most consistent with the data. If I assume that the predictions of the pure changes model are false, I can usually reject that they are false. At the same time, if I assume that the predictions of the pure learning model are false, I can usually not reject that they are false. This holds for the reference case. However, looking at the predictions from Table 5, it is clear that, based on the data, it is not possible to reject that outcomes 1 and 3 are driven by a pure learning model with a small amount of learning. Only outcome 2 from table 5 allows us to distinguish between the pure learning model and the pure changes model, and the pattern in the data for outcome 2 is more favorable to the pure changes model. Additionally, data on the distribution of marital satisfaction at different marriage durations is not supportive of the pure learning model. Overall, I conclude that, while it is difficult to reject a model with a small amount of learning, the data does not support a large amount of learning (i.e. high standard deviation of the observation). At the same time, patterns in the data are consistent with changes in marital quality driving the bulk of divorces.

Having confirmed that there is no substantial role for learning in explaining divorce, it becomes interesting to examine whether learning may explain separations in cohabiting relationships. Indeed, it could be that little learning happens in marriages because such learning occurred earlier, during the cohabitation phase. Given the data I use, I only know the duration of cohabiting relationships for those that started during the sample, which means that I only observe the early stages of cohabiting relationships (at most 4 years if the relationship started at the very beginning of the observation window). Hence, tests based on the impact of job loss at various durations cannot be used reliably. Additionally, job loss is not a significant predictor of separation in these relationships. Interestingly, the fact that job loss does not predict separation in cohabiting relationships is consistent with the pure changes model applied to cohabiting relationships. As Figure 3 shows, the impact of job loss increases with relationship duration in the pure changes model. Since I only observe the early stages of cohabiting relationships, it is possible that the impact of job loss is too small to be statistically significant.

While I cannot use any tests based on the impact of job loss, I can still use the prediction about outcome number 1 in Table 2. Figure 8 plots the separation hazard for cohabiting relationships. Here, one can see more clearly than in the case of marriages that the separation hazard initially increases with duration. However, the level of the hazard at the very beginning of the relationship is *not* significantly smaller than the maximum of the hazard; hence I cannot reject that the hazard is initially flat, just like in the marriage case. Additionally, a separation hazard that is increasing and decreasing with duration is compatible both with the pure learning model and the pure changes model, provided separation costs are high enough (see section 2.3.3). Overall, while my ability to reject the pure learning model for cohabiting relationships is much more limited than in the case of marriages, it is still the case that, even for cohabiting relationships, the pure changes model is more consistent with the data.

To give more evidence on the role of learning, one can also compare marriages that were preceded by cohabitation with those that were not. Intuitively, marriages that were not preceded by cohabitation should show more signs of learning. Because I can only observe whether marriages were preceded by cohabitation if the marriage started during the observation window, I have to restrict the sample to these marriages. Therefore, due to a follow up of only two years on average, I can only use the first test, i.e. examining the shape of the overall divorce hazard. Whether marriages started with cohabitation or not, we do not see a significant initial increase in the divorce hazard (Figure 9), contrary to the prediction of the pure learning model. At the same time, those marriages that started with cohabitation have a lower divorce hazard in the first year, but not beyond (Figure 9). This lower divorce hazard is consistent with selection during cohabitation, so that only better relationships transition to the marriage phase. Because such selection should happen in both the pure changes and the pure learning model, a lower divorce hazard for marriages preceded by cohabitation does not allow us to distinguish between these models. Overall, these results suggest that the predictions unique to the pure learning model also fail to hold up for marriages that were not preceded by cohabitation, and where learning should play a larger role. By contrast, the results are consistent with the pure changes model, which strengthens the case for this model.

Considering the analysis of both marriage and cohabitation, I find little conclusive evidence for learning. On the other hand, separations during both marriage and cohabitation can be explained by a model based on shocks to marital quality. If learning plays an important role, it is likely to happen much earlier in the course of the relationship, possibly not even during cohabitation but during the dating stage.

