.190	0.17	
Has kids within current marriage	0.338	-1.08	***	1.312	0.27		0.377	-0.98	***	0.783	-0.25	
No religion belief	1.297	0.26	***	0.728	-0.32		1.212	0.19		0.836	-0.18	
Partner age at CM							0.921	-0.08		0.811	-0.21	
Partner age squared							1.034	0.03		1.099	0.09	
Downward							1.309	0.27		1.402	0.34	
Upward							1.114	0.11		1.563	0.45	
Partner older than respondent							0.969	-0.03		0.504	-0.68	
First marriage ended in divorce										0.583	-0.54	
No partnership between marriages										0.211	-1.56	**
Months until second marriage										1.000	0.00	
Cohabit before first marriage										0.647	-0.44	
Age at first marriage										1.471	0.39	
Age at first squared										0.425	-0.86	
σ_u		2.07	***		0.17			1.44	*		1.67	
Constant		-16.12	***		-13.74	***		-13.91			-13.50	*
Log Likelihood		-2111			-459			-2106			-440	

Note: $* : p < 0.1$; $** : p < 0.05$; $*** : p < 0.01$

Table 12: Independent hazard models for first and second divorces with partner sample: women

	1						2					
	First			**Second**			**First**			**Second**		
	HR	β		HR	β		HR	β		HR	β	
Marriage duration 0-2yrs	1.087	0.083	***	1.026	0.025		1.092	0.088	***	1.026	0.026	
Marriage duration 2-5yrs	1.006	0.006		1.015	0.015		1.008	0.008		1.018	0.018	
Marriage duration 5-10yrs	1.023	0.023	***	1.003	0.003		1.025	0.025	***	1.003	0.003	
Marriage duration 10yrs+	1.009	0.009	***	1.004	0.004		1.009	0.009	***	1.004	0.004	
Born after 31stDec45	4.187	1.432	***	1.160	0.149		5.030	1.616	***	0.924	-0.079	
Cohabit before CM	1.498	0.404	**	0.650	-0.431		1.553	0.440	**	0.273	-1.299	*
Age at CM	0.960	-0.041		0.851	-0.161		0.959	-0.042		0.881	-0.127	
Age squared at CM	0.956	-0.046		1.147	0.137		0.953	-0.049		1.188	0.172	
First degree or higher	0.403	-0.910	***	1.682	0.520		0.262	-1.340	***	2.807	1.032	
A-level or equivalent	0.544	-0.609	**	1.630	0.489		0.398	-0.922	***	2.005	0.696	
O level	0.900	-0.105		1.218	0.197		0.795	-0.230		1.207	0.188	
Lower than O level	0.827	-0.190		1.135	0.126		0.746	-0.293		1.152	0.141	
Divorce rate	1.149	0.139	***	1.132	0.124	***	1.158	0.146	***	1.141	0.132	**
Has kids before CM	2.522	0.925	***	1.123	0.116		2.656	0.977	***	0.914	-0.090	
Has kids within CM	0.471	-0.753	***	0.740	-0.302		0.444	-0.812	***	0.599	-0.512	
No religion belief	1.168	0.155		1.116	0.109		1.185	0.170		0.997	-0.003	
Partner age at CM							0.963	-0.038		1.004	0.004	
Partner age squared							1.047	0.046		0.945	-0.057	
Downward							1.050	0.049		1.103	0.098	
Upward							0.611	-0.493	**	1.132	0.124	
Partner older than respondent							1.484	0.395		0.645	-0.439	
First marriage ended in divorce										2.686	0.988	
No partnership between marriages										0.416	-0.877	
Months until second marriage										0.996	-0.004	
Cohabit before first marriage										1.540	0.432	
Age at first marriage										0.382	-0.963	**
Age at first squared										6.084	1.806	**
σ_u		1.548	***		†			1.721	**		†	
Constant		-16.36	***		-10.19	***		-16.23	***		0.98	
Log Likelihood		-2844			-536			-2837			-523	

Note: †: the model does not converge with marginal unobserved heterogeneity so it has not been included $* : p < 0.1$; $** : p < 0.05$; $*** : p < 0.01$

Table 13: Independent hazard model for first and second divorces. Duration dependence is a linear spline without knots

	Men						**Women**					
	First			**Second**			**First**			**Second**		
	HR	b		HR	b		HR	b		HR	b	
Marriage duration	0.997	-0.003	***	1.249	-0.001		0.998	-0.002	***	0.997	-0.003	
Born after 31stDec45	1.642	0.496	**	1.249	0.222		2.153	0.767	***	0.816	-0.203	
Cohabit before CM	1.298	0.261	***	0.504	-0.686	***	1.182	0.167	***	0.505	-0.684	***
Age at current marriage	0.890	-0.116	***	0.937	-0.065		0.877	-0.131	***	0.862	-0.149	***
Age squared	1.063	0.061	*	1.021	0.021		1.067	0.065	*	1.124	0.117	**
First degree or higher	0.846	-0.167		1.017	0.017		1.026	0.026		1.251	0.224	
A-level or equivalent	1.051	0.050		1.017	0.017		1.028	0.028		1.137	0.128	
O level	1.130	0.122		0.776	-0.254		1.047	0.046		0.871	-0.138	
Lower than O level	1.028	0.028		0.643	-0.442		0.988	-0.012		0.978	-0.022	
Divorce rate	1.012	0.012	***	1.039	0.038	***	1.019	0.019	***	1.044	0.043	***
Has kids before CM	1.612	0.477	***	1.791	0.583	*	1.642	0.496	***	1.596	0.468	*
Has kids within CM	0.570	-0.563	***	0.768	-0.264		0.669	-0.402	***	0.867	-0.143	
No religion belief	1.165	0.152	**	0.928	-0.075		1.208	0.189	***	1.141	0.132	
Constant		-4.190	***		-5.827	***		-4.547	***		-4.027	***
σ_u		0.01			1.04	*		0.01			0.73	
Log Likelihood		-9340			-1350			-13783			-1837	

Note: $*: p < 0.1$; $**: p < 0.05$; $***: p < 0.01$