Unilateral Divorce and the Rise of Informal Cohabitation*

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Abstract

Does unilateral divorce eroded the gains of marriage with respect to informal cohabitation? Exploiting the staggered introduction of unilateral divorce across U.S. states, we show that after the reform newly formed relationships are 5% more likely to be cohabitations instead of marriages, and that cohabitation spells last longer. To understand the mechanisms underlying the law changes, we build and estimate a structural life cycle model with partnership choice, female labor supply and savings decisions, where the gains of marriage with respect to cohabitation come from a better risk sharing and specialization within the household, enforced through a costly divorce. In the model the reform increases the risk of divorce, making cohabitation preferred to couples that would have had the highest risk of divorce. Since the couples switching relationship are on average better matched than the average cohabitants, the duration of cohabitations increases.

Keywords: Marriage, Cohabitation, Unilateral Divorce, Structural Estimation

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1 Introduction

Cohabitation is on the rise: according to Manning (2013), the share of women that ever cohabited moved from 33% in 1987 to 60% in 2010. Why did this happen? Since the seminal work of Becker (Becker, 1981), economists studied the incentives behind the decision to marry, among which the sharing of public goods, the division of labor to exploit comparative advantages (Chiappori, 1997), and risk sharing (Voena, 2015 and Oikonomou and Siegel, 2015). These reasons tell us why couples live together, while they are actually silent about the choice between marriage and informal cohabitation, two partnership contracts subject to different rules. While the literature often simplifies, avoiding this distinction, these two type of couples display a different labor supply, wealth accumulation and educational composition. It is not surprising that households, the smallest economic unit, can behave differently when the contract ruling them is different, but this can be the key to understand important economic phenomena. For example, cohabitations have a much higher separation rate than marriages, which might be a cause of the high share of single mothers living in the US nowadays, which is the single strongest predictor for upward mobility[1] according to Chetty and Hendren (2018). If we want to understand the behavior of cohabiting households and its implications, we first need to understand how they are formed and why they are growing in number.

In this paper we address the question of the rise of cohabitation, focusing on the role of unilateral divorce on the share of people that decides to cohabit. Unilateral divorce is a natural candidate for explaining this choice, since it has been shown by the literature to be an important factor of the marriage surplus. Unilateral divorce also made cohabitation and marriage more similar in the rights of breaking up a relationship, which is an opportunity to study whether the different outcomes of those relationships are due to selection or by

[1] While the share of single mothers is the strongest predictor of differences in upward mobility across counties on top of segregation, residential segregation, income inequality, social capital, school quality, and racial shares, Chetty and Hendren (2018) points out that half of this effect is due to self selection.

the rules governing those contracts. Our main contribution is to show that the rate of cohabitation increased after the changes in the US law because the increased risk of divorce made marriage less attractive. More in particular, cohabitation becomes the preferred choice to couples that would have experienced the highest risk of divorce. As a consequence, the average match quality of cohabiting couples increases, which cause cohabitation spells to last longer.

We first use data from the National Survey of Family and the Household and from the National Survey of Family Growth to build a sample of first and second relationships[2]. Then, exploiting the exogenous variation coming from the staggered introduction of unilateral divorce over time across US states, we show that cohabitation becomes around 5% more likely to be chosen compared to the pre-reform period. Interestingly, the effect is heterogeneous on how property is divided upon divorce, being strongest in states where each spouse gets half of the wealth. This suggest that the result cannot be entirely due to a deterioration of divorce as a commitment technology[3], since the egalitarian property division rule can act as a substitute of the mutual consent regime. Moreover, we analyze how unilateral divorce affected the duration of newly formed cohabitation spells, showing that they last longer both because of a reduced risk of marriage and separation. To understand the mechanisms that lead to these changes we build a dynamic model of intrahousehold decision making, where cohabitation and marriage differ in their splitting cost as well as in the way property is divided. While in the case of separation assets are always split as an agreement between spouses, in the case of divorce in some states it is the judge to decide. Moreover, separation can be initiated unilaterally, as opposed to divorce, that would need the consensus of both partner under a mutual divorce regime. Individuals are initially single, and with some probability in each period they meet a potential partner, which they can decide to marry

[2] A relationship is defined as an interruption of the state of singleness, which can either be marriage or cohabitation.

[3] This mechanism is highlighted by Lafortune and Low (2019), where the equal division of assets within marriage makes possible to efficiently invest in children even after the rise of unilateral divorce.

or start cohabiting with. Couples make decisions about consumption, savings and female labor supply and they are subject to idiosyncratic income shocks. Couples also receive time varying match quality shocks, which might drive the couple to change their partnership status (i.e. from cohabitation to marriage) or to separate. We model the decision making in the couple building on the literature of limited commitment (see for example Kocherlakota (1996), Ligon et al. (2002), Marcet and Marimon (2019) and Pavoni et al. (2018)), which has been applied to dynamic collective models in the household by Voena (2015), Mazzocco (2007), Foerster (2019) and Lise and Yamada (2018) among others. In this framework, when one member of the couple wishes to split, the couple rebargains such that the binding member is made indifferent between separation and staying in a couple[4]. The gains of marriage with respect to cohabitation come from a better risk sharing and a more efficient specialization in the production of a public good[5], which arise from a better commitment within the couple, enforced by the threat of a costly divorce. On the other hand, couples that would face a high risk of divorce if married (i.e. because of a low match quality draw) are more likely to choose cohabitation instead, since it implies a lower cost of separation while allowing to enjoy the gains from being in a couple. In the model, a switch from mutual consent to unilateral divorce causes couples to start cohabiting more, since the higher risk of divorce makes the expected value of marriage with respect to cohabitation lower. The effect would be particularly pronounced under community property division of assets upon divorce, since the richest part of the couple would risk to lose most of its wealth. This mechanism implies that couples that would have married under the old regime, are cohabiting instead. Since those have a higher match quality than the average cohabiting couples, this selection drives down the risk of separation for cohabiting couples, as observed in the data.

We then estimate the model using the simulated method of moments to learn about the

[4] For particularly bad draws in the match quality or productivity shock this might not be possible and hence the couple would split.

[5] We assume that a public good is produced with money an female time. When females stop working for producing such good their potential productivity in the labor market decreases.

size of our main mechanism. We use as targets an array of moments regarding the mating market and the differential female labor supply for cohabiting and married couples. We find that the model is able to reproduce the results from our empirical evidence, thus validating our mechanism. We then run a series of counterfactual experiments to gain intuition about forces that might have contributed to the rise of cohabitation in the last decades. [In particular, we quantify the role of the wage structure and technological progress in the household sector, which increases the opportunity cost of home production with female time and decreases the gains coming from labor market specialization.]

The contribution of this paper is threefold. First, we document and explain how divorce laws affected the choice between marriage and cohabitation. This adds to the existing literature that documented the effects of divorce laws on the rate of divorce (Friedberg, 1998, Wolfers, 2006), female labor supply (Stevenson, 2008, Voena, 2015), savings (Voena, 2015), assortative mating (Reynoso, 2019) and prostitution (Ciacci, 2017) among the others. As in Reynoso (2019), we study not only the effect of unilateral divorce on married couples, but also on partnership choice. While her focus is on who marries whom and concludes that unilateral divorced raised the share of singles, we abstract from modeling the mating market and we focus on partnership choice, which allow us to conclude that the rate of singleness declined less than previously thought, since some people that were believed not to be in a couple were actually cohabiting. Our paper builds on Voena (2015), that studies how the interaction of unilateral divorce with property rights upon divorce affected household behavior of married couples. We extend her work both considering cohabitation as an alternative relationship and in analyzing the effects of these laws on sorting. Second, our paper expands the literature on cohabitation, showing how the risk of divorce is essential for understanding partnership choices. Different papers in the literature highlighted various gains of marriage with respect cohabitation: commitment (Matouschek and Rasul, 2008), labor specialization within the couple Gemici and Laufer (2014), learning about match quality Brien et al. (2006), the interaction between the cost of divorce and learning Blasutto (2020) and investment in children Lafortune and Low (2019). A paper close to ours is Lafortune and Low (2019), who highlight the role of assets as a collateral that enforces commitment and hence allows for optimal investment in children. In their model, a switch from mutual consent to unilateral divorce causes people without wealth to start cohabiting because they are left without a commitment technology. While we think that their mechanism is important, it cannot be the whole story since we observe that the switch toward cohabitation was the weakest in title based state, while their model would predict the opposite. In this paper we will quantify how much of the shift is due to the erosion of marriage's collateral versus the role of the increased risk of divorce. We extend the work of Gemici and Laufer (2014) and Blasutto (2020), who develop collective dynamic models with limited commitment, introducing asset accumulation decisions, which are shown to play an important role for commitment and hence for partnership choice, especially when interacted with property rights upon divorce. Third, our paper speaks to the literature studying the changes of the family in the last decades. Recent works have investigated various channels through which the structure of families might have changed over time. Albanesi and Olivetti (2016) show the role of improved maternal health on the rise of female labor force participation, Greenwood et al. (2016) instead study the role that technology and the wage structure played in the rise in assortative mating, female labor force participation, the share of divorced and the increase in the share of singles. Our paper extends this work, studying the effect of wage structure, gender wage gap and changes in the home production technology on the rise of cohabitation. Through a series of counterfactual experiments we are able to inspected which were the main forces behind the rise in cohabitation. Intuitively, as wages grow and the price of home appliances decreases, household can buy on the the market goods that were once produced at home. Since one of the gain of marriage with respect to cohabitation lies in the better specialization of production within the household, we might expect that those forces imply a reduction in the share of couples choosing marriage over cohabitation.

The paper is organized as follows: section 2 offers an overview of US divorce laws, section

3 presents the empirical results, while section 4 describes in detail the theoretical model. Section 5 explain the procedure used for the estimation as well as the results. Section 6 report the results from a series of counter-factual experiments, while section 7 performs a welfare analysis. Section 8 draws the conclusions of the paper.