4 Conclusion

This paper examines the fundamental reasons underlying the evolution of the divorce probability over the course of a marriage. Although learning about marital quality has been often proposed as an explanation for the divorce hazard, this mechanism finds limited support in the data. On the other hand, the divorce hazard can be fully explained by the assumption that the marital quality follows a random walk. In other terms, divorce can be fully explained by real changes in relationship quality, and without invoking any learning. The fact that learning plays at best a limited role in explaining divorce patterns may be part of the reason why it is so difficult to show empirically that pre-marital cohabitation decreases the probability of divorce. From a policy perspective, the results from this paper suggest that policies that strengthen marriages are those that help couples cope with negative shocks, such as marital counseling or income support policies.

This result is important not only because it sheds light on the substantial mechanisms behind divorce, but also because it clarifies which class of models is most appropriate for marriage. Indeed, learning models are cumbersome, and the mixed model, which also allows for changes in match quality, is even less tractable. If shocks to match quality are the key cause of divorce, then only these shocks need to be modeled in theories whose aim is to explore aspects of the marital relationship other than divorce timing, such as investment in the relationship.

While the theory developed here is suitable to test for the role of learning in marriages, it has important limitations. First, the theory only allows us to test for the presence of substantial learning. The tests used here do not allow us to reject that there is any learning at all in marriage. Second, I do not explicitly model investments in the relationship. Third, the model does not specify what the sources of shocks to relationship quality are. The empirical work concentrates on one of these shocks, job loss, but other elements must also play an important role. Future research should better quantify the relative contribution of various types of shocks to marital dissolution. Another promising research endeavor is to better understand the role of cohabitation. Since learning may not be an important reason for cohabitation, what explains this behavior? Is it for example that partners cohabit instead of marrying because they expect shocks to occur in the near future that could change their valuation of the relationship? Focusing on shocks to relationship quality instead of learning opens interesting avenues for future research on marriage and cohabitation.

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Figure 1: Timing of partner's decisions

