Cohabitation *vs* Marriage: Mating Strategies by Education in the USA*

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Abstract

The number of couples that are living together without being married represents a large share of total cohabiting couples in the United States as well as many other countries. Yet, very little is known about the reasons behind cohabitation. In this paper, we use data from the National Longitudinal Survey of Youth 1997 to shed light on the different mating behavior observed by education. Using a structural model of partnership choice where agents learn about the quality of their match, we find that for college graduates cohabitation is more of an investment good, used to gather information about the partner that they eventually marry, while for the others cohabitation is more of a consumption good, used as a cheap substitute of marriage.

Keywords: Marriage, Cohabitation, Divorce, Heterogeneous Agents, Match Quality Models, Education, Structural Estimation

JEL-Code: D83 - J12

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1 Introduction

In the economic literature marriage has received a great deal of attention in the last decades. According to the seminal work of Becker (1981), people marry both for non-economic (i.e. love and companionship) and economic reasons, among which the sharing of public goods, the division of labor to exploit comparative advantage and risk pooling. All these reasons are able to explain why couples decide to live together, but they are silent about the choice between just living "under the same roof", henceforth cohabitation, and marrying. More in particular, it is not clear why many couple cohabit before marriage and why do cohabitation rates differ by age and education, as Perelli-Harris and Lyons-Amos (2016) point out.

In this paper we address these questions, focusing on the role of cohabitation as an information device and on the role of learning and economic incentives in forming different mating strategies by education. Our main contribution is to understand how much does economic incentives can explain of the mating differences by education, observed using data from the National Longitudinal Survey of Youth 1997. Specifically, we propose a theory of search and matching in the mating market (marriage and cohabitation), where agents take their decisions according to perceived match quality, in the spirit of Jovanovic (1979). When singles, agents meet in every period a potential partner associated with a match quality, that is imperfectly observed. After the draw, they can decide whether to stay single, cohabit or marry. In the last two cases, in every period they receive an update in their match quality and they decide whether to remain in the same status or to change it. Agents are heterogeneous in their education, which affects their earnings: since the divorce cost is assumed to be monetary, the least educated are *ceteris paribus* less likely to enter marriage compared to the others, since in case of divorce this cost would hit harder on their concave utility. Then, these agents will substitute marriage with serial cohabitation, while the most educated will cohabit to gather information about their partner, before eventually marrying him. The model is built to rationalize a new empirical regularity: the risk of divorce is relatively low for couples that have not cohabited before marriage, it is the highest for couples that cohabited for short periods and then decreases monotonically for longer spells of premarital cohabitation. The model explains these effect with self selection into direct marriage for couples that have a high initial match quality and with learning the decrease in the hazard of divorce for long cohabitation spells. The model described here will be estimated using the method of simulated moments to reflect the real mating market and then it will be evaluated on its ability to reflect the role of premarital cohabitation on divorce and the different mating strategies by education.

It is worth noting that the model can reproduce a non-zero marriage rate only if there are gains from marriage with respect to simple cohabitation. These gains can derive from *incentives* or from agents *preferences*. Among the incentives, we know that the higher commitment[1] associated with divorce enforces specialization within the couple (Cigno (2012)) and the investment in children(Lundberg et al. (2016)). Moreover, a cost of divorce can provide insurance against adverse income shocks within the couple and the law treatment for married and cohabitors is different in the United States[2]. Another reason why people could prefer marriage to cohabitation lies in their preferences: Thornton et al. (2008) documents that religiosity is correlated with the probability of entering into marriage. The mechanism is that more religious people prefer to marry[3] rather to cohabit because for them there is a stigma on cohabitation linked to premarital sex [4]. This link is reinforced by the Gallup Youth Survey 2003, where it is reported that 50% of teens[5] that attend church approve cohabitation, while among the rest of the sample 85% of them approve this kind of relationships.

The contribution to the literature is twofold. First, we find that the cohabitation strategies differ by education: for college graduates, cohabitation is more of an investment good that serves as a marriage trial, while the others substitute marriage with serial cohabitation. There are two main reasons behind this behavior: couples learn

[1] Higher commitment for marriage can be explained by a high cost of divorce. According to Schramm (2006) the cost of divorce is high and amounts to 14 364 US dollars for Utah in 2001.

[2] Bowman (2010) points out that when marriage ends up in divorce the marital property is divided between spouses, while it is not the case within cohabitation. Moreover, alimony is not available for ex-cohabitors.

[3] Mark 10:7-9 "Therefore a man shall leave his father and mother and hold fast to his wife, and the two shall become one flesh. So they are no longer two but one flesh. What therefore God has joined together, let not man separate."

[4] See for example Fernández-Villaverde et al. (2014).

[5] Aged 13-17.

about their match quality and the monetary cost of divorce provokes a higher drop in utility for the poorer. Second, we document some new stylized facts about the role of premarital cohabitation on marriage duration, showing that the distinction between extensive and intensive margin of cohabitation matters.

The main objective of this paper is to explain the different mating strategies by education in the United States, which has been completely ignored by the economic literature. Nevertheless, this topic has already been treated by sociologist and demographers. Bumpass and Lu (2000) document that college educated women are the least likely to ever-cohabit, while Lichter et al. (2010) observed that the phenomenon of serial cohabitation is on the raise in the United States, especially for the disadvantaged. As Perelli-Harris and Lyons-Amos (2016) point out, it is clear that trajectories in partnership formation and dissolution are diverging in the United States and that marriage now seems a partnership type reserved to elites, since the low-educated do not have the economic resources to convert cohabitations into marriages. This paper will be about trying to understand how much does the economic incentives matter for explaining the different mating behavior by education, namely the substitution of marriage with serial cohabitation for the low-educated. This paper also relates to previous literature in economics that focused on the understanding of cohabitation. Gemici and Laufer (2014) build a model of household formation and dissolution where there is a trade off between cohabiting and marrying in the sense that the first one permits to separate with a lower cost, but it display less specialization due to lower commitment. Adamopoulou (2010) instead try to rationalize the increase in the cohabitation rate observed in the United States and in Western Europe with the reduction in the wage gap and the improvement in household production technology, that reduces the gains from specialization. The paper that is most closely related is Brien et al. (2006): they develop a model of match quality where agents cohabit in order to learn about the quality of couple specific match and to insure against future bad bliss shocks[6]. Despite they show that their model is consistent with the incomplete information story, they cannot rule out the possibility that information is actually complete, while it is the true match value that varies stochastically with time. The improvement of this paper with respect to theirs is that, we are able to explain the different mating strategies by education observed in the data

[6] They say this in the paper but they have linear utilities on love shocks, so it is not really an insurance

and the different role of the extensive and intensive margins of premarital cohabitation on the risk of divorce, while their paper cannot. This paper also relates to the literature on the effect of premarital cohabitation on marriage duration. Lillard et al. (1995) were the first to point out that the observed longer duration of marriages without premarital cohabitation is due to self selection. Reinhold (2010) instead uses the National Survey of Family Growth and find that the negative association between premarital cohabitation and marriage duration has weakened for the most recent cohorts and also suggest that self selection is due to individual heterogeneity and may be stabilizing for second and third marriages. This evidence is consistent with Svarer (2004), that using Danish data finds that the self selection affect disappears after a number of controls is inserted into the cox regression model. In the economic literature Marinescu (2016) tests a model of match quality with learning versus changing marriage quality and finds that this last one fits better the data. Using new stylized fact about cohabitation I will claim the opposite.

This paper is organized as follows: section 2 discusses some differences between cohabitation and marriage, section 3 presents the stylized facts, while section 4 present in detail the theoretical model. Section 5 explain the procedure used for the estimation as well as the results. Section 6 draws the conclusions of the paper.

2 The Data

2.1 The Sample

The data used is from the database "National Longitudinal Survey of Youth 97" (henceforth NLSY97), a national longitudinal survey of 8984 people born in the USA between 1980 and 1984 and followed with yearly interviews until 2013. Each round contains a large number of information regarding the education, family background, values and marital history of the interviewed. Moreover, each respondent provides information about the members living in their household. There are two main reasons why we used this data.

First, monthly precision for history of cohabitation and marriage is provided: this information is important since it allows me to account for cohabitation spells that are shorter than one year, which are non negligible in the sample (see Figure 12). The monthly degree of precision for cohabitation data allow us to account not only for the presence or not of cohabitation before marriage (the *extensive margin* of premarital cohabitation), but also its length, that I will call *intensive margin* of premarital cohabitation. In the theoretical section of this paper we will make clear why is it important to distinguish these two margins.

Second, this data contains a *roster* of some characteristics of the partner, such as age, race and education: this will allow me to check whether the effect of marital cohabitation on marriage duration is different when the couple matched assortatively along these characteristics.

We use for our analysis a subsample of the NLSY97 composed by all the observations for which we have full information about the marital history and the information about education is non-missing. Moreover, we drop observations that provided non-consistent answers in the marital history section and for which their partner did not die.[7] The descriptive statistics for the sample of individuals are presented in Table 6, while the descriptive statistics for the resulting sample of cohabitation and marriages is are presented respectively in Table 9 and Table 6. A shortcoming of this data is that it follows individuals until they are 28-33, which is a quite young age, even thought

[7] In principle we could retains these individuals, but in that case we should model the risk of death, which would be computationally expensive. In any case, we observations dropped are less that 20 and the results do not change without the inclusion of these observations.

a significant number of people have experienced cohabitation and marriage already: the mean number of cohabitations per person is around 1 and the average number of marriages is 0.55, as it is reported in Table 6. It is worth noting that also the paper mostly related to ours (Brien et al. (2006)), which uses a sample of 6118 women, followed from the age of 16 to 32. Even thought our model will be estimated using a sample of young people, we will provide evidence in section 4 that our model reproduce realistically the share of people of older ages that are cohabiting.

2.2 Stylized Facts

In this subsection we will present evidence that the mating behavior significantly differs by education. Despite the fact that the sociological and demographic literature have already provided some evidence that serial cohabitation is more of a phenomenon observed for non college graduate and that college graduated seems to prefer marriage to cohabitation, we present these differences also in this paper. We do that for two reasons: first, we want to be sure that they apply also for our data. Second, we also want to be clear about how the array of stylized facts that we would like to explain with the model are built. The type of statistics that we will use is the coefficients of cox regressions. We are using this type of techniques for the stylized facts because they allow to clean for heterogeneity that could potentially affects the behavior of the agents through preference heterogeneity and stigma by social groups[8]. All this "cleaned" heterogeneity can be very interesting to study, in particular for the evolution of the cohabitation rate through time and across countries, but it is not the focus of this paper. It should be clear that this section is about stylized facts: I will not claim causality here, which is instead an issue that I will cover in the estimation section.