2 US Divorce Laws: an Overview

Between late 1960s and early 1980s most U.S. states experienced fundamental changes in the divorce law, both regarding the right to initiate a divorce without the consent of the other spouse and about the laws that govern the division of assets upon divorce.

Before the 1960s the vast majority of US states had a mutual consent divorce regime[6], where the agreement of both spouses was needed to obtain a divorce for mundane reasons (i.e. without misconduct by any spouse). Moreover, divorce was permitted for grounds showing guilt of misconduct[7] by any of the two spouses: for those cases the agreement of the innocent party alone was enough for having a divorce granted. From the late 1960s and early 1980s most U.S. states[8] switched to a unilateral divorce regime. Under this regime divorce can be filed by one spouse without the consent of the other.

Another dimension along which divorce laws differs across states is the one about property division regimes. In the United States there are three types of those:

1. *Community Property.* Under this regime the couple are jointly owning family wealth, both that obtained during marriage and before. This implies that when divorce occurs, each spouse gets exactly half of the total family wealth.

[6] All the states apart from New Mexico, Oklahoma and Alaska.

[7] Examples of guilt or misconduct are adultery or abandonment.

[8] A list of the years at which unilateral divorce was introduced in different states can be found in table 1 of Ciacci (2017).

2. *Equitable distribution.* Under this regime, it is the court that decides how to split family wealth between the two spouses. This decision is driven by the principle of equity, which is ambiguous: in some cases the wealth is divided exactly in half, while in others a larger share reserved to the party that contributed the most to its accumulation.

3. *Title Based Regime.* Under this regime wealth is split according to the title of ownership.

The comparison between marriage and cohabitation is worth a final remark. Separation can be initiated unilaterally and it falls under the title based property. Another importance difference is that while divorce requires the couple to undergo a legal process, which implies monetary and time costs, separation from cohabitation just requires one member of the couple to leave.

3 Data and Empirical Evidence

3.1 The Dataset

We begin by describing our data. We use the the National Survey of Family and the Household (NSFH) wave I, and the National survey of Family Growth, 1988 wave. Both surveys were designed to study the causes and consequences of changes happening in families and households within the United States. This is reflected in detailed questions regarding the retrospective family history of respondents, which includes information both about marriage and cohabitation. Moreover, primary respondents[9] are asked a large set of questions regarding their socio economic background and the demographics of the household. While the NSFH I is the first of three longitudinal waves, NSFG is made of several repeated cross

[9] One adult per household was randomly selected as the primary respondent, while in the NSFG respondents are all women of 15-44 years of age.

sectional samples. We decided not to use the other two other waves of the NSFH because in the second wave all currently cohabiting households were dropped from the survey, while the 1988 wave of NSFG is the only one with publicly available information about the residence of the respondents. A drawback of using this data[10] is that we know the state of residence of the respondents only at age 16 for the NSFH and at birth for the NSFG. Since we also know whether people lived all their life in the same State, we are able to perform our empirical analysis both on the universe and of the subsample of never movers. We will show that point estimates turn out to be statistically not distinguishable between the two samples. Further details regarding those two surveys can be found in Bumpass et al. (2017) and Mosher and Bachrach (1996). We use this dataset to build two samples, the one of *first and second relationships* and the one of *first cohabitations*, that are described below.

First and Second Relationships Sample

We build a sample to analyze the type of relationship, which can be either marriage or cohabitation,[11] that respondents decided to have. The sample is made of first and second relationships. One first relationship is defined observing the first time (if ever) a certain person started cohabiting or married. This observation is associated to the date at which the relationship starts, to the characteristics of the respondent member of the formed couple, and with a *type*, which can either marriage or cohabitation. Note the type of couples that cohabited before marriage is "cohabitation": the transition from cohabitation to marriage is analyzed using the sample of *first cohabitations*. Second relationships are defined in a similar fashion, but they include only respondents that ended the relationship with their first partner and started a new one with a different person. The way this sample is built implies that

[10] We do not have the choice of using other surveys for our analysis, since they either lack the State of residence variable, or they miss information about cohabitation history, or they do not cover people that were in a relationship age at the time the law changed.

[11] Dating is not considered, since we cannot observe this state. Hence, people dating will fall under the category of singles.

for some respondents we will have zero corresponding observations in this sample, while for others we will have one, and for others we will have two. We did not consider third or higher order relationships for our analysis since these individuals would be further away from the age at which we knew their state of residence. Finally, we consider only relationship that started when the respondent was 20 years old or older. In table 1 we report the descriptive statistics of this sample.

TABLE 1
Descriptive Statistics, Cohabitation Sample

Statistic	N	Mean	Median	St. Dev.
Unilateral Divorce	13,627	0.279	0	0.449
Age Relationship Starts	13,627	25.400	23	6.833
Married	13,627	0.700	1	0.458
College	13,627	0.226	0	0.418
Female	13,627	0.630	1	0.483
Year of birth	13,627	1,944.433	1,949	15.819
NSFH	13,627	0.795	1	0.404

First Cohabitation Sample

This sample is built to analyze the decisions of cohabiting couples to separate or to marry. It is composed of the first non marital cohabitation experienced by respondents. This sample includes couples that cohabited before marriage, but it also includes cohabitations experienced by people with the following marital history: marriage without premarital cohabitation, divorce, cohabitation with a different person. Each observation of this sample is associated with a starting date, a possible ending date, and an outcome, which can be: still cohabiting, married or separated. In table 2 we report the descriptive statistics of this sample.

Table 2
Descriptive Statistics, Relationship Sample

Statistic	N	Mean	Median	St. Dev.
Unilateral Divorce	5,675	0.454	0	0.498
Age Cohabitation Starts	5,675	23.701	22	6.976
Year Cohabitation Starts	5,675	1,978.724	1,980	7.160
College	5,675	0.162	0	0.368
Female	5,675	0.758	1	0.428
Cohabitation Duration	5,675	24.170	13	29.513
Year of birth	5,675	1,954.630	1,956	13.790
NSFH	5,675	0.562	1	0.496
Censored	5,675	0.102	0	0.303
Married	5,675	0.490	0	0.500
Separated	5,675	0.408	0	0.491

3.2 Empirical Evidence

Does unilateral divorce affects the partnership choice of couples? We exploit the timing[12] in the adoption of unilateral divorce as a source of exogenous variation in the right to divorce. This strategy has already been used several times by the literature[13] to study the non-neutrality of of the rights to divorce on various economic and demographic outcomes. According to Gruber (2004), who reviews the legal literature about the topic, the introduction of unilateral divorce was not view as a tool of social policy, but rather a way to reduce the legal burden of divorce processes. This reasoning is consistent with the fact that this change was not initiated by the most liberal states: New York was the last state to introduce unilateral divorce in October 2010, almost 40 years later than Kentucky. Moreover, Reynoso (2019) shows that there is no geographic correlation in adoption.

[12] See table 1 in Ciacci (2017) for the timing of adoption of unilateral divorce.

[13] Among the others, see Wolfers (2006), Stevenson (2008), Voena (2015), Reynoso (2019) and Ciacci (2017).

Relationship Choice

What is the effect of unilateral divorce on the partnerships that couples choose? To answer this question we estimate equation 3, where i are the newly formed couples, t is the calendar time, and s is the state:

$$\text{married}_{i,t,s} = \beta_0 + \beta_1 * \text{Unilatearal}_{t,s} + \gamma' \mathbf{X}_i + \delta_s + \nu_t + \epsilon_{i,t,s}. \tag{1}$$

The dependent variable is a dummy take takes value 1 if the couple i, started at time t if state s is a marriage, and 0 if it is cohabitation. The vector $\mathbf{X}_i$ instead includes a set of socio demographic controls, while δ_s are the state fixed effects and ν_t are the time fixed effects. The variable $\text{Unilateral}_{t,s}$ instead is a dummy that takes value 1 if unilateral divorce wave in place in state s at time t: β_1 instead is the coefficient that is informative about the effect of unilateral divorce on partnership choice. The results of the estimation are reported in table 3 for different samples. Column (1) reports the results for the full sample described in section 3.1, while column (2) is restricted the observation for which we know that the person lived all its life in the reported states, which ensures that they did not migrate. Finally, columns (3) and (4) restrict the sample to respectively the NSFH and NSFG surveys only .

Table 3
OLS Regression. Observation: first and second relationships

	Dependent variable:			
	Married (0/1)			
	Full Sample	Resident	NSFH	NSFG
	(1)	(2)	(3)	(4)
Unilateral Divorce	−0.057***	−0.066***	−0.067***	−0.054
	(0.013)	(0.016)	(0.015)	(0.034)
State Fixed effects	Yes	Yes	Yes	Yes
Age Polynomials	Yes	Yes	Yes	Yes
Year started Fixed Effect	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
Observations	13,627	8,357	10,830	2,797
R^2	0.203	0.220	0.224	0.140

Notes: standard errors are clustered at the state level. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5% and ***1%.

The results reported in table 3 suggest that the effect of unilateral divorced decreased the share of couples that are married by $-5\%/-6\%$. This results are robust to an alternative specification that includes state specific linear trends, whose results are reported in table C.1, and to the use of a logistic regression, reported in table C.3.

We then move on to better understand the heterogeneity hidden behind the effect of unilateral divorce. While in some states assets are split in the same way within separation and divorce, which is the case of *title based regime* states, in others this rule is different, which is the case of *community property* and *equitable distribution* states. Analyzing this heterogeneity is then interesting to understand how much the asset sharing rule is important for understanding relationship choices. We hence estimate equation

$$
\begin{aligned}
\text{married}_{i,t,s} = \beta_0 + &\beta_1 * \text{Unilatearal*No Title Based}_{t,s} \\
&+ \beta_2 * \text{Unilatearal*Title Based}_{t,s} + \\
&\beta_3 * \text{Title Based}_{t,s} + \gamma' \mathbf{X_i} + \delta_s + \nu_t + \epsilon_{i,t,s},
\end{aligned}
\tag{2}
$$

whose indexes and controls are the same of equation 2, with the difference that now we capture the interaction of unilateral divorce with asset division regimes interacting $\text{Unilateral}_{t,s}$ with $\text{Title Based}_{t,s}$ and $\text{No Title Based}_{t,s}$, which indicates whether state s at time t had or not a title based regime. In table 4 we report the results of the estimation of equation 2. Similarly to table 3, column (1) reports the results for the full sample described in section 3.1, while column (2) is restricted the observation for which we know that the person lived all its life in the reported states, which ensures that they did not migrate. Finally, columns (3) and (4) restrict the sample to respectively the NSFH and NSFG surveys only.