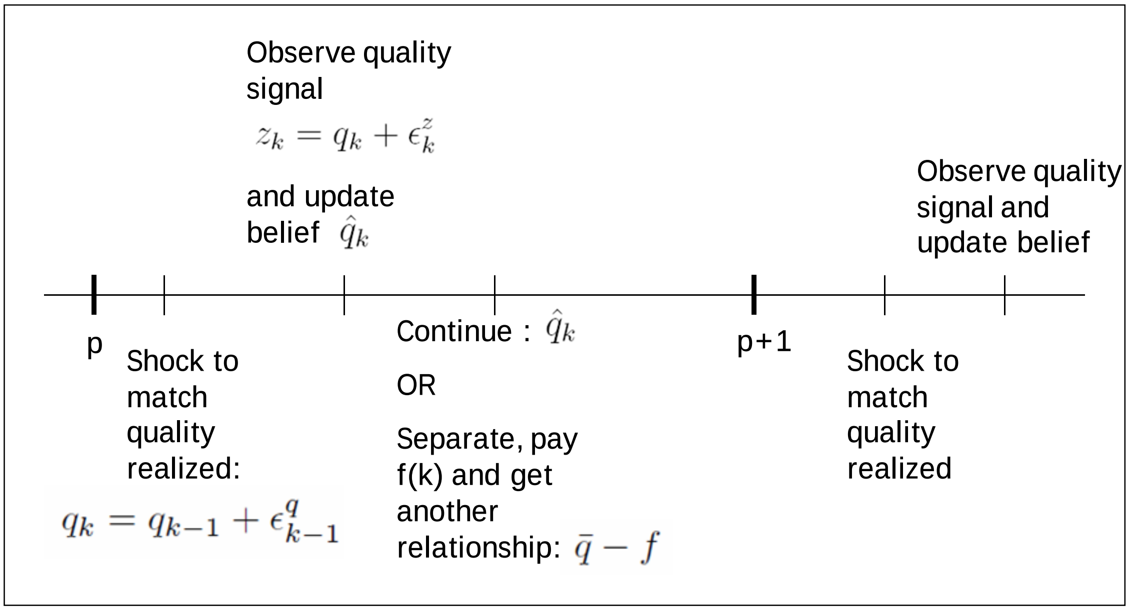
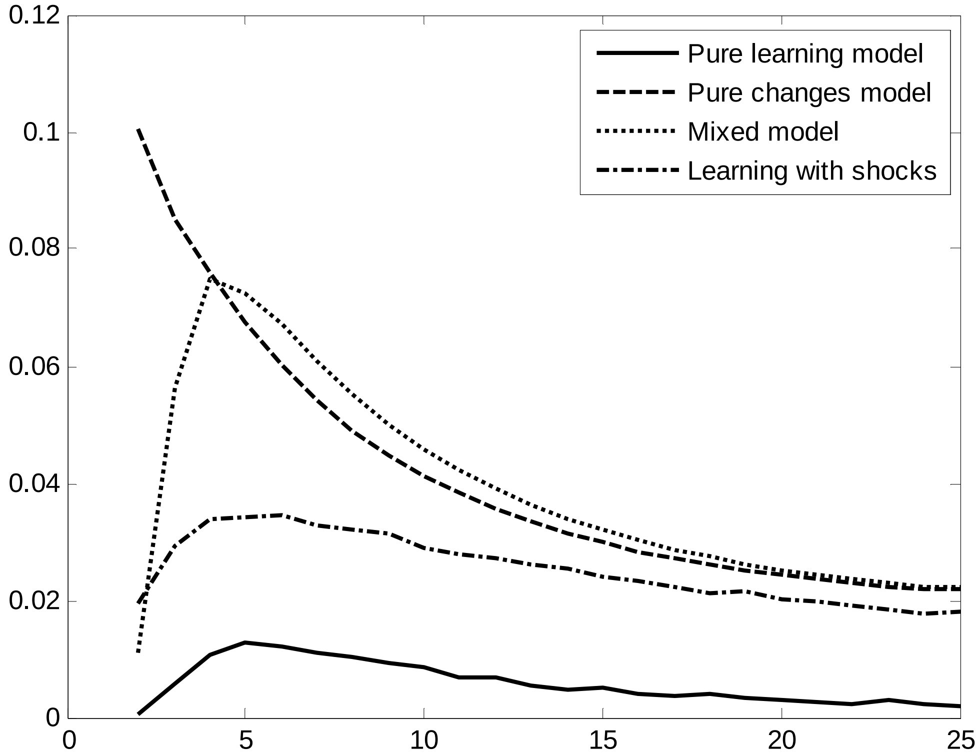


Table 1: Reference parameters

	Pure learning model	Pure changes model	Mixed model	Learning with shocks
Parameters of interest				
Standard deviation of observation	**10**	**0**	**10**	**10**
Standard deviation of process	**0**	**5**	**5**	**0**
Probability of job loss occuring	N/A	N/A	N/A	**0.05**
Probability of job loss state ending	N/A	N/A	N/A	**0.1**
Standard deviation of noise to the observer*	N/A	5*	N/A	N/A
Parameters held constant				
Mean of prior	30	30	30	30
Standard deviation of prior	5	5	5	5
Drift of process	0	0	0	0
Auto-correlation of process	1	1	1	1
Threshold for bad observation	15	15	15	15
Separation cost	30	30	30	30
Discount factor	0.8	0.8	0.8	0.8
Technical parameters				
Range of match qualities	[0,60]	[0,60]	[0,60]	[0,60]
Number of match quality values	801	801	801	801
Maximal duration	50	50	50	50