Fact 1: *College graduate marry more and cohabit less than other people.*
If we look at descriptive statistics, we can notice that college graduates cohabit less than the others: in our sample, the ratio of the average number of cohabitations of college to non college graduate is 0.63, as it is illustrated in Figure 5. The ratio of the average number of marriages of the college to non college graduate is instead bigger than one (1.06). While these differences appear to be quite big, especially considering that our

[8] Think, for example at the stigma towards premarital cohabitation for Christian Catholics.

sample is quite young and college graduate usually marry later than the others, it is still possible that these differences are driven by other characteristics, as for example religion or ethnicity, that is correlated both to education and to mating behavior. In order to check whether these differences still hold when we control for some possible confounding factors, we run a cox regression of the Fine and Gray (1999) type, using as a unit of analysis the singleness spells of our sample. This statistical tool allows us to inspect how the fact of being a college graduate is correlated to the risk of marrying versus cohabiting, controlling for observed heterogeneity as well as the possibility of observing singleness spells that end up in censoring. I reported the results from this analysis in the table Table 1 below: in both specifications[9] it is clear that being a college graduate increases the probability that the singleness spell ends up in marriage, where cohabitation is the competing risk. Note that this result prove that college graduate are more likely to choose marriage versus cohabitation when they are singles, but this does not automatically imply that they marry more and cohabit less. It could be that college graduate never transit from cohabitation to marriage, while the others do it frequently: this situation could give rise to an higher number of marriages for non college graduate even thought their singleness spells are more likely to end up in cohabitation than marriage. The next stylized fact will rule out this possibility.

Table 1: Estimation results : Fine and Gray (1999) regression, separation is a competing risk

	(1)	(2)
eq1		
College	0.64^{***}	0.15^{**}
Individual Controls	✓	✓
Religion Dummies	✓	✓
Macro Region Dummies	✓	✓
Children Controls		✓
N	10135	10106

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Fact 2: *For college graduate, cohabitation is more likely to end up in marriage.*

Another interesting difference in the mating behavior by education is about the probability of transitioning from one partnership to the other, because it can give hints about

[9] For seeing a complete list of the controlling variables, see Table 13 in the appendix.

whether the partnership is considered to be a permanent one or a temporary one. While we do not observe in our sample people that transitioned from marriage to cohabitation with the same person, the opposite is quite common: 66% of married people cohabited for a period before marrying. The interesting feature of the data is that the probability of transitioning from cohabitation to marriage is more frequent for college graduate than for the others. In order to show whether this difference is statistically significant, we use again the Fine and Gray (1999) regression that was used for the first stylized fact. This time the unit of analysis will be the cohabitation spells of our sample, while the risk will be marriage and the competing risk separation. The results are shown in table[10]: in both specifications we find that the probability of marriage versus separation is higher for college graduate also after controlling for a number of covariates. Note that this results are consistent with the story that college graduates use cohabitation as a marriage trial and therefore they experience more often a transition from cohabitation to marriage.

Table 2: Estimation results : Fine and Gray (1999) regression, separation is a competing risk

	(1)	(2)	(3)
eq1			
College	0.59***	0.52***	0.57***
Individual Controls	✓	✓	✓
Partner Controls	✓	✓	✓
Religion Dummies	✓	✓	✓
Macro Region Dummies	✓	✓	✓
Children Controls			✓
N	5275	5254	5254

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2.3 The Extensive and Intensive Margins of Cohabitation

In the introduction of this section I documented two stylized facts that show a different mating behavior by education in the United States. In this paper we will show how much economic incentives explain this different behavior. In particular, we will focus our attention on the monetary cost of divorce and on the role that learning plays for

[10] For the full list of controls look at Table 12

couples, in the sense that they experience high and lows during their relationship and that it takes time to understand how good their match is. This subsection is about the latter mechanism, that we will call learning about match quality, and on the role of premarital cohabitation has when learning is at stake.

First I will provide evidence that learning is important to understand mating behavior. Jovanovic (1979) builds a model where employers and employees learn about the quality on their match and concludes that when learning is at play the hazard rate of separation is first increasing and suddenly decreasing over time. This result has then been used also in the marriage and divorce literature (see for example Brien et al. (2006) or Marinescu (2016)). As Figure 1 illustrate, for our sample the hazard of divorce is first increasing and then decreasing.

Figure 1

After having found evidence for learning, we would like to go one step further and try to understand how premarital cohabitation affects marriage and whether learning is one mechanism through which premarital cohabitation affects the probability of divorce. According to theory, in fact, there could be two different effects that premarital cohabitation have on the risk of divorce. On one hand, there could be a self selection effect: couples that are not completely sure about the quality of their match prefer to cohabit before marrying, since in case of separation they will pay a lower cost. In other words, couples with an initial bad quality self select into cohabitation before (eventually) transitioning into marriage: if they do, they will have on average an higher probability of divorce than the average married couple. On the other hand, cohabiting before marriage could lower the probability of divorce if it helps the couple to learn how good the quality of their match is, therefore lowering the share of couples with a bad match quality that marry. It is worth noting that while the first mechanism works on the extensive margin of cohabitation (couples with an initial bad match quality decide to cohabit), the second one works through the intensive margin: the more one couple cohabit before marrying, the more it gets to know each other. Clearly, the hazard of divorce over time is not enough to discriminate between the two effects. We could build the hazard of divorce for couples that have already cohabited before marriage and the all the others, but this technique has two shortcomings. First, our sample size is not big enough, which would translate in big standard errors, and second, it does not allow to control for observed characteristics. Then, we will use a different statistical method to provide evidence for the coexistence of the extensive and intensive margin of cohabitation: the cox proportional hazard model Cox (1972). This model allows to estimate how selected variables correlates with the risk of divorce and, contrarily to a standard lest squares regression, it controls for the time length during which each observation is at risk [11]. Therefore, we estimate the model:

$$\lambda(t|X_i) = \lambda_0 Exp(\beta_0 Cohabited + \beta_1 Ln(Cohabitation + \epsilon) + \gamma_1 \mathbf{X_i} + \gamma_2 \mathbf{Y_j}), \tag{1}$$

where β_0 captures the intensive margin of cohabitation[12] and β_1 the intensive margin of cohabitation. Instead, $\mathbf{X_i}$ is a vector of individual characteristics and $\mathbf{Y_j}$ is a vector of marriage specific characteristics. We estimate four version of this model: in the fist model we kept just the cohabitation variables, in the second one we controlled for a number of individual and marriage specific controls[13], while in the third one we add controls concerning pregnancies and babies of the individual and couple. Finally, in the third model, we estimate the parameters using the same controls of model 4, but we

[11] This is essential since most of marriages in our sample are right censored.

[12] We use the log of cohabitation to capture the rate at which couples learn about match quality is diminishing over time. ϵ is a small number that allow us to keep observation that did not cohabit in the sample.

[13] A complete list of the controls is available in Table 10

excluded second and third order marriages. The results are presented briefly in

Table 3: Estimation results : Cox proportional Hazard Model for Divorce

	(1)	(2)	(3)	(4)
Cohabited	1.88***	1.05*	1.46**	1.27*
Log_coh	-0.17***	-0.10*	-0.16**	-0.13*
Individual Controls		✓	✓	✓
Partner Controls		✓	✓	✓
Religion Dummies		✓	✓	✓
Macro Region Dummies		✓	✓	✓
Children Controls			✓	✓
N	2814	2814	2743	2506

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10 and more completely in Table 10. We clearly see that in all our specifications the extensive margin of cohabitation increases the risk of divorce, while the intensive margin reduces it: this is exactly what we expected from the theory that we explained above in this. In order to provide a better intuition of the overall effect, we plot Figure 2, the predicted risk of divorce given a certain number of years of cohabitation, over the predicted risk of divorce of marriages with no previous cohabitation. We observe that when premarital cohabitation increases, the hazard first increases and then decreases slowly, suggesting that the initial adverse self selection effect fades out as the number of years of premarital cohabitation increases. In the same graph we also plot the raw probability of divorce given a certain cohabitation length. It can be noticed that the trend of the curve is exactly the same, even thought the curve is first above the predicted one, which could be explained by the fact that individual heterogeneity is not accounted for, and then it is lower, which make sense since raw data does not control for the time at risk[14]. It is still possible that our results are not precise because our data is discrete or because the risk of divorce over time is not proportional for all the covariates we control for [15] Then, we ran a robustness check, where we use a discrete hazard model, in the spirit of Jenkins (1995): for every marriage spell, we create one observation per unit of time (month in this case) and we run a logit model where the dependent variable is a dummy that takes value one if a divorce

[14] Marriages that were preceded by long cohabitation spells are more likely to begin at the end of the survey and therefore to be censored

[15] Among the assumptions of the cox regression hazard mode we have continuous time and proportional hazard over time for the different categories that we control for.

was observed. The results with this method are never statistically different from the ones obtained from the cox regression and the sign of the coefficients is always the same.