TABLE 4
OLS Regression. Observation: first and second relationships

	Dependent variable:			
	Married (0/1)			
	Full Sample	Resident	NSFH	NSFG
	(1)	(2)	(3)	(4)
UnDiv*NoTit	-0.065^{***}	-0.073^{***}	-0.079^{***}	-0.049
	(0.014)	(0.018)	(0.016)	(0.037)
UnDiv*Tit	-0.012	-0.018	-0.005	-0.053
	(0.028)	(0.037)	(0.033)	(0.063)
Tit	0.004	0.001	0.012	-0.024
	(0.016)	(0.020)	(0.018)	(0.034)
State Fixed effects	Yes	Yes	Yes	Yes
Age Polynomials	Yes	Yes	Yes	Yes
Year started Fixed Effect	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
Observations	13,627	8,357	10,830	2,797
R^2	0.204	0.220	0.224	0.140

NOTES: standard errors are clustered at the state level. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5% and ***1%.

The results show that the effect of unilateral divorce on the likelihood that a couples chooses marriage over cohabitation is significant and around $-5\%/-6\%$ in non title based states, while it is non significant and much smaller in title based states. This results suggests that the fact of having a sharing rule decided by the law is not enough to replace the mutual consent regime as an alternative commitment technology. Instead, this results are consistent with the view that the richest partner start disliking marriage when divorce becomes unilateral, since she would risk to lose most of his wealth upon divorce. This was not happening in mutual consent regime, since she could have exercised her right to veto divorce. In title based state this threat for the richest member of the couple does not exist, hence marriage surplus with respect to cohabitation does not vary significantly. Table C.2 shows that results are robust to the inclusion of state specific linear trends.

Cohabitation Duration

What is the effect of unilateral divorce on cohabitation duration? How much of the change is due to a variation in the risk of separation versus the risk of marriage? In order to answer these question, we construct a model of cohabitation duration with multiple risks, namely separation and marriage. Our model builds on Jenkins (1995), who shows how that a logistic regression can be used for studying duration of events, expanding the the dataset of relevant spells to make unit of time per spells observations, where the dependent variable takes value 1 whenever the event of interest occurs. The natural extension of this model to a multiple risk environment would be to use a multinomial logit. However, the problem with this model is that it assumes independence of irrelevant alternatives, which is particularly unappealing for our problem, since it would imply that the relative probability of choosing marriage over separation stays the same after cohabitation is no longer an option. Hence, we chose to model cohabitation duration with a multinomial probit, where the independence of irrelevant alternatives does not need to be satisfied. We then study the choice of cohabiting couple i, at calendar time t in state s and at duration d estimating the following model:

$$
\begin{aligned}
Y^{\text{Marry}}_{i,s,t,d} &= \beta^{\text{Marry}} * \text{Unilatearal}_{s,t} + \gamma^{\text{Marry'}}\mathbf{X_i} + \alpha_d + \delta_s + \nu_t + \epsilon^{\text{Marry}}_{i,s,t,d}, \\
Y^{\text{Cohabit}}_{i,s,t,d} &= \beta^{\text{Cohabit}} * \text{Unilatearal}_{s,t} + \gamma^{\text{Cohabit'}}\mathbf{X_i} + \alpha_d + \delta_s + \nu_t + \epsilon^{\text{Cohabit}}_{i,s,t,d}, \\
Y^{\text{Separate}}_{i,s,t,d} &= \beta^{\text{Separate}} * \text{Unilatearal}_{s,t} + \gamma^{\text{Separate'}}\mathbf{X_i} + \alpha_d + \delta_s + \nu_t + \epsilon^{\text{Separate}}_{i,s,t,d},
\end{aligned}
\tag{3}
$$

where

$$
\begin{pmatrix} \epsilon^{\text{Marry}}_{i,s,t,d} \\ \epsilon^{\text{Cohabit}}_{i,s,t,d} \\ \epsilon^{\text{Separate}}_{i,s,t,d} \end{pmatrix} \sim \mathcal{N}(\mathbf{0}, \mathbf{\Sigma}),
\tag{4}
$$

and

$$
Y_{i,s,t,d} = \begin{cases} \text{Marry} & \text{if} \quad Y^{\text{Marry}}_{i,s,t,d} > Y^{\text{Cohabit}}_{i,s,t,d} \ \text{and} \ Y^{\text{Marry}}_{i,s,t,d} > Y^{\text{Separate}}_{i,s,t,d} \\ \text{Cohabit} & \text{if} \quad Y^{\text{Cohabit}}_{i,s,t,d} > Y^{\text{Marry}}_{i,s,t,d} \ \text{and} \ Y^{\text{Cohabit}}_{i,s,t,d} > Y^{\text{Separate}}_{i,s,t,d} \\ \text{Separate} & \text{otherwise.} \end{cases}
\tag{5}
$$

The model described above is estimated with bayesian techniques via Markov chain Monte Carlo following the procedure of Imai and Van Dyk (2005), which is implemented using the standard options provided by the *R* package *MNP* developed by Imai et al. (2005). In table 5 we report results from the full sample in column (1), from the resident only sample in column (2) and from the observations coming from the NSFH and NSFG surveys alone respectively in column (3) and (4). Note that to gain intuition about the size of the results, in table 5 we computed the average risk of the event of interest relatively of continue cohabiting.The results shows that unilateral divorce caused an increase in the duration of cohabitation, which comes from both a reduced hazard of marriage and of separation. While the result about the risk of marriage is not unexpected in light of the estimation results described above, the reduced risk of separation brings new insights about the possible mechanisms underlying partnership choices. In fact, the decrease in the risk of separation is consistent with a selection effect: some cohabiting couples would have married if mutual consent divorce was still in place. If the match quality of cohabitations is lower than the one of marriages[14], unilateral divorce drives down the risk of separation because of a selection effect.

Table 5
Multinomial Probit. Observation: person-month of cohabitation

	Full Sample	Resident	NSFH	NSFG
	(1)	(2)	(3)	(4)
	Risk of Marriage relative to Cohabitation			
Unilateral Divorce	−0.24***	−0.25***	−0.28***	−0.28***
	(0.06)	(0.08)	(0.09)	(0.09)
Average Relative Risk	0.64	0.63	0.59	0.6
	Risk of Separation relative to Cohabitation			
Unilateral Divorce	-0.19***	-0.16***	-0.08	-0.24*
	(0.07)	(0.06)	(0.05)	(0.14)
Average Relative Risk	0.67	0.71	0.83	0.62
State Fixed effects	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes
Age Polynomial	Yes	Yes	Yes	Yes
Picewise Duration	Yes	Yes	Yes	Yes
Observations	138012	81920	77826	60186
Censored spells(%)	10.18	10.98	11.6	8.38

Notes: standard errors are obtained through the distribution of parameter obtained using the markov chain monte carlo estimation descibed by Imai and Van Dyk (2005). Coefficients that are significantly different from zero are denoted by the following system: *10%, **5% and ***1%.

4 The Model

This section describes a dynamic life cycle structural model of partnership formation, savings, female labor supply and home production. Couples act cooperatively subject to limited commitment, which means that rebargaining might happen in response to changes in the outside options, which are assumed to be divorce or separation.

[14] This seems plausible in light of the fact that the risk of divorce is much lower than the risk of separation.

In the model time is discrete, and in each period men and women draw their productivities. If single, with some probability they meet a potential partner: after drawing a match quality shock they decide whether to marry, cohabit or to stay single. Couples observe realization of the match quality shock as well as of their productivity, and according to those they decide whether to stay together or to split. Both singles and couples make consumption and savings decisions, using their money for private or public good expenditure. Couples also make female labor supply decisions[15] and female time can be used to produce the public good, but this comes at the cost of a loss in productivity. The gains of being in a couple comes from love, risk sharing and labor market specialization. Instead, the gains of marriage with respect to cohabitation comes from a more functioning risk sharing and a better specialization in time use, which derives from the high cost of divorce serving as a commitment device. These gains of marriage deteriorates when the love shock is low enough to cause a high risk of divorce and frequent renegotiations: in this case cohabitation might be the better option, since we assume that the cost of separation will be lower than the cost of marriage.

[15] We assume that single females and all men work full time.