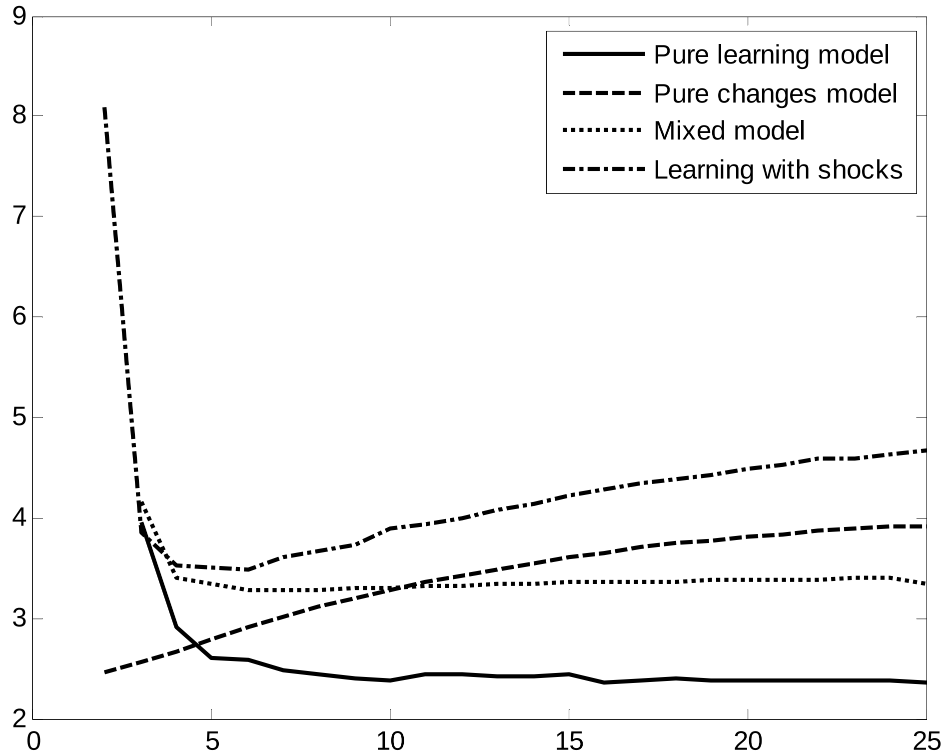
Note: the standard deviation of noise to the observer is only used in Figure 4.

Figure 2: Theoretical divorce hazard under alternative models



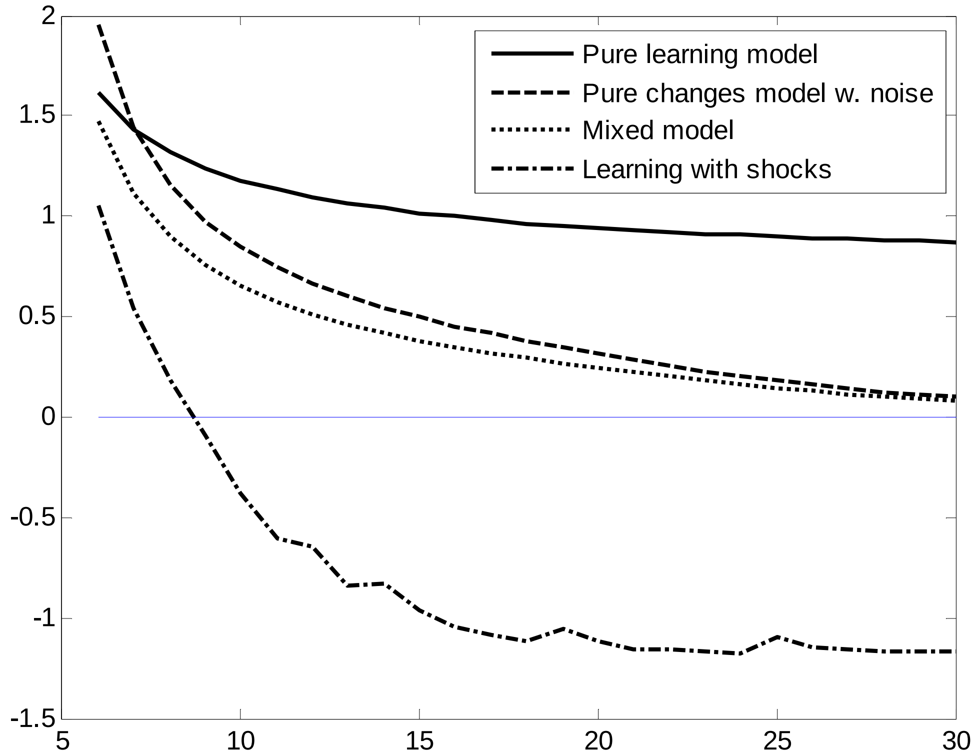
Note: The parameters for the calculation of these hazards can be found in Table 1.