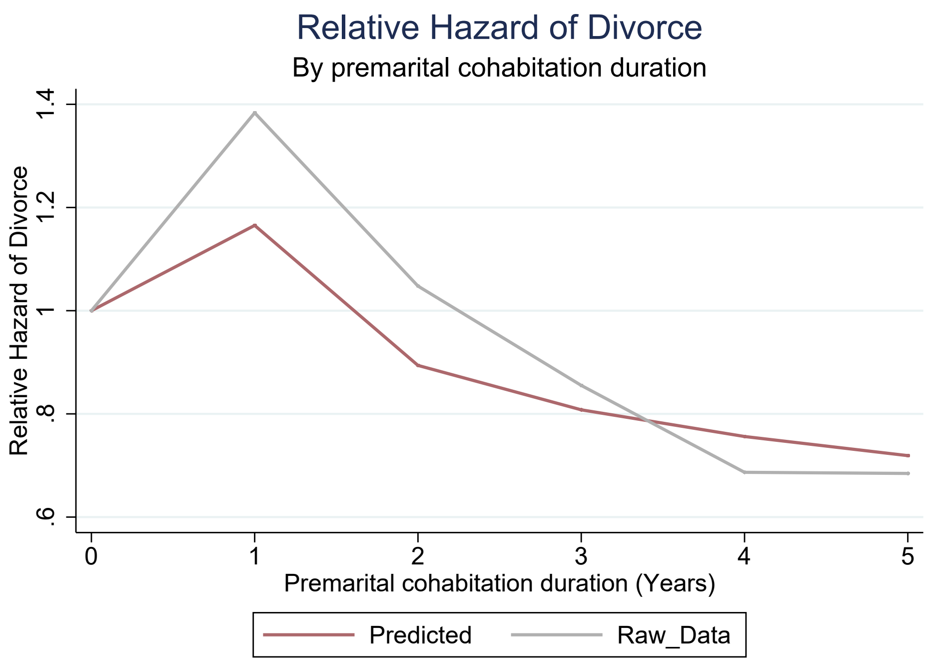


Figure 2: Effect of cohabitation of the proportional hazard of marriage duration, derived from model (3) of Table 3.

3 Theory

This is a partial equilibrium model, in the sense that we do not model production and we describe the behavior of just a fraction of the whole population. The theory that we propose is based on search, partnership choice and dissolution in the *mating market*, where agents take their decisions according to match quality, in the spirit of Jovanovic (1979). In the economy that we describe agents can be singles or in a partnership, which could be informal cohabitation or marriage. The economy is populated by agents that live an infinite number of periods[16] When agents are single, at the beginning of

[16] We chose an infinite planning horizon as in Marinescu (2016) instead of a finite one because it allows us have one less state variable, which allows for a non negligible decrease in the time needed to solve the model. We are assuming that the discount factor is low enough to consider negligible in terms of utility the moment when the agents will leave that marriage market. Since our model aims to reproduce the behavior of people that are young, we believe that this assumption is fair.

each period[17] they meet one person with probability 1 and receive a noisy signal of a randomly assigned match-quality, which can be interpreted as the utility value of love and companionship, but also[18] of complementaries in home production, children etc. If the perceived match quality is low, agents may decide to stay singles, while if it is high they can enter a relationship, which could be either cohabitation or marriage. Both marriage and cohabitation present economy of scale in consumption, but they differ because the first only is associated with a monetary cost of dissolution, as well as an exogenous utility flow that can be interpreted as the additional gains of marriage with respect to cohabitation [19]. There are two reasons that could make cohabitation the preferred relationship: the fact that it is "cheaper", in the sense that there are no exit costs, and the fact that it allows to gather information about the match quality, since every period spent with the same partner allows to increase the precision at which agents know the true match quality, which is stochastic. Note that the differences between cohabitation and marriage can give rise to heterogeneous mating strategies. A poor might want to choose cohabitation rather to marriage because in case of separation he would pay a lower monetary cost, which more that compensates the additional utility gain that she could have had if she married instead. On the other hand, cohabitation could be used more like an investment: people that observe a match quality that is not high enough to convince them to marry[20] might prefer to enter a relationship in order to understand whether the observed match quality was actually bad or just temporary. It is worth noting that in our model we excluded the possibility of dating. We did it for two reasons: first, there are no good enough data about this status in the NLSY97. Second, for our purposes, dating is very similar to singleness: in both there are no gains from living together and also, since the time spent together with the partner while dating is much lower that the one spent together while cohabiting, the information

[17] Every period is equal to one year. We tried setting the time period to six months but we could not see any significance difference: the distribution of cohabitations lengths can be fitted very well even with a one year period. We then chose the one period because it allows us to simulate the model faster.

[18] In principle, the match can be thought as any gain of living together which can be or not be *match specific*. For example, the one partner can cook very well a dish that the other loves but he cannot cook. Note that you might need to live with your partner to learn these complementaries.

[19] As explained in section two these gains could be cultural or linked to the better cooperation within the couple that can be achieved thanks to the higher commitment.

[20] A bad match quality is harmful for the utility and an initial lower match quality will result in an expected lower match quality for all the duration of the relationship.

acquired about the match quality will be also lower. Moreover, if we think at the match quality not just in terms of love and companionship, but also in terms of other gains from living together (complementaries of abilities in joint production, productivity in house works etc.), the difference in the learning curve will be even higher. In a way, in the model we pool the dating and singleness partnership in the same status. In other words, we assume that the time spent together allows much more learning while staying together than just dating. The rest of this section will be about explaining all the building blocks of the model.

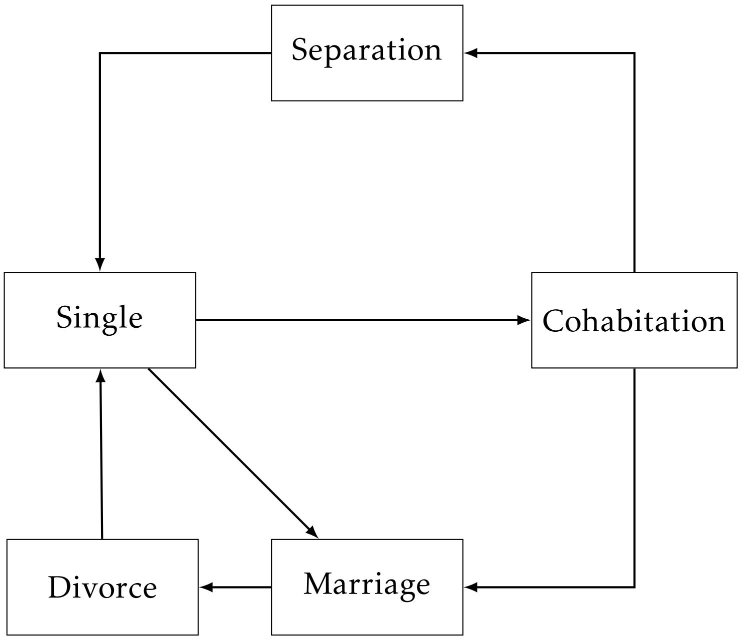


Figure 3

3.1 The Match quality

A crucial element in the model is the way the evolution of match quality is specified, because it has an impact both on the disruption of the couples and the effect of premarital cohabitation on marriage duration. The idea is that the quality of the relationship varies stochastically and that people can do errors in computing the probabilities of the match quality of tomorrow, but their precision increases with duration, which means that they learn. In this section we explain how we modeled these ideas. The match quality of a couple at a first meeting is distributed as $\theta_0^v \sim \mathcal{S}(\overline{\theta}, \sigma_\theta^2)$: agents do not know it, but they know that the distribution of signals of the match quality is distributed as $z_0 \sim \mathcal{L}(\overline{\theta}, \sigma_z^2)$. Agents will form their prior about the true match quality after the first meeting and in particular it will be distributed as a normal distribution with mean z and variance $sig\hat{m}a_0^2$. θ_d^v instead is the true match quality at d, where d represents the number of period the couple has been staying together. Agents do not observe directly the match quality, but rather a noisy signal of it, z_d. The law of motion of the match quality and of the signal is

$$\begin{cases} \theta_d^v = \theta_{d-1}^v + \epsilon_t \\ \theta_d^f = \theta_d^v + \mu_t, \end{cases} \tag{2}$$

where $\mu_d \sim \mathcal{N}(0, \sigma_\mu^2)$ and $\epsilon_d \sim \mathcal{N}(0, \sigma_\epsilon^2)$ are independent. Given their previous observations and their prior, agents use all the information that they gathered in order to compute the best estimate for θ_d^v, $\hat{\theta}_d^v$ and its variance $\hat{\sigma}_d^2$. I assume that the agents know the dynamics of the match quality, described the system 2, so that their belief in d about θ_d^v is normally distributed. I also assume that agents use efficiently the information that they have through Bayesian learning, which means that their best prediction of the match quality is given by the *Kalman filter*. Note that the set $[\hat{\theta}_d^v; d]$ is a sufficient statistic for determining agent's priors in d. Following Ljungqvist and Sargent (2012) I can write the recursion of the expectations as follow:

$$\begin{cases} \hat{\theta}_{d+1}^v = \hat{\theta}_d^v + K_{d+1}(\theta_d^f - \hat{\theta}_d^v) \\ \hat{\sigma}_{d+1}^2 = (1 - K_{d+1})(\hat{\sigma}_d^2 + \sigma_\epsilon^2) \\ K_{d+1} = \frac{\hat{\sigma}_d^2 + \sigma_\epsilon^2}{\hat{\sigma}_d^2 + \sigma_\epsilon^2 + \sigma_\mu^2}. \end{cases} \tag{3}$$

I will call $\mathcal{C}_d = [\hat{\theta}_d^v; d]$ the information set in d. Note that I will call $Prob(z \leq s | \mathcal{C}_d) = F(z|\mathcal{C}_d)$, where $\int F(z|\mathcal{C}_d)dz = \mathcal{N}(\hat{\sigma}_d^v, \hat{\sigma}_d^2)$. There is another way to interpret the dynamics of match quality. We can rewrite Equation 2 in the following way

$$\begin{cases} \theta_d^v = \theta_{d-1}^v + \epsilon_t \\ z_d = \mu_t \\ \theta_d^f = \theta_d^v + z_d. \end{cases} \tag{4}$$

Now θ_d^c is the "long run" match quality, which depends on past realizations, while z_d is the "short term" match quality which does not depend on past realizations. Agents just observe θ_d^f, a sum of the short and long run match qualities: this means that they are not able to distinguish whether the match quality that they observed will be persistent or it will vanish fast next period: only living with the same person will give the opportunity to better predict how will be the match quality tomorrow, given what was observed today. Also in this formulation the best prediction of the agent of the true match quality is given by Equation 3. The only shortcoming of this interpretation is that agents do not gain utilities by the observed match quality, θ_d^f, but rather by the belief of the agent of what is the long run quality.