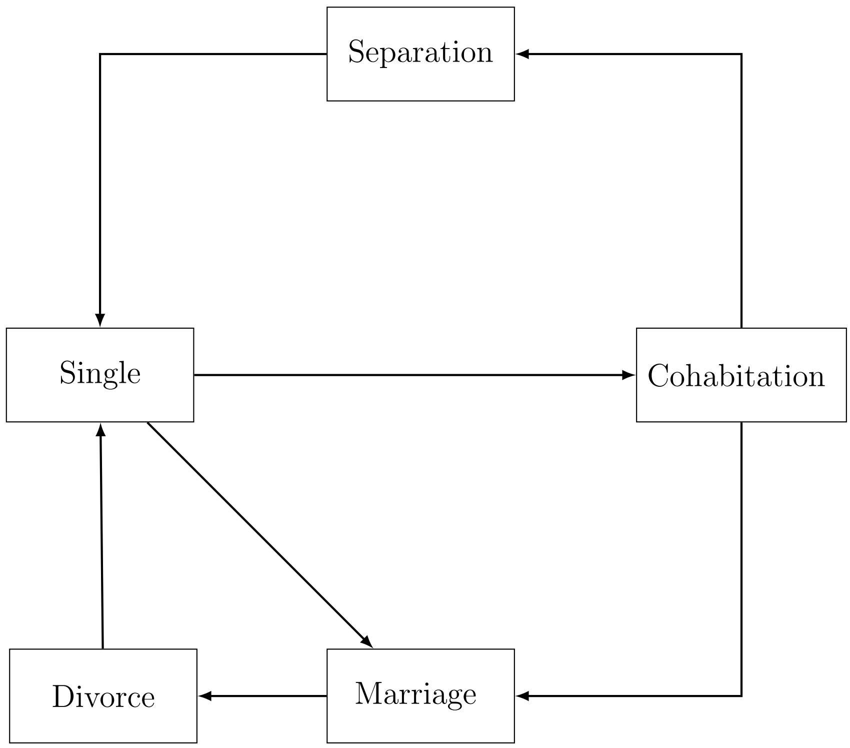

FIGURE 1

4.1 Preferences

Women f and men m derive utility consuming a private good c and a household public good Q. The public good can be interpreted in terms of both the quantity and quality of children, as well as the goods and services produced within the household, as washing clothes or home cooked meals. Preferences are separable in the two goods and across time. Agents derives utility from a couple specific love shock ψ which evolves over time and it can be interpreted as can be interpreted as the value of love and companionship in a couples. The intra period utility of a single agent $s \in (f, m)$ is:

$$u(c_t^s, Q_t^s) = \frac{c_t^{s\,1-\sigma}}{1-\sigma} + \alpha \frac{Q_t^{s\,1-\xi}}{1-\xi},$$

where the superscript s on Q accounts for the fact that there is no partner to share the public good. Instead, the utility for agent $s \in (f, m)$ in a couple is:

$$u^C(c_t^s, Q_t) = \frac{c_t^{s\,1-\sigma}}{1-\sigma} + \alpha \frac{Q_t^{1-\xi}}{1-\xi} + \psi_t,$$

where the match quality evolves over time according to the following law of motion:

$$\psi_t = \psi_{t-1} + \epsilon_t, \text{ where } \epsilon_t \sim \mathcal{N}(0, \sigma_\psi^2),$$

while the love shock at first meeting is allowed to have a different variance $\sigma_{\psi,I}^2$

4.2 Home Production

In our model each agent in embodied with one unit of time. While singles and married men are assumed to supply inelastically one unit of market labor, females in a couple can be out of the labor force to devote their time producing the home good Q. The public good can be produced buying d goods in the market. Following Greenwood et al. (2016) we define the production function of home good as:

$$Q_t = [d_t^\nu + \kappa(1 - P_t^f)^\nu]^{\frac{1}{\nu}}, \text{ where } 0 < \nu < 1. \tag{6}$$

The parameter ν captures the degree of substitutability between female time and the use of durables in the production of the home good. This structure implies that when the relative price of durables decreases and when wages goes up, households will use less female time for its production, and hence female employment will increase. The variable P_t^f is a dummy variable that that takes value 1 when the women is participating in the labor market.

4.3 Wages

The labor income for agents $s \in \{f, m\}$ depends on their age t and on a permanent income component z_t^s:

$$\ln(w_t^s) = f_t^s + z_t^s,$$

where f_t^s is a gender specific function that captures the evolution of productivity over age. The permanent income component z_t^s evolves over time as:

$$z_t^s = z_{t-1}^s - (1 - P_t^s)\mu + \zeta_t^s, \text{ where } \zeta_t^s \sim^{iid} \mathcal{N}(0, \sigma_{\zeta^s}^2), \text{ and } \zeta_1^s = z_1^s. \tag{7}$$

Note that μ is the loss in productivity that affects women[16] that are not participating in the labor market. It can be be interpreted as a reduced form way of capturing both the missed opportunity to accumulate human capital while working as wells as the skill atrophy deriving from interruptions, a phenomenon described by Adda et al. (2017). Modeling the loss in productivity for not working is an important feature of our model as it creates an incentive to join the labor force for women that expect to divorce or separate soon.

4.4 Budget Constraints

The budget constraint of single agents $s \in \{f, m\}$ is:

$$a_{t+1}^s = Ra_t^s + w_t^s - c_t^s - d_t^s, \text{ with } a_{t+1}^s \geq 0, \tag{8}$$

where a^s are agent's savings, w^s is the wage and c^s and d^s are consumption in the private good and the expenditure used to produce the public good. The budget constraint for a

[16] As we anticipated men always participate in the labor market, hence $P_t^m = 1 \; \forall \; t$.

couple instead is:

$$a_{t+1} = Ra_t + w_t^m + P_t^f w_t^f - c_t^f - c_t^m - d_t, \text{ with } a_{t+1} \geq 0, \tag{9}$$

where P_t^F is a dummy of female labor force participation. When a couple divorces in t, we assume

$$a_t^m + a_t^f = \delta a_t,$$

where δ is the fraction of total assets a_t left[17] after divorce. Separation instead comes with no monetary costs[18]. An important feature of our model is the role of property rights upon divorce, which define how assets are divided. We distinguish three cases which define the share of assets χ going to the women:

1. *Community Property.* Assets are split exactly in half: $\chi = 0.5$
2. *Equitable Distribution.* $\chi \sim \mathcal{U}(1/3, 2/3)$.
3. *Title Based Regime.* χ is proportional to the productivity of the women compared to the one of the men, formally

$$\chi = \frac{\exp z^f}{\exp z^f + \exp z^m}.$$

It is worth noting that we depart from Voena (2015) in the way title based regime is modeled: she assumes that assets are split following a couple decision, while for us the sharing rule depends only on z^F and z^M. Since in our model relative productivities are the only source of disagreement. If we took the modeling assumption of Voena (2015) we would still get

[17] The assumption that divorce erodes a fracction of wealth is common to Cubeddu and Ríos-Rull (2003).

[18] In reality the monetary cost of separation is likely to be positive. We assumed it to be zero because of the difficulties that arises when it comes to identify it. In fact, the gap in divorce and separation cost is what is actually needed to match the data.

that the sharing rule is mainly determined by productivities[19]. Moreover, if the sharing rule was endogenous, couples would always choose cohabitation over community property or equitable distribution marriage,[20] which would make matching the data impossible.

4.5 Problem of the Singles

We start by by describing the problem for a single agent $i \in \{f, m\}$ in t. The agent have to make consumption and saving decisions, and she is also determining expenditured_t^i. In $t+1$ she meets a potential partner j of the opposite sex with probability λ_{t+1} and she can decide to enter a partnership, which also depend on whether the potential partner will agree. If the two decides to marry, the variable MA_{t+1} will take value 1, while $CO_{t+1} = 1$ if the couple decides to cohabit. Otherwise, MA_{t+1} and CO_{t+1} will be equal to 0. Note we assume singles to always participate in the labor market. The state variable of a single then is $\omega_t^i = \{a_t^i, z_t^i\}$, while her choices are represented by the vector $\mathbf{q}_t^i = \{a_{t+1}^i, c_t^i, d_t^i\}$. We denote by $V_t^{i,S}(\Omega_t^i)$ the value function of agent s, which we define as

$$
\begin{aligned}
V_t^{iS}(\omega_t^i) = \max_{\mathbf{q}_t^i} u(c_t^i, Q_t^i) + \beta E_t \Big\{ & (1-\lambda_t) V_{t+1}^{iS}(\omega_{t+1}^i) + \\
& \lambda_t \big\{ (1 - MA_{t+1})(1 - CO_{t+1}) V_{t+1}^{i,S}(\omega_{t+1}) + \\
& MA_{t+1} V_{t+1}^{i,M}(\Omega_{t+1}) + CO_{t+1} V_{t+1}^{i,C}(\Omega_{t+1}) \big\} \Big\}, \\
\text{s.t. } (8) \text{ and } (6).
\end{aligned}
\tag{10}
$$

[19] If we had individual specific love shocks, our reduced form modeling assumption would give different results instead.

[20] This would happen because separation would have more degrees of freedom that divorce, where it is the court that decides the sharing rule.

4.6 Household Planning Problem

The problem of the couple depends both on the type of relationship, cohabitation or marriage, and on the divorce regime, which can be either *mutual consent* or *unilateral*. Separation is always unilateral. Under the unilateral regime, one partner can initiate the separation/divorce process alone, while under mutual consent the agreement of both is needed.

Mutual Consent Regime

Under mutual consent marriage $\hat{M}$, couples solve a Pareto problem where the weight[21] of the wife is θ^f, while the one of the husband is $1-\theta^f$. The state vector is $\Omega_t^{\hat{M}} = \{a_t, z_t^f, z_t^m, \psi_t, \theta^f\}$, while the variables over which the couple maximize are summarized by the vector $\mathbf{q}_t^M = \{a_{t+1}, d_t, c_t^m, c_t^f, P_t^f, D_t\}$, where D_t is a dummy variable that takes value 1 is divorce happens and 0 otherwise. The formal problem that a couple married is t solve is:

$$
\begin{aligned}
V_t^{\hat{M}}(\Omega_t^{\hat{M}}) = & \max_{\mathbf{q}_t^M}(1-D_t)\{\theta^f u(c_t^f, Q_t) + (1-\theta^f)u(c_t^m, Q_t) + \psi_t + \beta E_t V_{t+1}^{\hat{M}}(\Omega_{t+1}^{\hat{M}})\} \\
& + D_t\{\theta^f V_t^{fS}(\omega_{t+1}^f) + (1-\theta^f)V_t^{mS}(\omega_t^m))\} \\
\text{if } D_t = 0: \quad & \text{s.t. (9) and (6)} \\
\text{if } D_t = 1: \quad & \text{s.t. (8), (6) for } i \in \{f, m\}, \\
& a_t^m + a_t^f = \delta a_t, \\
& a_t^m, a_t^f \text{ determined according to property right regime}, \\
& V_t^{fS}(\omega_t^f) > W_t^{f\hat{M}}(\Omega_t^{\hat{M}}), \\
& V_t^{mS}(\omega_t^m) > W_t^{m\hat{M}}(\Omega_t^{\hat{M}}).
\end{aligned}
\tag{11}
$$

[21] Refer to subsection 4.7 for a description about how pareto weight are initially set.