Figure 3: Theoretical log hazard ratios under alternative models



Note: The parameters for the calculation of these hazards can be found in Table 1. The hazard ratio is defined as the hazard if job loss occurred at k divided by the hazard if no job loss occurred at k. Time k is represented on the x axis. The log ratios for the pure learning model and for learning with shocks have been smoothed with a moving average with a span of 5 for all values of k greater or equal to 10 in order to attenuate discretization artifacts.

Figure 4: Theoretical log hazard ratios after job loss occurred at period 5



Note: The parameters for the calculation of these hazards can be found in Table 1. The hazard ratio is defined as the hazard at k if job loss occurred at period 5 divided by the hazard at k if no job loss occurred at period 5. Time k is represented on the x axis.

Table 2: Empirically testable predictions using reference parameters

Outcome Number	Outcome description	Prediction under alternative models: Pure learning	Pure changes	Mixed model	Learning with shocks
1	Slope of the divorce hazard (see Fig. 2)	+ then -	-	+ then -	+ then -
2	Sign of the impact of job loss on the divorce hazard a few periods after job loss occurred (see Fig. 4)	+	Undefined in simple model. In the model with extra noise, + then approaches 0 when the number of periods since job loss is large enough	+ then approaches 0 when the number of periods since job loss is large enough	+, then - when the number of periods since job loss is large enough
3	Slope of the impact of job loss as a function of marriage duration (see Fig. 3)	-	+	- then +	- then +

Note: the reference parameters are in Table 1.

Table 3: Range of parameters tested

Standard deviation of observation	Standard deviation of process	Separation cost	Threshold for bad observation
0	0	20	10
1	1	30	15
2	2	40	20
3	3	60	25
4	4		
5	5		
10	7		
20	10		

Note: I have computed the outcomes in Table 2 under all possible combinations of the parameters above. Parameters not listed above remain the same as in the reference case.

Table 4: Sensitivity of predictions to changes in parameters

		Range of parameters yielding the same predictions as in the reference case			
Model	Outcome	S.d. of process	S.d. of observation	Divorce cost	Threshold for bad observation
Pure learning	1	0	[4:20]	[20:60]	N/A
	2	0	[1:20]	[20:60]	[10:25]
	3	0	[3:20]	[20:60]	[10:20]
Pure changes	1	[1:10]	0	[20:30]	N/A
	2	[1:10]	0	[20:60]	[10:25]
	3	[1:10]	0	[20:30]	[10:15]
Mixed	1	[1:10]	[3:20]	[20:60]	N/A
	2	[1:10]	[3:20]	[20:60]	[10:25]
	3	[2:10]	[2:20]	[20:40]	[10:20]
Learning with shocks	1	0	[4:20]	[20:60]	N/A
	2	0	[3:20]	[20:60]	N/A
	3	0	[4:20]	[20:60]	N/A

Note: For each parameter, the range given is the range that preserves the reference case predictions in Table 2, assuming that all other parameters remain the same as in the reference case. Only parameter values in Table 3 were tested.

Table 5: Predictions under a low level of learning

		Prediction under alternative models			
Outcome Number	**Outcome description**	**Pure learning**	**Pure changes**	**Mixed model**	**Learning with shocks**
1	Slope of the divorce hazard	-	-	-	-
2	Sign of the impact of job loss on the divorce hazard a few periods after job loss occurred	+	Undefined in simple model. In the model with extra noise, + then approaches 0 when the number of periods since job loss is large enough	Undefined in simple model. In the model with extra noise, + then approaches 0 when the number of periods since job loss is large enough	-
3	Slope of the impact of job loss as a function of marriage duration	+	+	- then +	+