3.2 Preferences

Agents derive utility from consumption c and, when they are into a relationship, also from their perceived match quality $\hat{\theta}_d^v$ in period d. Moreover, only if they are married, they gain utility γ: as we explained in the introduction, this gain represents the additional gains of marriage compared to cohabitation and can have its roots in preferences (religious norms for example) or economic incentives (risk sharing is better when married, thanks to the cost of divorce). We recognize that the choice of introducing this exogenous gain in utility for marriage is a reduced from of what happen in reality, but it is the only way to summarize economically all its possible gains: it has already done by all the literature on cohabitation[21]. We assume that preferences are separable in consumption, match quality, gain from marriage and across time. Periods utility are given by:

$$u^{Single} = u(c)$$

$$u_d^{Cohabiting} = u(c) + \hat{\theta}_d^v,$$

$$u_d^{Married} = u(c) + \hat{\theta}_d^v + \gamma.$$

The utility function is constant relative risk aversion:

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma}, \qquad \sigma >= 0.$$

[21] See for example Brien et al. (2006) or Gemici and Laufer (2014)

3.3 The Budget Constraint

The budget constraint in this model is very easy, because I assume that agents cannot save and hence there are no assets. We made this choice to make the computational part faster: introducing assets would increase the computational time drastically, making impossible to estimate the model. Nevertheless, we believe that this assumption is not problematic for our case: agents in our model are young, which means that if they know that their income will be higher in the future[22], we know from the literature of consumption over the life cycle that they would like to borrow. If financial markets are incomplete and people cannot borrow, the young will be hand to mouth consumers, as in our model. Then, when agents are singles, they just consume their wage w, which varies by sex and education, but it is constant over time. When agents are cohabiting or married, they experience economies of scale in consumption. In particular their expenditure is equal to the sum of their wages:

$$w_w + w_h = (c_w^\rho + c_h^\rho)^{\frac{1}{\rho}}.$$

When $\rho > 1$ it means that there are economies of scale in consumption: for a given expenditure, the couple can consume more that how she would have consumed if she were single.

3.4 Singles

Agents are heterogeneous and can be of the type $i \in \{H, L\}$, which means that they can be respectively college graduated or people with lower education. When they are single, agents meet one person with probability 1 and draw a noisy signal of the true *match quality* parameter, then agents have to decide whether to stay single, to marry or to cohabit. If they stay singles, they just consume their earnings, which are given by the predicted income given their education[23]. Moreover, singles also get the discounted expected utility in next period, when, according to the match quality that will be realized, they will decide to stay single, cohabit or marry. The utility of being and

[22] text

[23] I use the return to education and the gender wage gap in Baudin et al. (2015) to get predicted income. A more detailed description of wage is given in the appendix.

staying single for an agent of type $j \in \{H, L\}$ and sex $r \in \{f, m\}$ that meets a person of sex g and type i during next period:

$$
\begin{aligned}
V^S_{r,j} = {} & \frac{w^{1-\sigma}_{r,j}}{1-\sigma} + \\
& \beta \sum_{i \in \{H,L\}} \int \max\left\{ V^S_{r,j}; V^C_{r,j}(\mathcal{C}_1, i) + \mathcal{I}^C_{r,j}(\mathcal{C}_1, i); V^M_{r,j}(\mathcal{C}_1, i) + \mathcal{I}^M_{r,j}(\mathcal{C}_1, i) \right\} q^g_i \, dF(\hat{\theta}^v_1 | \mathcal{C}_0),
\end{aligned}
\tag{5}
$$

where the index functions show whether the other person agree about entering in the relationship and are defined as:

$$
\mathcal{I}^C_{r,j}(\mathcal{C}_d, i) = \begin{cases} 0 & \text{if } V^C_{g,i}(\mathcal{C}_d, j) \geq V^S_{g,i} \\ -\infty & else \end{cases} \tag{6}
$$

and

$$
\mathcal{I}^M_{r,j}(\mathcal{C}_d, i) = \begin{cases} 0 & \text{if } V^M_{g,i}(\mathcal{C}_d, j) \geq \max\left\{ V^S_{g,i}, V^C_{g,i}(\mathcal{C}_d, j) \right\} \\ -\infty & else. \end{cases} \tag{7}
$$

Note that the share of people of the other sex $k \in \{f, m\}$ of the type $j \in \{H, L\}$ is given by q^g_i.

3.5 Cohabiting partners

If the partners are cohabiting, they face a different problem: they get utility from their best prediction of the true love shock, $\hat{\theta}^v_d$, they experience economy of scale in consumption and they bargain. In particular, female f with education i and male m with education j face the following problem:

$$
\max_{c_f, c_m} \quad \Theta V^C_{f,i} + (1 - \Theta) V^C_{m,j}, \tag{8}
$$

under the budget constraint:

$$
w_{f,j} + w_{m,i} = (c^\rho_f + c^\rho_m)^{\frac{1}{\rho}}. \tag{9}
$$

Individual utility is then given by:

$$V^C_{r,j}(\mathcal{C}_d, i) = \frac{(c^*_{r,j})^{1-\sigma}}{1-\sigma} + \hat{\theta}^v_d + \\ \beta \int \max\left\{V^S_{r,j}; V^C_{r,j}(\mathcal{C}_{d+1}, i) + \mathcal{I}^C_{r,j}(\mathcal{C}_1, i); V^M_{r,j}(\mathcal{C}_{d+1}, i) + \mathcal{I}^M_{r,j}(\mathcal{C}_{d+1}, i)\right\} dF(\hat{\theta}^v_{d+1}|\mathcal{C}_d); \tag{10}$$

where $c^*_{r,j}$ si the solution to Equation 8. It is important to notice that the bargaining power is fixed at the first meeting and after that it never changes: this mean that we are assuming full commitment. It is as if the couple were signing at the moment of their first meeting a contract about how to behave in every period and state of the world and they stick to it. A different approach would be to follow Mazzocco et al. (2017): they develop a dynamic model with limited commitment bargaining (LIC), in the sense that contracts are renegotiated only if one of the two counterparts prefer to split with the current bargaining power. This type of model make sense if the outside options varies with time, which is not the case of our model: LIC would just be unnecessarily complicated, without adding any intuition. We set Θ such that the gain in utility from singleness to cohabitation at their first meeting is equally shared between the two members of the couple, as in Voena (2015), but different sharing rules do not make a big difference, since there are no hold up problems in this setting.

3.6 Married partners

If the two partners are married, the problem of the couple is identical to the one described for cohabitation, with the difference that the individual utilities $V^C_{r,j}$ are substituted by the married utilities $V^C_{r,j}$, which are defined as:

$$V^M_{r,j}(\mathcal{C}_d, i) = \frac{(c^*_{r,j})^{1-\sigma}}{1-\sigma} + \hat{\theta}^v_d + \gamma \\ \beta \int \max\left\{V^D_{r,j}; V^C_{r,j}(\mathcal{C}_{d+1}, i) + \mathcal{I}^C_{r,j}(\mathcal{C}_1, i); V^M_{r,j}(\mathcal{C}_{d+1}, i) + \mathcal{I}^M_{r,j}(\mathcal{C}_{d+1}, i)\right\} dF(\hat{\theta}^v_{d+1}|\mathcal{C}_d); \tag{11}$$

Where γ is the additional utility for being married and $V^D_{r,j}$ is the utility of being divorced, which is equal to:

$$V^D_{r,j} = \frac{(w_{r,j} - \kappa)^{1-\sigma}}{1-\sigma} + \beta \sum_{i \in \{H,L\}} \int \max \left\{ V^S_{r,j}; V^C_{r,j}(\mathcal{C}_1, i) + \mathcal{I}^C_{r,j}(\mathcal{C}_1, i); V^M_{r,j}(\mathcal{C}_1, i) + \mathcal{I}^M_{r,j}(\mathcal{C}_1, i) \right\} q^g_i \, dF(\hat{\theta}^v_1 | \mathcal{C}_0), \tag{12}$$

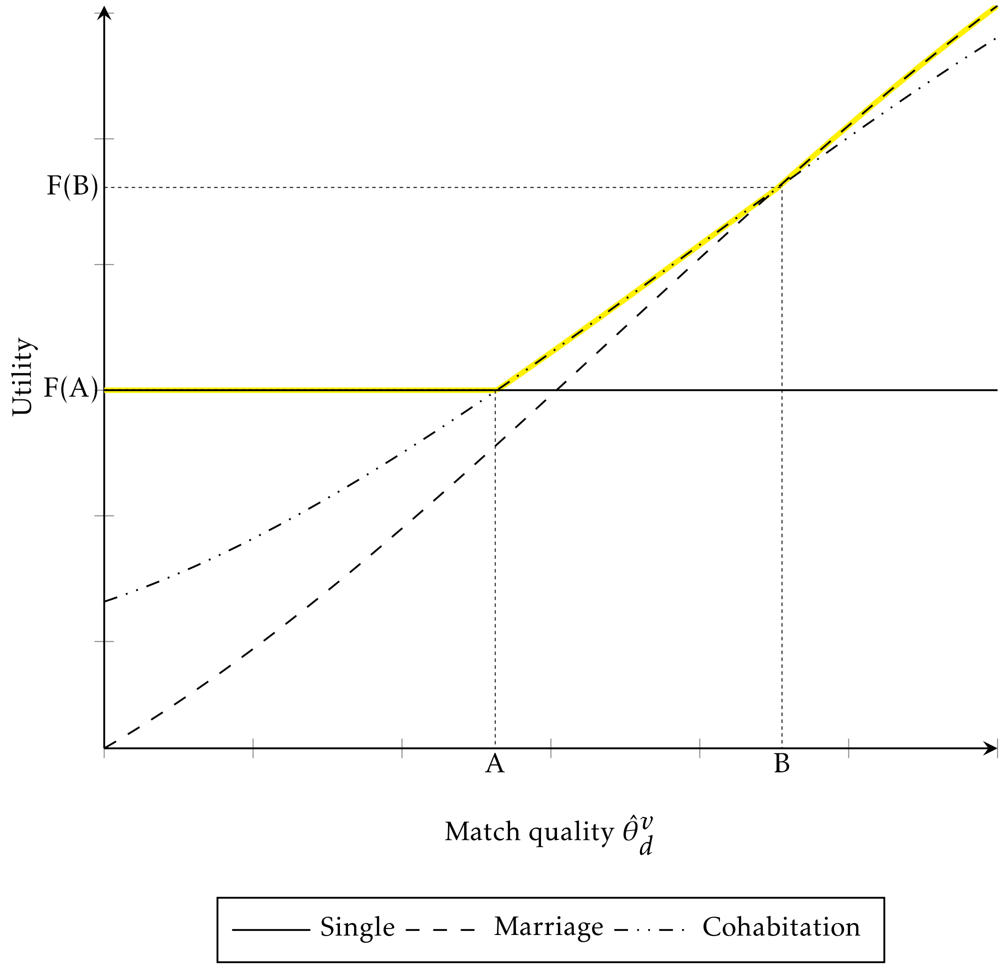
where κ is the monetary cost of divorce.