The individual value of marriage conditional on $D_t = 0$ is $W_t^{i\hat{M}}$ for $i \in \{F, M\}$, and it is defined as

$$W_t^{i\hat{M}} = u(\tilde{c}_t^i, \tilde{Q}_t) + \psi_t + \beta E_t V_t^{i\hat{M}}(\Omega_{t+1}^{\hat{M}}), \tag{12}$$

where $\tilde{\mathbf{q}}_t^{\hat{M}} = \{\tilde{a}_{t+1}, \tilde{d}_t, \tilde{c}_t^m, \tilde{c}_t^f, \tilde{P}_t^f\}$ is the $\arg\max$ of problem (11) conditionally on having chosen $D_t = 0$. $V_{t+1}^{i\hat{M}}(\Omega_{t+1}^{\hat{M}})$ instead can be obtained by the expectation of the sum of the time utilities that the agent get from $t + 1$ to T, where the variables entering the utility function derive derive from the the pareto problem if the agent is in a relationship, otherwise they are the solution of (10). Under mutual consent regime the pareto weight is never rebargained, which makes risk sharing efficient. It also makes harder a divorce to happen, since the member that after a shock is relatively worse off can exercise her veto power to avoid a divorce: this feature makes labor specialization easier.

Unilateral Divorce Regime

Under the unilateral divorce regime, denoted by $\overline{M}$, couples solve a Pareto problem where the weight of the wife is θ_t^f and the one of the husband is θ_t^m. Note that, in opposition to the mutual consent regime, now pareto weights are allowed to vary over time. This happes whenever a member of the couple is better off divorcing: the other member will try to convinve her not to split offering her a larger share of resources. The state vector of this proble is $\Omega_t^{\overline{M}} = \{a_t, z_t^f, z_t^m, \psi_t, \theta_t^f, \theta_t^m\}$, while the variables over which the couple maximize are summarized by the vector $\mathbf{q}_t^M$. The formal problem that a couple married at t solves is:

$$
\begin{aligned}
V_t^{\overline{M}}(\Omega_t^{\overline{M}}) = & \max_{\mathbf{q}_t^M}(1-D_t)\{\theta_{t+1}^f u(c_t^f, Q_t) + \theta_{t+1}^m u(c_t^m, Q_t) + \psi_t + \beta E_t V_{t+1}^{\overline{M}}(\Omega_{t+1}^{\overline{M}})\} \\
& + D_t\{\theta_t^f V_t^{fS}(\omega_{t+1}^f) + \theta_t^m V_t^{mS}(\omega_t^m))\} \\
\text{if } D_t = 0: \quad & \text{s.t. (9) and (6)}, \\
& \theta_{t+1}^f = \theta_t^f + \mu_t^f, \\
& \theta_{t+1}^m = \theta_t^m + \mu_t^m, \\
\text{if } D_t = 1: \quad & \text{s.t. (8), (6) for } i \in \{f, m\}, \\
& a_t^m + a_t^f = \delta a_t, \\
& a_t^m, a_t^f \text{ determined according to property right regime},
\end{aligned}
\tag{13}
$$

where θ_{t+1}^f and θ_{t+1}^m adjust such that the following participation constraints are satisfied:

$$
\begin{aligned}
W_t^{f\overline{M}}(\Omega_t^{\overline{M}}) &\geq V_t^{fS}(\omega_t^f), \\
W_t^{m\overline{M}}(\Omega_t^{\overline{M}}) &\geq V_t^{mS}(\omega_t^m).
\end{aligned}
\tag{14}
$$

Note that μ_t^i are the langrange multipliers associated with spouses' participation constraints. Similarly to mutual consent regime, the individual value of marriage conditional on $D_t = 0$ is $W_t^{i\overline{M}}$ for $i \in \{f, m\}$, and it is defined as

$$
W_t^{i\overline{M}} = u(\tilde{c}_t^i, \tilde{Q}_t) + \psi + \beta E_t V_{t+1}^{i\overline{M}}(\Omega_{t+1}^{\overline{M}}),
\tag{15}
$$

where $\tilde{\mathbf{q}}_t^{\overline{M}} = \{\tilde{a}_{t+1}, \tilde{d}_t, \tilde{c}_t^m, \tilde{c}_t^f, \tilde{P}_t^f\}$ is the arg max of problem (11) conditionally on having chosen $D_t = 0$. $V_{t+1}^{i\hat{M}}(\Omega_{t+1}^{\overline{M}})$ instead can be obtained by the expectation of the sum of the time utilities that the agent get from $t+1$ to T, where the variables entering the utility function derive derive from the the pareto problem if the agent is in a relationship, otherwise they are the solution of (10). Note that we follow the literature assuming that the planner evaluates the welfare of the two members of the couple if a divorce happens with the current Pareto weights. Under the unilaral divorce regime pareto weights varies every time one participation constraint is binding, which makes risk sharing worse than in the mutual divorce regime. Labor market specialisation is also less functioning, since the higher risk of divorce makes women willing to insure against this event through labor market participation. Property rights upon divorce plays a significative role when splitting is unilateral: for example under community propery the least wealthy member can bargain a higher share of resources since the threat of divorce is real. This could not happen under a title based regime.

Cohabitation

Cohabiting couples, denoted by C, solve a pareto problem where the weight of the wife is θ_t^f and the one of the husband is θ_t^m.The state vector is $\Omega_t^C = \{a_t, z_t^f, z_t^m, \psi_t, \theta_t^f, \theta_t^m\}$, while the variables over which the couple maximize are summarized by the vector $\mathbf{q}_t^C = \{a_{t+1}, d_t, c_t^m, c_t^f, P_t^f, S_t, MA_t\}$. S_t and MA_t are dummy variable that take value 1 is the couple respectively separate of marry[22] and 0 otherwise. The formal problem that a cohabiting

[22] We denote marriage by M, which might be fall under unilateral divorce regime $\overline{M}$ or mutual consent $\hat{M}$.

couple at t solves is:

$$
\begin{aligned}
V_t^C(\Omega_t^C) = &\max_{\mathbf{q}_t^C}(1-S_t)\{\theta_{t+1}^f u(c_t^f, Q_t) + \theta_{t+1}^m u(c_t^m, Q_t) + \psi_t + \beta E_t V_{t+1}^C(\Omega_{t+1}^C)\} \\
&\quad + MA_t\{\theta_{t+1}^f u(c_t^f, Q_t) + \theta_{t+1}^m u(c_t^m, Q_t) + \psi_t + \beta E_t V_{t+1}^M(\Omega_{t+1}^M)\} \\
&\quad + S_t\{\theta_t^f V_t^{fS}(\omega_{t+1}^f) + \theta_t^m V_t^{mS}(\omega_t^m))\} \\
\text{if } S_t = 0: &\qquad \text{s.t. (9) and (6),} \\
&\qquad \theta_{t+1}^f = \theta_t^f + \mu_t^f, \\
&\qquad \theta_{t+1}^m = \theta_t^m + \mu_t^m, \\
\text{if } S_t = 1: &\qquad \text{s.t. (8), (6) for } i \in \{f, m\}, \\
&\qquad a_t^m + a_t^f = a_t, \\
&\qquad a_t^m, a_t^f \text{ determined as in the title based regime,}
\end{aligned}
\tag{16}
$$

where θ_{t+1}^f and θ_{t+1}^m adjust such that the following participation constraints are satisfied:

$$
\begin{aligned}
W_t^{fC}(\Omega_t^C) \geq V_t^{fS}(\omega_t^f), \\
W_t^{mC}(\Omega_t^C) \geq V_t^{mS}(\omega_t^m).
\end{aligned}
\tag{17}
$$

Note that μ_t^i are the langrange multipliers associated with spouses' participation constraints. The individual value of cohabitation conditional on $S_t =$ is W_t^{iC} for $i \in \{f, m\}$, and it is defined as

$$
W_t^{iC} = u(\tilde{c}_t^i, \tilde{Q}_t^i) + \psi_t + \beta E_t V_{t+1}^{iC}(\Omega_{t+1}^C), \tag{18}
$$

where $\tilde{\mathbf{q}}_t^C = \{\tilde{a}_{t+1}, \tilde{d}_t, \tilde{c}_t^m, \tilde{c}_t^f, \tilde{P}_t^f\}$ is the arg max of problem (11) conditionally on having chosen $S_t = 0$. $V_{t+1}^{iC}(\Omega_{t+1}^C)$ instead can be obtained by the expectation of the sum of the time utilities that the agent get from $t+1$ to T, where the variables entering the utility function derive derive from the the pareto problem if the agent is in a relationship, otherwise they are the solution of (10). Similarly to the unilateral divorce regime, we assume that the planner evaluates the welfare of the two members of the couple if a separation happens with the current Pareto weights.

The cohabitation problem is similar to the one of marriage under the unilateral divorce regime, but two main features are different. First, the way assets are split within cohabitation might not be the same, and total assets are not eroded when separation happens. On the one hand this makes risk sharing and cooperation less functioning than in marriage with unilateral divorce, since the couple is left without a commitment-enhancing technology. On the other hand, assuming no cost of separation makes cohabitation more appealing to couples with a low surplus of being in a couple. Since for them splitting if very likely, they prefer the relationship that allow them to do it in a cheaper way.

4.7 Partnership Choice and the Mating Market

In each period t singles have a probability λ_t to meet a potential partner of their same age and with a productivity and wealth that depends on their productivity z_t and assets a_t. Formally:

$$\ln(a_t^p) = \ln(a_t) + \hat{\epsilon}, \text{ where } \hat{\epsilon} \sim \mathcal{N}(0, \sigma_{\hat{p}}^2), \tag{19}$$

$$z_t^p = z_t + \tilde{\epsilon}, \text{ where } \tilde{\epsilon} \sim \mathcal{N}(0, \sigma_{\tilde{p}}^2). \tag{20}$$

These assumptions allow us to capture in a reduced from fashion that people are mating assortatively[23] both within marriage and cohabitation, as Gemici and Laufer (2014) point out. Once the meeting happened, agents have to decide whether to stay in a couple and eventually decide which partnership contract to choose. Note that for the rest of this section we will refer to marriage as M, but depending on property rights upon divorce we have $M \in \{\hat{M}, \overline{M}\}$. We model their choices in three steps.