3.7 The Choices

Given what we have said above, we can now start analyzing more in detail choices. When a single agent receive a match quality shock, if she can stay single obviously her utility will not depend on that match quality, as illustrated in Figure **??**. On the other hand, if she enters the relationship, her utility will be increasing on that match quality, both because it will give her an higher utility today and an expected higher utility tomorrow. Then, there exists a threshold in the level of match quality above which agents enters a relationship: for a combination of high enough divorce cost and low enough[24] gain from marriage γ, the relationship chosen by the agent for a match quality just above the threshold A will be the cohabitation and not marriage. The reason is that for intermediate values of match quality, agents are not ready to enter marriage, which means risking to pay a cost of divorce if the match quality turns out to be bad in one of the next periods. Instead, they prefer to cohabit, which allows them to learn about the match quality, making entering into marriage a less risky decision in the future if the match quality turns out to be higher than expected. If it happens the opposite, they can just separate without any cost. Instead, if the initial match quality is higher that threshold B, agents prefer to marry, because the risk that the match quality will become low enough to trigger a divorce is low and because she can enjoy the additional utility from marriage γ. In Figure **??** below, we represented the choices as described in this paragraph: the yellow line represents the value function of receiving a certain match quality while singles, and it is the envelop of the value of being single, cohabiting or being married. The choice made once the individual is into a partnership looks exactly

[24] If this conditions do not hold, the agent will never choose cohabitation over marriage.

the same, with the exception that the shape of the curves look a bit different.



4 The Mechanisms

4.1 Learning

In our model learning is very important. There are two main ways through which it plays a role. The first one is straightforward: when couples learn about their match quality through living together, they are able to better predict what will be the value of their match quality tomorrow. We show this mechanism in Figure 4: on the horizontal axis we have the time d the couple has been living together, while on the vertical axis there is the error that agents made when computing their next period match quality. In particular, every point of the graph is built in this way: for a duration d, we took all the couples that have been living together for d periods and we compute the absolute

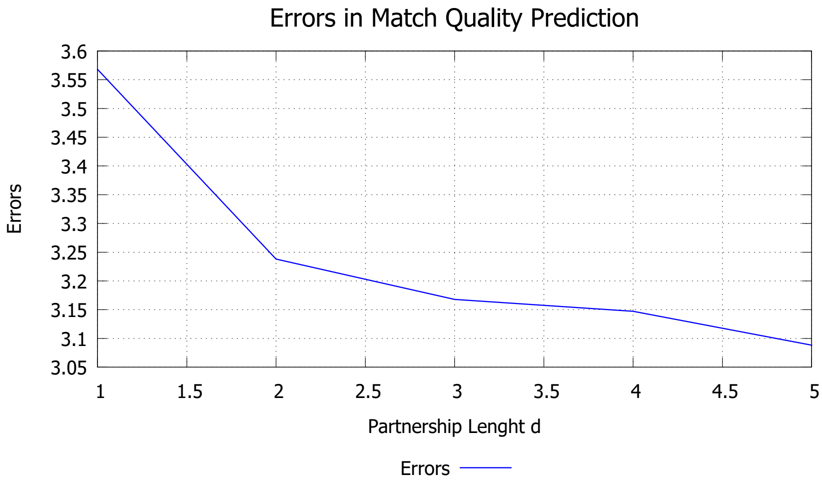


Figure 4

value of the difference between their predicted[25] and actual match quality that they will observe next period, which is equal to $|\hat{\theta}_d^v - \hat{\theta}_{d+1}^v|$. Then, we will take the average of these errors for each time d. The fact that in the graph we observe an average error that declines with time, indicates that in our model learning[26] is at play.

The second effect of learning is less mechanical, and is about how people reacts to the fact that their best estimates of the match quality does not coincide with the "true" one. As we have seen above, agents do more precise predictions once they have been staying together for some time, and they are aware of that: in fact, the variance of their prior has a decreasing variance over time. For this reasons, the same value of the match quality is valued differently at different times d.For example, if the observed match quality of a cohabiting couple is relatively low, the lifetime utility of being in a relationship is much higher at period d_1 than period d_2, with $d_1 < d_2$. This happens because while in d_1 there is a chance that the true match quality is actually higher, which would lead to a marriage[27], in d_2 the couple knows that the chances of marrying are quite low, since they can measure with a good precision that the true match quality is low too.

[25] The predicted match quality tomorrow is equal to the best estimates of the true match quality today: $E(\hat{\theta}_{d+1}^v) = \hat{\theta}_d^v$

[26] The graph is build with our best parametrization of the model.

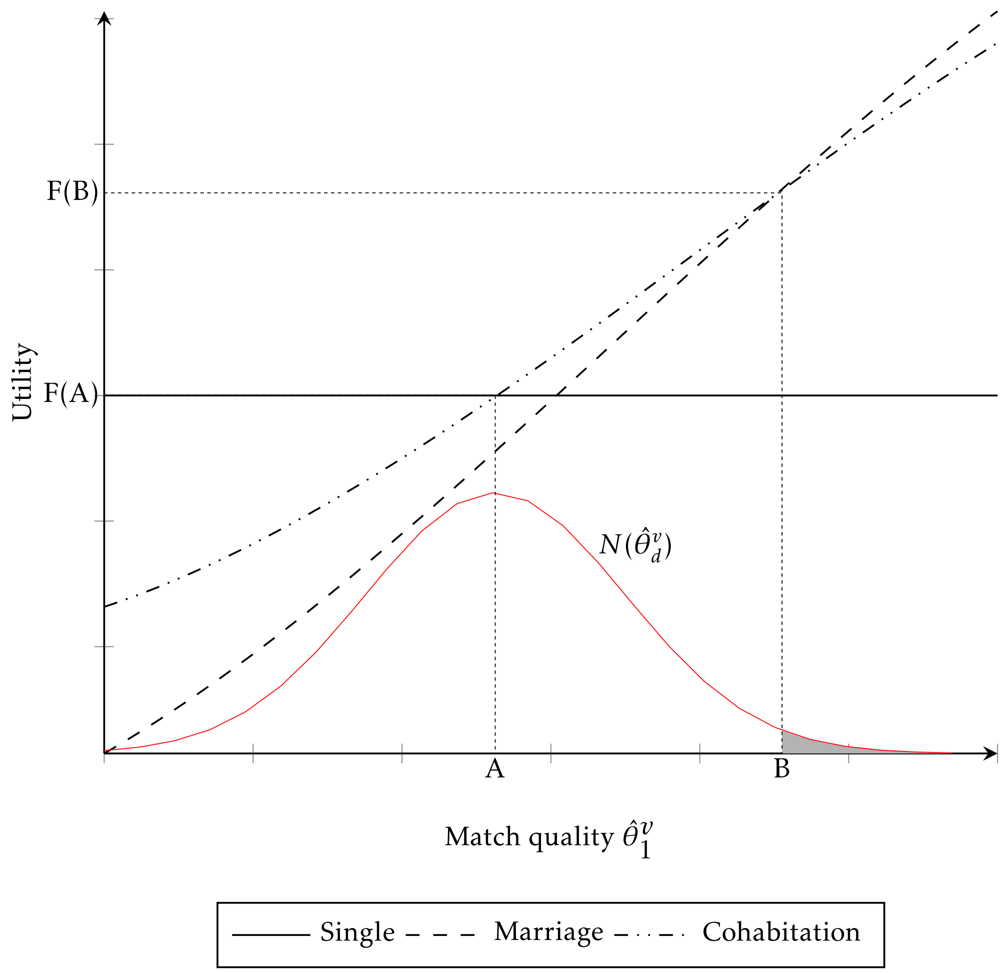
[27] Note that the match quality could also be lower, but this is not a big deal for the couple since in that case they would split, avoiding the cost of a low realization.

4.2 Self Selection

The other effect of this model comes from a positive self selection of couples with a good quality into marriage. To make more clear our argument, we drew Figure 4.2, that represents the value function of being in a certain relationship, as well as the distribution of the match quality at the first meeting, denoted by $N(\hat{\theta}_d^v)$: people will marry directly if their utility is above threshold B. Now suppose that the probability of marrying directly in each period is fixed[28]: the strength of the self selection effect will depend on the shape of gray area under curve. In fact, if the probability distribution has a high kurtosis, then the tails are thick and there is a good proportion of people among the ones married at the first period with a very high initial match quality. When the average quality of the group if high enough, it will compensate the effect of learning, and the average probability of divorce for this group will be low. This effect explains why we chose the logistic instead of the normal distribution for the match quality at first meeting: the first one in fact has a higher kurtosis, which translates into a higher self selection effect. Note that if the kurosis is extremely high[29], then the self selection will bee too high compared to the data, and it will also be hard to replicate the right distribution of marriages (it would be too right skewed) as well as the number of cohabitations, which would be too low.

[28] We will capture this probability in the moments that we will match for the estimation.

[29] As it is the case for the Cauchy distribution, for example.