[23] In the life cycle models featured in Ciscato (2019), Shephard (2019) and Reynoso (2019) assortative mating arise in marriage markets through the interactions of preferences, incentives, supply and demand forces.

1. The couple considers marriage M (cohabitation C) as a viable alternative if the set of pareto weights[24] θ^f such that the couple prefers to marry (cohabit) is non-empty. Formally, for relationship $J \in \{M, C\}$ the set is

$$\Theta_t^J(\Omega_t^J, \omega_t^f, \omega_t^m) = \left\{\theta_t : V_t^{fJ}(\Omega_t^J) \geq V_t^{fS}(\omega_t^f), V_t^{mJ}(\Omega_t^J) \geq V_t^{mS}(\omega_t^m)\right\}. \tag{21}$$

2. If the set for marriage (cohabitation) is non-empty, the pareto weight for the potential marriage $\theta^{m,f}$ (cohabitation $\theta^{c,f}$) is set through symmetric Nash Bargaining.[25] Formally[26], for $J \in \{M, C\}$ $\theta^{J,f}$ is set to :

$$\theta_t^{J,f} = \underset{\theta_t^f \in \Theta_t^J}{\arg\max}\, \Upsilon^J(\theta_t^f, \Omega_t^{J,-1}, \omega_t^f, \omega_t^m), \tag{22}$$

where

$$\Upsilon^J(\theta_t^f, \Omega_t^{J,-1}, \omega_t^f, \omega_t^m) = \left[V_t^{fJ}(\Omega_t^{J,-1}) - V_t^{fS}(\omega_t^f)\right] \times \left[V_t^{mJ}(\Omega_t^{J,-1}) - V_t^{mS}(\omega_t^m)\right]. \tag{23}$$

3. Four possible situation can arise:
   - $\Theta_t^M = \emptyset$ and $\Theta_t^C = \emptyset \Rightarrow$ stay single.
   - $\Theta_t^M \neq \emptyset$ and $\Theta_t^C = \emptyset \Rightarrow$ marry.
   - $\Theta_t^M = \emptyset$ and $\Theta_t^C \neq \emptyset \Rightarrow$ cohabit.
   - $\Theta_t^M \neq \emptyset$ and $\Theta_t^C \neq \emptyset \Rightarrow$ The couple chooses the partnership that gives the largest Nash product. Formally, if $\Upsilon^M(\Omega_t^M, \omega_t^f, \omega_t^m) \geq \Upsilon^C(\Omega_t^C, \omega_t^f, \omega_t^m)$, otherwise cohabit.

[24] Without loss of generality, we impose $\theta^f + \theta^m = 1$ at first meeting.

[25] The assumption that the initial pareto weight is pinned down by Nash Bargaining can be found in Low et al. (2018).

[26] For consistency with the rest of the paper we define $\Omega_t^{J,-1}$ as the state vector for the couple excluding pareto weights.

This framework is a natural extension of the nash bargaining problem[27] to discrete choices.

5 Estimation

We estimate our model following a two step procedure. In a first step, we set some parameters outside the model. This can be done for parameters that can be directly linked to the data and for parameters that our data does not directly identifies: those are fixed according to findings coming from the existing literature. Moreover, we also estimate the labor income processes of men and women outside the model: this procedure is common in the literature[28] and it has been used to reduce the burden of structural estimation. In the second step we use the simulated method of moments to estimate the deep parameters of the model. In this section we describe in detailed every step of the estimation and we discuss the identification of the structural parameters as well as the results.

5.1 Income Processes

For both men and women we model the hourly wage rate using PSID, dividing the annual labor income by the number of yearly working hours supplied. In this way we avoid considering a variation in working hours as a productivity shock. This correction is particularly relevant for the estimation of women's income process, as the variance of hours worked per year is considerably higher than for men. For our estimation we consider the 1968-1993

[27] Note that we could have chosen a different protocol for determining the choice between marriage and cohabitation. For example, we could have decided to impose a sequential structure to the problem, assuming that first agents compare cohabitation to singleness, obtaining the envelop of the two, where the pareto weight is set as above. Then, the agents make their final choice solving a pareto problem where the outside option is the outcome of the first step. We tried applying this methodology: results were indistinguishable from our main strategy.

[28] See for example Voena (2015), Reynoso (2019) and Gourinchas and Parker (2002).

waves of the PSID, including men and women between age 20 and 65.

For the estimation of men's processes we proceed estimating the following model for man i, of age t, from state s in survey year sur:

$$\ln(w^m_{i,t,s,sur}) = \iota^m_0 + \iota^m_1 * t + \iota^m_2 * t^2 + \delta_s + \nu_{sur} + u^m_{i,t,s,sur}, \tag{24}$$

where $u^m_{i,t,s,sur} = z^m_t + e^m_{i,t,s,sur}$. z^m_t follows equation 7, while $e^m_{i,t,s,sur}$ is the measurment error. Instead, δ_s are state fixed effects and ν_{sur} are year of the survey fixed effects. We then estimate equation 24, whose results are reported in table B.1: this allow us to obtain the residuals $\hat{u}^m_t$. We then use the regression residuals to estimate through GMM the variance of the permanent component of income σ^{2m}_ζ and the one of the measurment error σ^{2m}_e using the following conditions:

$$\begin{aligned} E(\Delta\hat{u}^m_t) &= \sigma^{2m}_\zeta + 2\sigma^{2m}_e \\ E(\Delta\hat{u}^m_t \Delta\hat{u}^m_{t-1}) &= -\sigma^{2m}_e \end{aligned} \tag{25}$$

Results are reported in table 6.

The estimation of female's labor earning differs from the men's one since we need to take into account the endogeneity of female labor participation. We do so using a Heckman selection correction procedure. Female labor earnings of female i, of age t, from state s in survey year sur:

$$\ln(w^f_{i,t,s,sur}) = \iota^f_0 + \iota^f_1 * t + \iota^f_2 * t^2 + \delta_s + \nu_{sur} + u^f_{i,t,s,sur}, \tag{26}$$

where $u^f_{i,t,s,sur} = z^f_t + e^f_{i,t,s,sur}$. z^f_t follows equation 7, while $e^f_{i,t,s,sur}$ is the measurment error. Instead, δ_s are state fixed effects and ν_{sur} are year of the survey fixed effects. We observe female wages only if

$$\gamma'\mathbf{Z}_{i,t,s,sur} + \pi_{i,t,s,sur} > 0, \tag{27}$$

where $\mathbf{Z}_{i,t,s,sur}$ includes all the regressors in equation 26 plus the interaction of unilateral divorce[29] with property rights regimes upon divorce. Instead, $\pi_{i,t,s,sur}$ includes measurment error and the permanent component of income. The estimation results of the two steps are reported in tables B.3 and B.2. Finally, we use the regression residuals from the second step $\hat{u}_t^m$ to estimate through GMM the variance of the permanent component of income σ_ζ^{2f} and the one of the measurment error σ_e^{2f} using the following conditions[30]:

$$
\begin{aligned}
E(\Delta \hat{u}_t^f | P_t^f = 1, P_{t-1}^f = 1) &= \sigma_\pi^f \frac{\phi(\tau_t)}{1 - \Phi(\tau_t)}, \\
E(\Delta (\hat{u}_t^f)^2 | P_t^f = 1, P_{t-1}^f = 1) &= \sigma_\zeta^{2f} + \sigma_\pi^{2f} + 2\sigma_e^{2f} + \tau_t \frac{\phi(\tau_t)}{1 - \Phi(\tau_t)}, \\
E(\Delta \hat{u}_t^f \Delta \hat{u}_{t-1}^f | P_t^f = 1, P_{t-1}^f = 1, P_{t-2}^f = 1)) &= -\sigma_e^{2f}.
\end{aligned}
\tag{28}
$$

Results are displayed in table 6.

TABLE 6
Parameters of the Income Processes

Parameter	Symbol	Value	Standard Error
f's age return (constant)	ι_0^f	-0.383	(0.012)
f's age return (linear component)	ι_1^f	0.0244	(0.002)
f's age return (squared component)	ι_2^f	-0.0005	(0.000)
Variance of f's permanent income shock	σ_ζ^{2f}	0.0399	(0.004)
m's age return (constant)	ι_0^m	-0.342	(0.014)
m's age return (linear component)	ι_1^m	0.0495	(0.002)
m's age return (squared component)	ι_2^m	-0.0009	(0.000)
Variance of m's permanent income shock	σ_ζ^{2m}	0.0417	(0.005)

NOTES: The parameters are estimated using nonlinear least squares using single, cohabiting and married males and females from the PSID. Standard errors are computed by bootstrap.

[29] This strategy has been used by Voena (2015) and Reynoso (2019)

[30] The conditions are those used by Low et al. (2018).

5.2 Preset Parameters

This section describes how we choose the parameters that are set externally from the model. In the model we assume agents to start making decisions at age 20, while they retire at 65 and die with probability 1 at age 82. Each period in the model lasts 1 year: we chose this length balancing the benefits of having a short period, which fits the fact that cohabitation spells are particularly short, and the computational burden associated with having too many periods. We chose the relative risk aversion γ of private goods and the discount factor β to be those in Attanasio et al. (2008), while the relative risk aversion of public goods ξ is taken from Greenwood et al. (2016). Instead, the parameters relative to the production of public goods, ν and κ are those in McGrattan et al. (1997). The annual interest rate is set to 3%. The unexplained variance of male and female's earnings at age 20 $\sigma^{2_m}_{\zeta,1}$ and $\sigma^{2_f}_{\zeta,1}$ are taken directly from the PSID data, as well as the variance in the labor earning of the partner at meeting, which is denoted by $\sigma^2_{\tilde{p}}$. Instead, the variance in the assets owned by the partner at meeting $\sigma^2_{\hat{p}}$ is taken from the ACS.

TABLE 7
Preset Parameters

Estimated Parameters	Symbol	Value	Source
Initial age		20	
Retirement age	T_R	65	
Age at death	T	82	
Years per period		1	
Interest rate	$R-1$	0.03	
m's average earnings in $t=1$		1	Normalization
Pensions			Heathcote et al. (2010)
Var. partner's asset at meeting	$\sigma^2_{\hat{p}}$	0.01	ACS
Var. partner's productivity at meeting	$\sigma^2_{\hat{p}}$	0.16	PSID
Var. f's productivity in $t=1$	$\sigma^{2_f}_{\zeta,1}$	0.41	PSID
Var. m's productivity $t=1$	$\sigma^{2_m}_{\zeta,1}$	0.40	PSID
Relarive Risk Aversion private good	γ	1.5	Attanasio et al. (2008)
Discount factor	β	0.98	Attanasio et al. (2008)
Relarive Risk Aversion public good	ξ	3.11	Greenwood et al. (2016)
Function	**Symbol**	**Value**	**Source**
$Q_t = [d_t^{\nu} + \kappa(1-P_t^f)^{\nu}]^{\frac{1}{\nu}}$	κ	3.76	McGrattan et al. (1997)
	ν	0.19	McGrattan et al. (1997)

5.3 Method of Simulated Moments

We use the method of simulated moments (McFadden, 1989 and Pakes and Pollard, 1989) to pin down the vector $\vartheta = (\alpha, \lambda, \sigma_{\psi}, \sigma_{\psi,I}, \delta, \mu)$ of the 6 remaining parameters of the model. We use 38 moments for the structural estimation, which capture the process of marriage andf cohabitation creation and dissolution, as well the labor supply behavior of women. More precisely, we include moments about the hazard of divorce (12), the hazard of separation (6), the hazard of marriage (6), the share of people everm married over time (6), the share of people that ever cohabited over time (6), female labor force participation (1), and differences in female labor force participation between marriage and cohabitation (1). We use the retrospective marital hisotry data from the NSFH wave III to construct[31] moments about marriage and cohabitation, while we use the PSID for female labor supply. We include in the sample for the data moment construction male and females born in 1945-1955, which allow us to follow them unitl a late age, and also to observe how their behavior react to changes in divorce laws. Moreover, we do not include in the sample state with a title based regime to reduce the burden of computation. The first step for the estimation is to solve the model for a vecto of paramters ϑ, then simulating income, love shocks and unexpected policy changes to obtain the simulated behavior for the given parametrization. This allow us to compare the simulated and the data moments: the objective is to obtain ϑ such that this difference is the smallest possible. Formally, the problem that we solve is

$$\hat{\vartheta} = \arg\min_{\theta} \qquad (\mathbf{m} - \mathbf{m}_{\vartheta})'\mathbf{W}(\mathbf{m} - \mathbf{m}_{\vartheta}), \tag{29}$$

where $\mathbf{m}$ is the vector of empirical moments, as described in the section about target moments, while $\mathbf{m}_{\vartheta}$ is the vector of the moments simulated by the model parametrized with ϑ. $\mathbf{W}$ is a matrix where the diagonal contains the inverse of the variance of the data moments, while all the other entries are zeros. The minimization of this object function is performed using a global minimization algorithm called TikTak, which is described in detail in appendix A.

[31] NSFH wave III is conducted in 2001/2003 following the original respondents of wave 1. This sample does not include respondents under age 45 as of January 2000 unless some particular conditions are met, but this is not an issue for us since the youngest person in our estimating sample was 44 in 2000. One possible issue with this data is that by mistake during NSFH wave II all cohabiting couples were dropped by the sample. We can circumvent this issue simulating the same "mistake" dropping some observation from the fictional samples.

5.4 Identification

This section provides a description of how, heuristically, the structural parameters of the model are identified. The parameter α is identified by total female labor force participation: when this parameter is large the household want to produce more of public good which require female time. Instead μ affects the gap in female labor force participation for married and cohabiting couples: when this parameter is large, specialization within cohabitation becomes harder, which increases the gap. λ is intuitively identified by the share of people in a relationship, while δ is informative about the gains of marriage with respect to cohabitation. The parameter $\sigma_{\psi,I}$ is identified by the hazard of separation and marriage: when this parameter is small compared to the variance of the transitory shocks, agents are not *picky* about sorting into cohabtitation, but they move fast to a new relationship or they separate within the first periods of the relationship. Finally, σ_{ψ} identifies the hazard of divorce: the larger the variance in the shocks, the higher would be the likelihood that marriage surplus becomes negative. We did not use the results from the empirical part as targets as we think that they would provide rendundant information about the identification. More in particular, as the risk of divorce is the main driver of the reaction to divorce laws, σ_{ψ} is also identifying the parameters of the empirical part.

5.5 Results

Table 8 reports the results of the structural estimation. The estimated standard σ_{psi} deviation of the transitory match quality shock is 0.18, while standard deviation $\sigma_{psi,I}$ of the love shock at first meeting is higher with a value of 0.21. Instead, the probability of meeting a partner λ is 0.8, while the share of assets left after a divroce is δ: this is not a big number, but it is able to generate large differences between marriage and cohabitation. Finally, the weight on the public good α is 0.18, while the loss in productivity parameter μ is 0.21.

The fit of the model is reported in table 9. The model matches well the hazard of marriage, separation and divorce over time: model moments rarely lies outside the moment data 95% condifidence interval. Also the share of people that ever cohabited and married over time is well matched, even though people start marry too early in the model and there are too many people that are ever married by 45: this is probably due to the fact that the meeting probabilities stay constant over the life cycle in the mode, while they might be lower in reality due to a shrink in the availability of possible partner with age. The data about female labor force participation is matched well.

The model is validated according to its ability to reproduce the effects of unilateral divorce. We run the same econometric models of section 3.2 with the data sample used for estimation and with a fictional sample that behaves according to the model with the estimated structural parameters. The results, reported in table 9, show that the direction of the effects is correct, while being quantitatively too large in model.

TABLE 8
Estimated Structural Parameters

Estimated Parameters		Value
Standard deviation of match quality shock	σ_ψ	0.18
Standard deviation of initial match quality shock	$\sigma_{\psi,I}$	0.21
Probability of meeting a partner	λ	0.8
Share assets left upon divorce	δ	0.80
Weight of public good	α	0.18
Loss in productivity while not working	μ	0.21

NOTES: The parameters in the table are estimated using the method of simulated moments.

Table 9
Model fit and Validation

Estimated Moments	Model	Data	95% CI
Hazards over Time	fig. D.1	fig. D.1	fig. D.1
Share Ever Cohabited and Married:	fig. D.2	fig. D.2	fig. D.2
FLFP in a Couple:	0.50	0.53	[0.52,0.54]
FLFP if Married/ FLFP if Cohabiting	0.95	0.90	[0.89,0.91]
External Moments	**Model**	**Data**	**95% CI**
β_1 equation: Unilateral Divorce on likelihood to Marry	-0.23	-0.065	[-0.041,-0.089]
Unilateral Divorce on the relative Risk of Marriage	0.62	0.73	[0.60,0.86]
Unilateral Divorce on the relative Risk of Separation	0.91	0.82	[0.75,0.89]

Notes: Confidence intervals are obtained by bootstrapping. The coefficients and the relative hazard ratios in the table differs from those obtained with the same econometric model in section 3.2. The reason is that the sample used for the empirical part is different from the one used for structural estimation.

6 Counterfactual Experiments

7 Welfare Analysis

Table 10
Welfare by gender and divorce regime

Female		**Male**	
Mutual Consent	Unilateral Divorce	Mutual Consent	Unilateral Divorce
Life-Time utilities in $t = 0$			
-20.03	-20.6	-18.48	-18.96
Welfare Losses with Unilateral Divorce			
			
2378.87 $		2208.37 $	

Welfare losses are obtained computing the amount of wealth that has to be transferred to men and women in $t = 0$ such that their life time utility under the unilateral divorce regime equals the one under mutual consent. The wealth is measured in 1990 dollars.

Table 11

Welfare by gender and divorce regime assuming Cohabitation is not an option

Female		**Male**	
Mutual Consent	Unilateral Divorce	Mutual Consent	Unilateral Divorce
Life-Time utilities in $t = 0$			
-20.04	-20.7	-18.48	-19.05
Welfare Losses with Unilateral Divorce			
			
2767.02 $		2592.36 $	

Welfare losses are obtained computing the amount of wealth that has to be transferred to men and women in $t = 0$ such that their life time utility under the unilateral divorce regime equals the one under mutual consent. The wealth is measured in 1990 dollars.

8 Conclusion

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Appendix

A Computational Appendix

Research research by Arnoud et al. (2019) compares an array of local and global optimizers, which are given the task or finding the global optimum of non well-behaved functions. They find that a multistart alborithm that they propose, called TikTak, outperforms the others regarding in terms of time required to reach the solution and the probability that the algorithm actually find the right point. In light of these findings, we decided to use TikTak for solving problem 29. While the core of the original algorithm is the same as in Arnoud et al. (2019), we adapted it to accomodate parallelization in conjunction with GPU computnig, which is used for solving efficiently the model by backward induction. TikTak is implemented following the following steps:

1. Draw and evaluate N Sobol points

2. Sort the N Sobol points $(s_1 ,..., s_N)$, with $f(s_1) \leq \cdots \leq f(s_N)$ and keep the first N^* with $N^* < N$. Note that $f()$ is the objective function. We set those number such that $N^*/N = 0.15$.