Utility
F(B)
F(A)
$N(\hat{\theta}_d^v)$
A
B
Match quality $\hat{\theta}_1^v$
Single
Marriage
Cohabitation

5 Structural Estimation

In this section we will explain the strategy used to estimate and evaluate the model. The research question is how much of the mating differences by education can be explained by economic incentives. Since my question is a quantitative one, it is important that the model is able to reproduce quantitatively the key features of the marriage market, such as the length distribution of marriages and cohabitation spells. If I was not able to do so, it would be hard to claim that the resulting differences in mating behavior are caused by the incentives of the model. Then, the first thing that we do is to select the moments that better describe the demographic object of our analysis, namely cohabitation and marriage spells and the relationships between them. Moreover, the selected moments should force the incentives of the model to be quantitatively realistic: for example,if we allow the self selection effect to be too strong, we could get a wrong difference in mating behavior by education, if the two categories respond differently to this effect. The next step is to simulate the model to create fictional moments that will be compared with their empirical counterpart. Second, I need to simulated the model, get the fictional moments and compare them with the empirical ones. In practice, I will create N fictional agents[30] that receive random potential partners and match qualities. Given a vector of parameters, they will take decisions according to the policy function that solves our theoretical moment. After having let the fictional agents to take decisions for T periods[31]. The next step is to estimate the model: we will choose the vector of parameters according to the Method of Simulated Moments(MSM), that will be explained in detail within this section. The idea is to take a vector of parameters such that the fictional moments are as closest as possible to the fictional ones. Then, we can finally compare the different mating behavior by education generated by the model with the data: the smaller these difference it is, the more important the economic incentive described by the model will be to describe the mating differences by education. The strength of this approach is that the stylized facts we are interested in are not used

[30] We take N=25000

[31] The number of years when I can observe the agents and the number of periods in the model coincides. I assume that agents enter in the market at age $\hat{t}$ with a probability governed by the distribution $F_e(t)$, $e \in \{H, L\}$. This education specific distributions represent the distribution in the number of years of education. This mean that we do not restrict the agents to enter the mating market when they finished their studies, but one average they do so. This choice derives by the considerations of Bergstrom and Bagnoli (1993)

directly for the estimation: this makes more credible the possibility that the mechanisms behind the different mating strategies by education are the ones contained in the model. Within this section, I will first describe the moments used for the estimation, then we will move to more technical aspects and the interpretation of the results.

5.1 The moments

In order to be convincing about the size of the effect of our models, a prerequisite is that the overall mating market should look realistic: none will believe us if we can reproduce the stylized facts presented above, but at the same time people marry one average twice a year. Therefore, we chose the moments that we want to match such that, once we are close enough to reproduce them, the mating market of our economy look realistic. We chose the entire distribution of marriage and cohabitation spells, the percentage of marriages and cohabitation spells that are disrupted before the last wave of the survey and the probability of moving from cohabitation to marriage with the same person and the average number of marriages and cohabitations experienced by person. In order to get a credible amount of learning, we insert among the target moments the hazard of exiting marriage for each of the first seven years of the relationship. The fact that the hazard first increases and then decreases as depicted in Figure 1, shows that there is some learning[32]. Finally, we also insert as target moments the percentage of married people that have cohabited before marriage, by marital duration. If this percentage is decreasing over time it will be more likely to observe a higher self selection effects. In total we have selected 40 moments for our estimation.

5.2 Identification

As mentioned before, we set one period to 1 year. Among the parameters that appear in the theory section, we set 4 a priori, using information provided by other papers. More in particular, we set to 0.96 the discount factor β, in line with the Real Business cycle literature. The relative Relative Risk Aversion parameter of the time utility function is instead set to $\sigma = 1.5$ from Voena (2015). The economies of scale parameter ρ is instead calibrated from McClements scale, according to which a childless couple spends 61%

[32] An increasing and then decreasing hazard of job spells disruption with tenure was one of the motivation that led Jovanovic (1979) to have a model of job search and matching with learning.

of a single person in order to consume the same amount of goods: this leads to a value of 1.4024 for our parameter. The wages by sex and education, instead are taken from Baudin et al. (2015), and the procedure to compute them is explained in appendix A. The remaining 6 parameters are instead identified according to the simulated method of moments. This means that parameters are taken such that the distance between the empirical and fictional moments is minimized. Formally, we will solve the following problem:

$$\hat{\theta} = \arg\min_{\theta} \qquad (\mathbf{m} - \mathbf{m}_{\theta})'\mathbf{W}(\mathbf{m} - \mathbf{m}_{\theta}) \tag{13}$$

Where $\mathbf{m}$ is the vector of empirical moments, as described in the section about target moments, and $\mathbf{m}_{\theta}$ is the vector of the moments simulated by the model parametrized with θ. Instead, $\mathbf{W}$ is a symmetric and positive semi-defined matrix.[33] The minimization of this object function is performed using a genetic algorithm called PIKAIA, which is a routine to find the global optimum of very complicated and not well-behaved functions, as it for our case. The estimated parameters are:

Table 4: The Parameters used for Calibration

External Parameters		Value	Target
Psychological discount factor	β	0.96	RBC Literature
Gender wage gap	γ	0,86	Baudin et al.(2015)
Relative Risk Aversion	σ	2	Voena(2015)
Economies of scale	ρ	1.4023	McClements scale
Estimated Parameters		**Value**	
Standard deviation of the love shock	σ_{ϵ}	2.2733	MSM
Standard deviation of the noise	σ_{μ}	1.9522	MSM
Standard deviation of the initial love shock	σ_0	6.807	MSM
Mean of the initial love shock	$\bar{\theta}$	-3.195	MSM
Divorce cost	κ	0.666	MSM
Additional Marriage util. flow	γ	0.1783	MSM
Probability of meeting	λ	0.2759	MSM

[33] Here, I temporarily filled the diagonal with ones, while the other entries are 0.

5.3 Estimation results

In Table 5 the fit of the model is presented. First, it can to be noticed that overall fit of the model is ok: the distributions of marriage and cohabitation spells are very well matched, as well as the % of separations and divorces. Instead, the match is less good for the hazard of divorce over time, that cannot hump shape as in the data, and for the % of people that cohabited before marriage which is increasing and then stays constant, instead of decreasing over time as in the data. The reason why these moments are not very well matched is that the balance between learning [34] and self selection.[35]

Now we can move on to the description of the stylized facts that we wanted to explain with our model. We observed that college graduates marry more and cohabit less than the others and more in particular the ratio of the average number of marriages of college to non college graduate was 1.06, while it is 0.63 for cohabitations. Our model does well in this sense, since we get the rations of 1.22 and 0.44: the direction of the ratios is the correct one, but we overestimated a bit the effect. Another stylized fact that we wanted to explain is the fact that college graduates, once they are cohabiting, they are more likely to transit into marriage. We observed this regularity using a cox regression with competing risks where separation is the competing risk. Now, running exactly the same model on simulated data we find that the dummy College graduate is significant and has a value of 0.15, as documented in Table 14.The sign of the effect is the same of its empirical counterpart in Table 12, but in real data the magnitude of the effect is higher. One last feature of the data that we observed was that the extensive margin of cohabitation increases the risk of divorce, while the intensive margin reduces it. Using simulated the simulated data we perform a a cox regression analysis on the risk of divorce (see Table 15): we find that the two effects has the right sign and that they are significant. In order to better visualize the results, we plotted a graph of the combined risk of divorce over time, taking people that did not cohabit as the reference: in Figure 10 we can observe that the effect of learning are strong and comparable to the data, while the self selection effect is slightly lower than in the data. In fact, self selection just compensate the effect of learning: people that did not cohabit have the

[34] Its strength depends on the hazard of divorce over time

[35] Self selection is stronger if the fraction of married people that have also cohabited decreases with the length of the relationship.

same risk of divorce of people that cohabited one year, and not lower as in the data.

Table 5: Model fit

Calibrated Moments	Data	Model
Average # of marriage per capita	0.55	0.48
Average # of cohabitations per capita	1.03	1.08
% Divorced after marriage	0.24	0.19
% Separated after cohabitation	0.48	0.51
Marriage Distribution: Figure 6	-	-
Cohabitation Distribution: Figure 7	-	-
Hazard of Divorce: Figure 8	-	-
% Married that Cohabited: Figure 9	-	-
External Moments	**Data**	**Model**
# Marriages college over non college	1.06	1.22
# Marriages cohabitants over non cohabitants	0.63	0.44
$\hat{\beta}$ for college parameter in Table 14	0.51	0.15
Extensive cohabitation of Cox, Table 15	-	1.30
Intensive cohabitation, Table 15	-	-0.28

6 Conclusion

Economic incentives matter for the choice about the type of partnership that couples do. We argue that economic incentives matter for the mating strategies by education, at least in the United States. In particular, the cost of divorce, the strength of the learning process and of the self selection into direct marriage determines how big are the differences in the partnership strategies by education.

In this paper we first provided evidence that mating strategies differ by education using the NLSY97 cohort for our analysis: college graduate marry more and cohabit less than and others, while they transit more often from cohabitation to marriage. Second, since the transition from cohabitation to marriage is relevant for the stylized facts that we want to explain, we analyzed the relationship between premarital cohabitation and risk of divorce: we find that people that marry directly have a risk of divorce that is relatively lower than couples that cohabited for short periods, while the lowest risk of divorce is observed for people that cohabited for a long time before marrying. We interpret this evidence as resulting as a combination of learning about the quality of the couple and self selection of couples with a high quality into direct marriage. We interpreted all these results as arising from two different mating strategies by education: college graduate use cohabitation as an investment good, in the sense that they use it lo learn about match quality before eventually entering into marriage, the relationship at which they aim, with a better idea about the true quality of their couple. Instead, non college graduates use cohabitation as a consumption good: they prefer cohabiting because is allows them to eventually their relationship at no cost, while in case of divorce they would have to pay a high monetary cost of divorce, which would hit harder on their utility functions than for the college graduate, which have on average an higher income.

Third, we built a model of match quality and mating market that incorporates all the mechanisms described above, and we estimated it to reflects features of the real world mating market. Then, we compared the mating strategies arising from simulated data and we compare them with actual data, so that we can see how much of the differences in the observed behavior can be explained by our mechanisms.

This paper represents a first tentative to understand how people choose between cohabitation and marriage, and in particular how economic incentives affect this behavior.

We are aware that our results arises for a a particular state in a particular moment in time: it can possible that our results by the introduction of different social norms, that arise across time and space.

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Appendix

Potential wage

The measure of potential wage I will be using is straightforward: in fact I will use the mincerian returns per year of education. In the NLSY97 I have data about the highest grade completed[36], measured every year: I will use this variable measured when the individual is 26. More precisely, I define predicted wage as:

$$w = \tilde{\gamma} \exp(\rho e),$$

when the agent is a woman. If the agent is a man instead, I define its human capital as:

$$w = \exp(\rho e),$$

where h is human capital, $\tilde{\gamma}$ is the wage gap, ρ is the mincerian return to education and e is the number of years of study completed at age 26. I will take $\rho = 0.119$ and $\tilde{\gamma} = 0.854$ as in Baudin et al. (2015). Since I have just two educational categories in the model (college graduates and the others), I will take the average predicted wage per category.