3. Then run local searches $(\hat{s}_1 ,..., \hat{s}_N)$. Call z_j^* the point resulting from the local minimization[32] starting from $\hat{s}_j$. Then, the next starting point will be a convex combination between $\hat{s}_{j+1}$ and the most fit point that arised so far through local minimizations Z_j^*, defined as $Z_j^* = \min\{z_1^*, ..., z_j^*\}$. Formally:

$$\hat{s}_{j+1} = (1 - \theta_j) + \theta_j Z_j^*,$$

[32] We use the local minimization algorithm provided by Cartis et al. (2019), which is a derivative-free optimization (DFO) for nonlinear Least-Squares (LS) problems. This algorithm is robuts to noise, which might arise because of the errors coming from the approximation of continuous problems on a discrete grid.

where

$$\theta_j = \min\big[\max[0, 1, (j/N^*)^{\frac{1}{2}}], 0.995\big].$$

4. The global minimum is $Z^*_{N^*}$.

B Estimation of Income Processes

TABLE B.1
OLS Regression. Observation: Males in Year t.

	(1)
DEP. VARIABLE: MALE LOG EARNINGS	
ι_1^m	0.05
ι_2^m	-0.00
ι_0^m	-0.34
Survey Year Fixed Effects	✓
State Fixed Effects	✓
Observations	98118
R^2	0.152

NOTES: Standard errors are obtained through bootstrapping and they are reported in summary table 6.

TABLE B.2

OLS Regression. Observation: Females in Year t.

	(1)
DEP. VARIABLE: FEMALE LABOR EARNINGS	
ι_1^f	0.02
ι_2^f	-0.00
ι_0^f	-0.38
Survey Year Fixed Effects	✓
State Fixed Effects	✓
Observations	86891
R^2	0.085

NOTES: Standard errors are obtained through bootstrapping and they are reported in summary table 6.

TABLE B.3

Probit Regression. Observation: Females in Year t.

	(1)
DEP. VARIABLE: FEMALE LABOR FORCE PARTICIPATION	
Unilateral Divorce∗Community Property	-0.18***
Unilateral Divorce∗Title Based	-0.08
Unilateral Divorce∗Equitable Distribution	-0.06
Equitable Distribution	-0.00
ι_1^f	0.01***
ι_2^f	-0.00***
ι_0^f	1.95
Survey Year Fixed Effects	✓
State Fixed Effects	✓
Observations	127728

NOTES: standard errors are clustered at the state level. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5% and ***1%. 6.

C Robustness Checks - Empircal Analysis

Relationship Choice - Linear State Trends

Table C.1
OLS Regression. Observation: first and second relationships

	Dependent variable:			
	Married (0/1)			
	Full Sample	Resident	NSFH	NSFG
	(1)	(2)	(3)	(4)
Unilateral Divorce	−0.060***	−0.071***	−0.071***	0.005
	(0.020)	(0.024)	(0.022)	(0.053)
State Fixed effects	Yes	Yes	Yes	Yes
Age Polynomials	Yes	Yes	Yes	Yes
Year started Fixed Effect	Yes	Yes	Yes	Yes
Linear trend by State	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
Observations	13,627	8,357	10,830	2,797
R^2	0.208	0.227	0.232	0.152

Notes: standard errors are clustered at the state level. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5% and ***1%.

Relationship Choice - Heterogeneity by Propoerty regime and linear state trends

Table C.2
OLS Regression. Observation: first and second relationships

	Dependent variable:			
	Married (0/1)			
	Full Sample	Resident	NSFH	NSFG
	(1)	(2)	(3)	(4)
UnDiv*NoTit	-0.062^{***}	-0.074^{***}	-0.072^{***}	0.004
	(0.021)	(0.025)	(0.022)	(0.056)
UnDiv*Tit	-0.015	-0.045	-0.023	0.012
	(0.026)	(0.046)	(0.040)	(0.051)
Tit	-0.034^{**}	-0.036	-0.030^{*}	-0.054
	(0.017)	(0.024)	(0.017)	(0.049)
State Fixed effects	Yes	Yes	Yes	Yes
Age Polynomials	Yes	Yes	Yes	Yes
Year started Fixed Effect	Yes	Yes	Yes	Yes
Linear trend by State	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
Observations	13,627	8,357	10,830	2,797
R^2	0.192	0.227	0.209	0.128

Notes: standard errors are clustered at the state level. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5% and ***1%.

Relationship Choice - Logit

Table C.3
Logitstic regression. Observation: first and second relationships

	Dependent variable:			
	Married (0/1)			
	Full Sample	Resident	NSFH	NSFG
	(1)	(2)	(3)	(4)
Unilateral Divorce	-0.307^{***}	-0.387^{***}	-0.354^{***}	-0.317
	(0.095)	(0.127)	(0.107)	(0.229)
State Fixed effects	Yes	Yes	Yes	Yes
Age Polynomials	Yes	Yes	Yes	Yes
Year started Fixed Effect	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
Average Marginal Effects	-0.051	-0.062	-0.051	-0.062
Observations	13,627	8,357	10,830	2,797

Notes: standard errors are clustered at the state level. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5% and ***1%.

D Model Fit

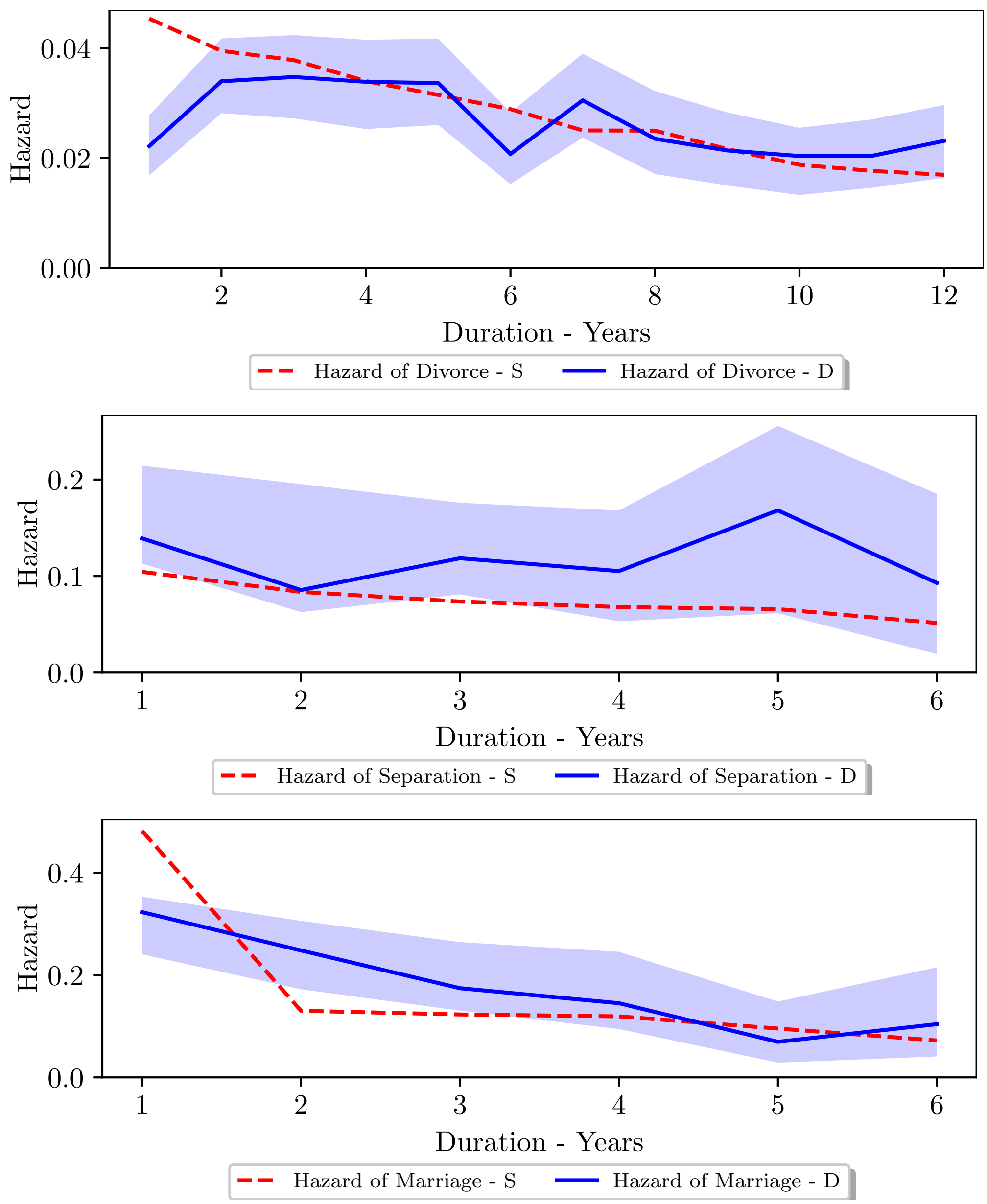

FIGURE D.1 Hazards by Duration of Spells: Data and Simulations

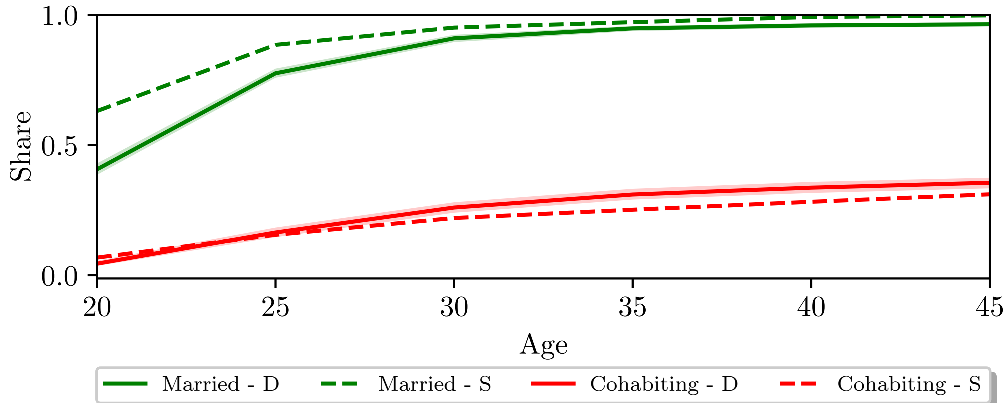

FIGURE D.2 Share ever cohabited and married: Data and Simulations