[36] Truncated at year 20.

Figures

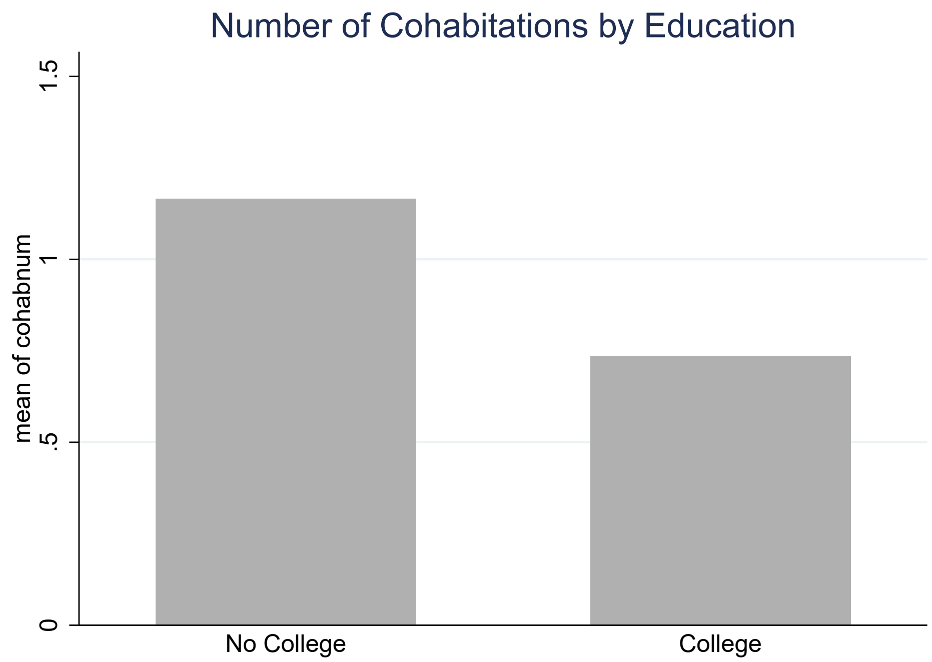

Figure 5

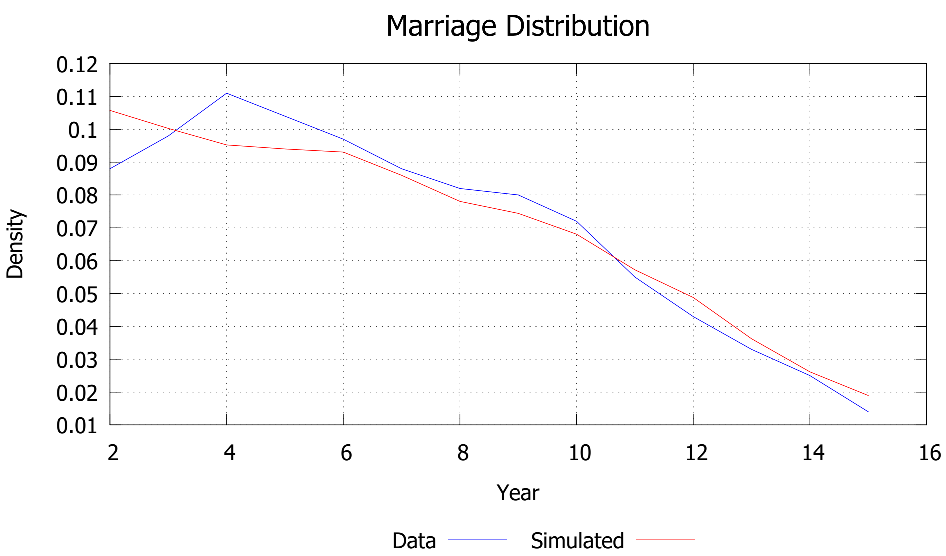

Figure 6

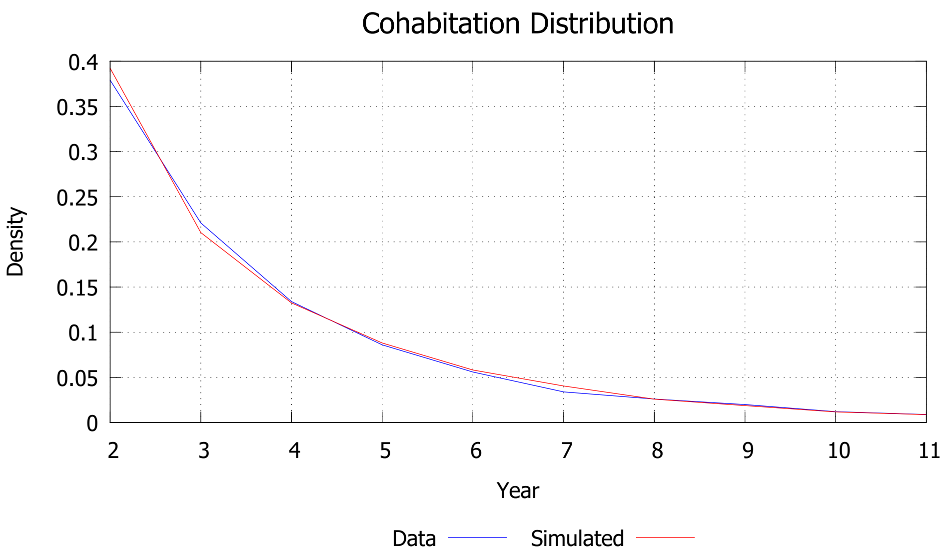

Figure 7

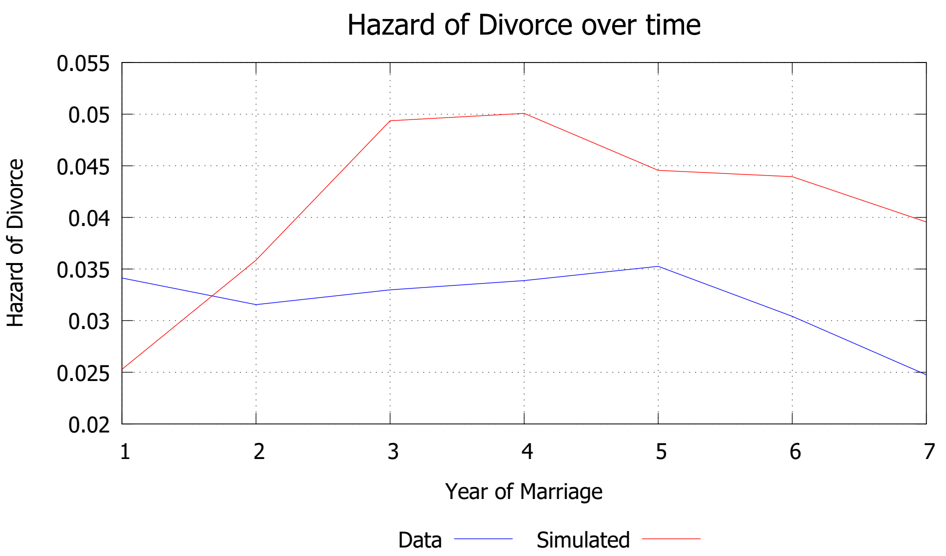

Figure 8

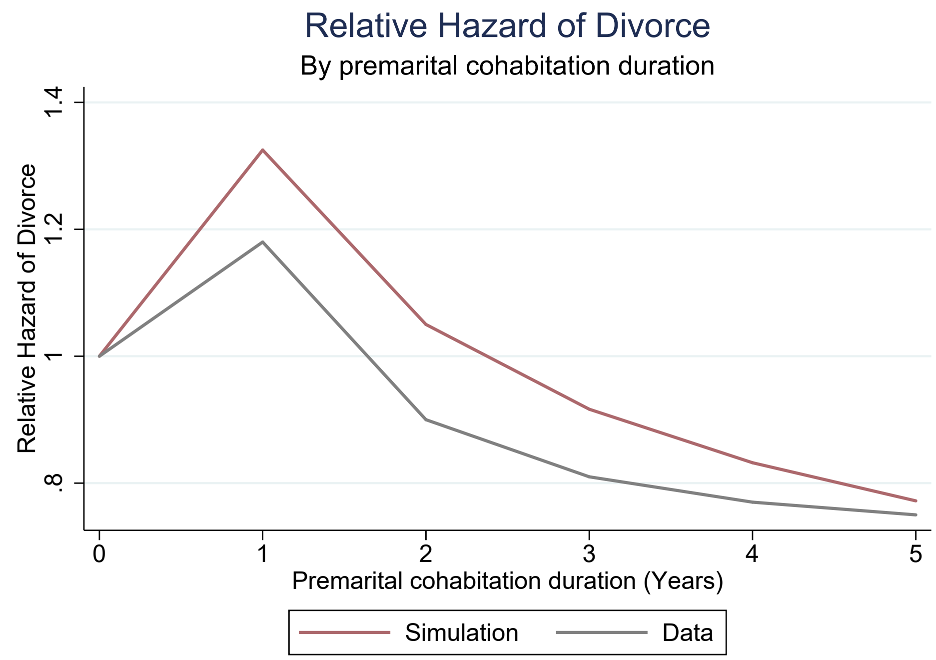

Figure 10

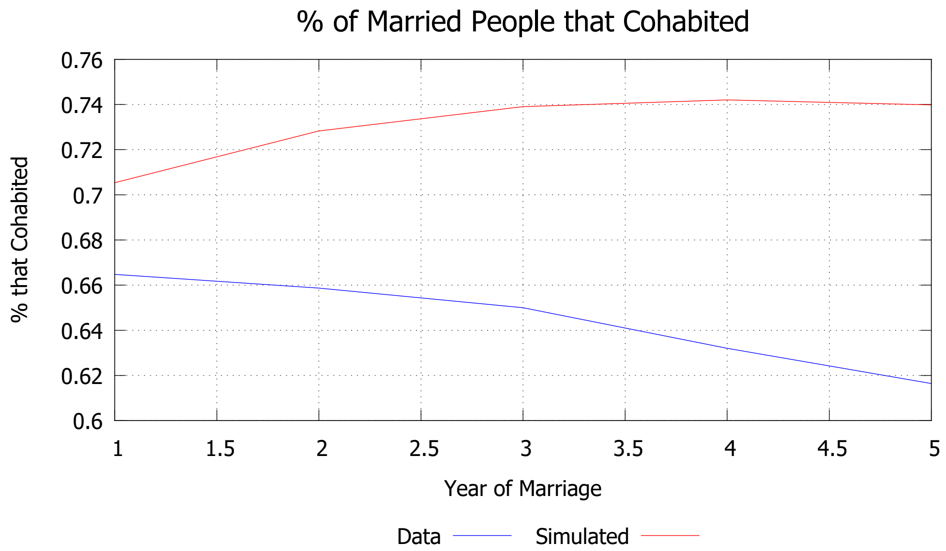

Figure 9

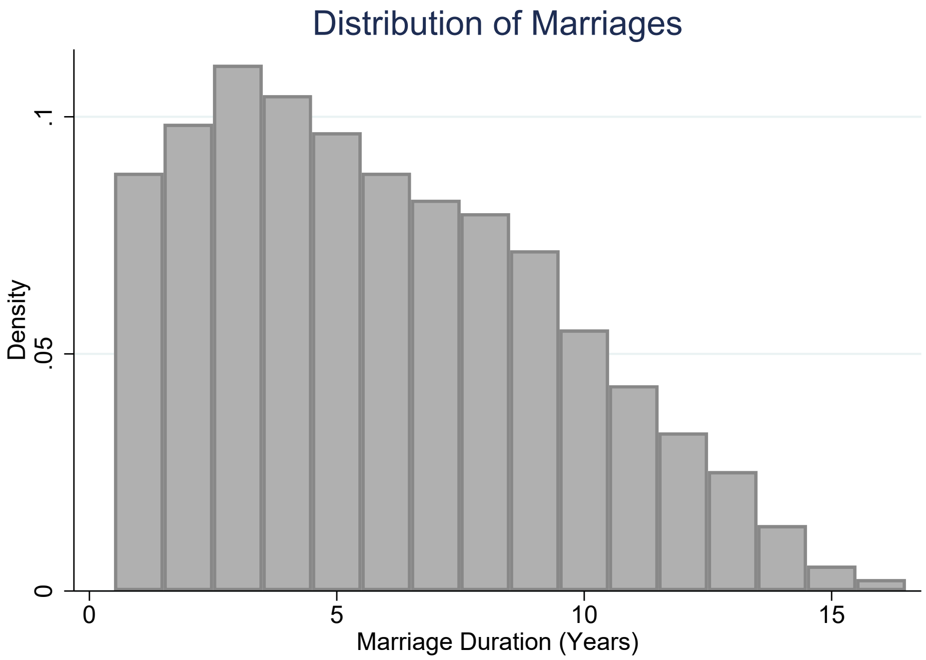

Figure 11

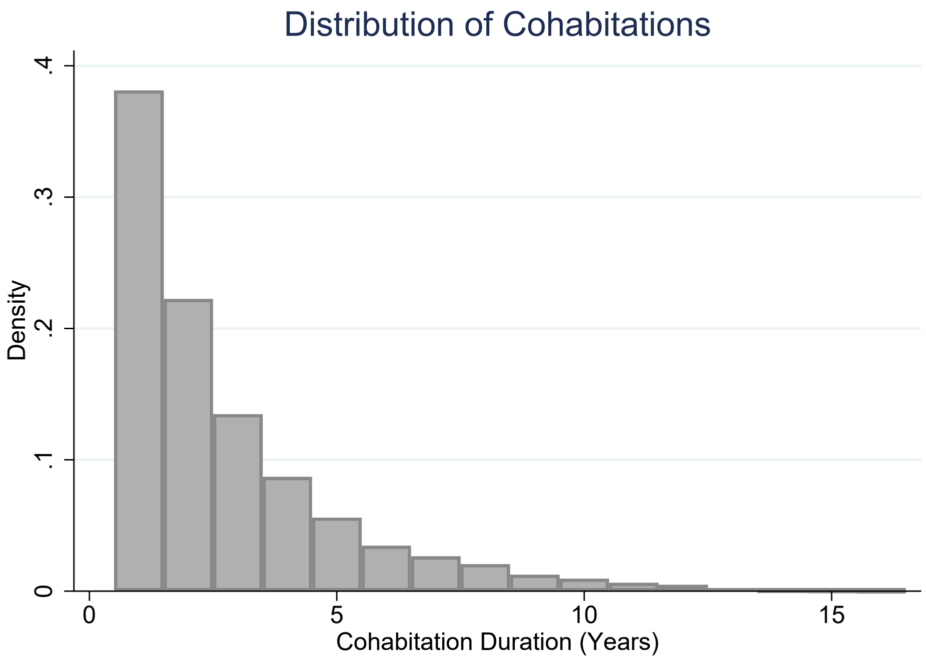

Figure 12

Tables

Table 6: Summary statistics

Variable	Mean	Std. Dev.	N
College	0.307	0.461	5200
Female	0.534	0.499	5200
Marriages	1.188	0.437	2814
Cohabitations	1.033	1.027	5166

Table 7: College by Sex

Variable	Mean	Std. Dev.	N
Female	0.331	0.471	2779
Male	0.280	0.449	2421

Table 8: Marriages

Variable	Mean	Std. Dev.	N
Duration	5.990	3.521	2814
Divorce	0.235	0.424	2814

Table 9: Cohabitations

Variable	Mean	Std. Dev.	N
Duration	2.813	2.361	5308
Marriage	0.339	0.474	5308
Separation	0.478	0.500	5308

Table 10: Estimation results : Cox proportional Hazard Model for Divorce

	(1)	(2)	(3)	(4)
Cohabited	1.88***	1.05*	1.46**	1.27*
Log_coh	-0.17***	-0.10*	-0.16**	-0.13*
Age		0.64*	0.36	0.16
Age2		-0.02**	-0.01	-0.01
College		-0.48***	-0.42**	-0.47***
Female		0.07	0.08	0.03
Black		0.33**	0.09	0.00
Hispanic		-0.19	-0.25*	-0.26*
Church		-0.12***	-0.05	-0.05
Mar_start		-0.01	-0.00	-0.00
Mar_start2		0.00	-0.00	-0.00
Religiosity		0.03	0.03	0.02
Rural		0.37*	0.32	0.35*
Marshare		5.30	2.80	3.95
Smoke		0.52***	0.32**	0.30*
Edu_homogamy			-0.05	-0.09
Age_diff			0.06**	0.06**
Female_Age_diff			-0.04	-0.04
Num_ch_in			0.01	-0.03
Shotgun_marriage			0.84***	0.89***
Num_ch_coh			0.04	0.08
Num_ch_fin			-1.02***	-1.05***
Religion Dummies		✓	✓	✓
Macro Region Dummies		✓	✓	✓
N	2814	2814	2743	2506

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Estimation results : Logit Model, probability of Divorce

Hazard of Divorce	(1) b	(2) b	(3) b	(4) b
faill				
Cohabited	1.89***	1.05*	1.30**	1.12*
Log_coh	-0.17***	-0.10*	-0.13*	-0.11*
t	0.04***	0.04***	0.05***	0.05***
t2	-0.00***	-0.00***	-0.00***	-0.00***
t3	0.00***	0.00***	0.00***	0.00***
Age		0.65*	0.57	0.49
Age2		-0.02**	-0.02*	-0.01*
College		-0.48***	-0.51***	-0.55***
Female		0.07	0.13	0.09
Black		0.33**	0.23	0.19
Hispanic		-0.20	-0.27*	-0.28*
Church		-0.12***	-0.10**	-0.10**
Mar_start		-0.01	-0.01	-0.01
Mar_start2		0.00	0.00	0.00
Religiosity		0.03	0.02	0.02
Rural		0.37*	0.37*	0.42**
Marshare		4.57	3.43	2.80
Mar_num		0.82***	0.87***	0.00
Smoke		0.53***	0.46***	0.46***
Edu_homogamy			-0.05	-0.09
Age_diff			0.05*	0.05*
Female_Age_diff			-0.03	-0.04
Num_ch_in			0.45***	0.45***
Shotgun_marriage			0.26*	0.33*
Num_ch_coh			0.51***	0.55***
Children			-0.39***	-0.41***
Religion Dummies		✓	✓	✓
Macro Region Dummies		✓	✓	✓
N	186022	186022	183203	174251

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12: Estimation results : Fine and Gray (1999) regression, separation is a competing risk

Hazard of Marriage	(1) b	(2) b	(3) b
eq1			
College	0.59***	0.52***	0.57***
Edu_homogamy		0.31***	0.27**
Age		0.28*	0.34**
Age2		-0.00	-0.00
Female		-0.04	-0.14**
Black		-1.04***	-1.12***
Hispanic		-0.45***	-0.45***
Church		0.17***	0.14***
Coh_start		-0.00	0.00
Coh_start2		-0.00	-0.00
Religiosity		-0.02	-0.02
Rural		-0.31***	-0.37***
Smoke		-0.51***	-0.49***
Age_diff			-0.02**
Female_Age_diff			-0.00
Num_ch_in			0.21***
Shotgun_marriage			0.58***
Num_ch_coh			0.00
Num_ch_fin			-0.49***
Religion Dummies	✓	✓	✓
Macro Region Dummies	✓	✓	✓
N	5275	5254	5254

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13: Estimation results : Fine and Gray (1999) regression, cohabitation is a competing risk

Hazard of Marriage	(1) b	(2) b
eq1		
College	0.64***	0.15**
Age		0.20
Age2		-0.00
Female		-0.07
Hispanic		0.14*
Church		0.40***
Black		-0.74***
Religiosity		0.01
Rural		-0.29**
Smoke		-0.79***
Start		-0.02***
Start2		0.00
Numcoh		-2.77***
Nummar		2.10***
Num_ch_in		0.53***
Religion Dummies		✓
Macro Region Dummies		✓
N	10135	10106

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14: Estimation results : Fine and Gray (1999) regression, separation is a competing risk

	(1)
eq1	
College	0.35***
N	83528

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15: Estimation results :Cox regression on the risk of Divorce

Hazard of Divorce	(1) b
Cohabited	2.60***
Log_coh	-0.34***
N	42558

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$