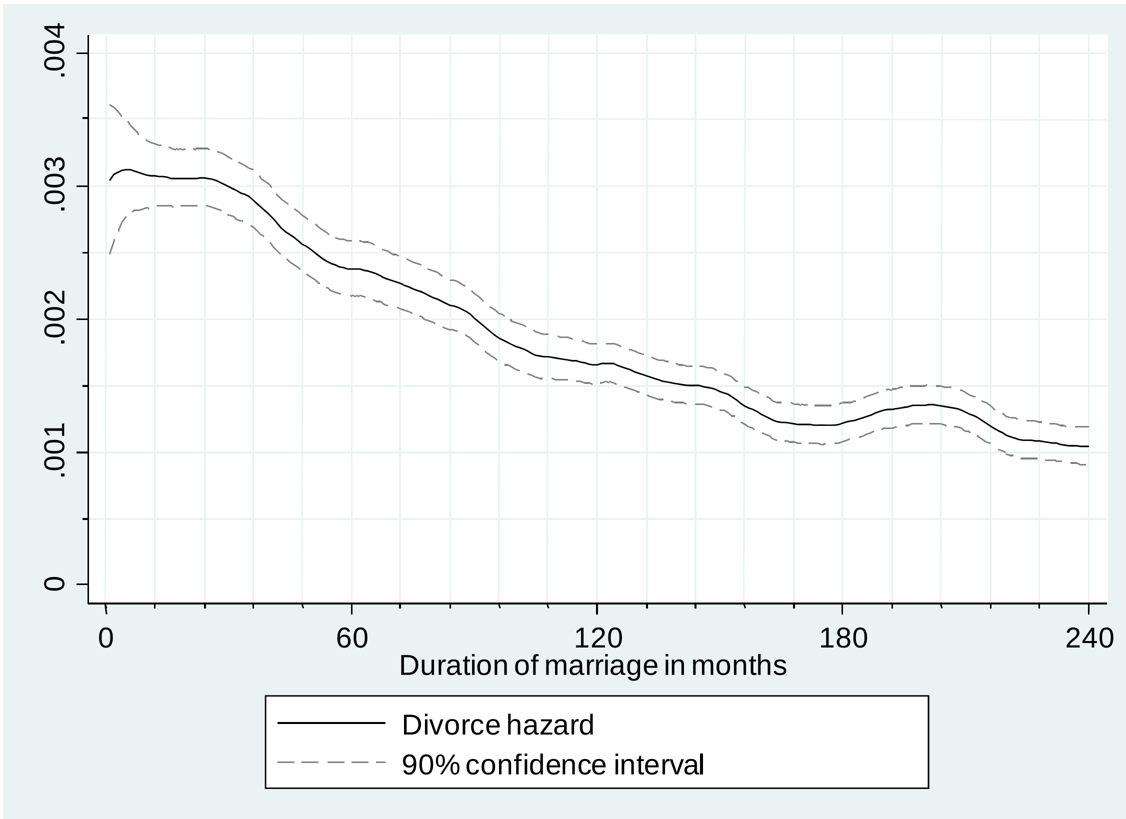
Note: Parameters as in the reference case (Table 1), except that the standard deviation of the observation is set to 2.

Table 6: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Divorce or separation	2797181	0.001256	0.035417	0	1
Husband laid off in the last year	2797181	0.011647	0.107291	0	1
Husband fired in the last year	2797181	0.00267	0.051605	0	1
Wife laid off in the last year	2797181	0.008068	0.08946	0	1
Wife fired in the last year	2797181	0.001847	0.04294	0	1
Husband has had another marriage	2797181	0.018288	0.133991	0	1
Wife has had another marriage	2797181	0.017493	0.131098	0	1
Age of the husband at the beginning of marriage	2796877	28.47455	9.432294	12	87
Age of the wife at the beginning of marriage	2796705	25.95334	8.744819	12	87
Husband is 5 years older than the wife or more	2797181	0.191416	0.393416	0	1
Wife is 5 years older or more	2797181	0.03128	0.174073	0	1
Husband is white	2797181	0.888015	0.315348	0	1
Both same race	2797181	0.973222	0.161433	0	1
Both high school educated or less	2797181	0.374762	0.484062	0	1
One with high school and one with some college or more	2797181	0.239599	0.426839	0	1
Both some college or more	2797181	0.263985	0.440791	0	1

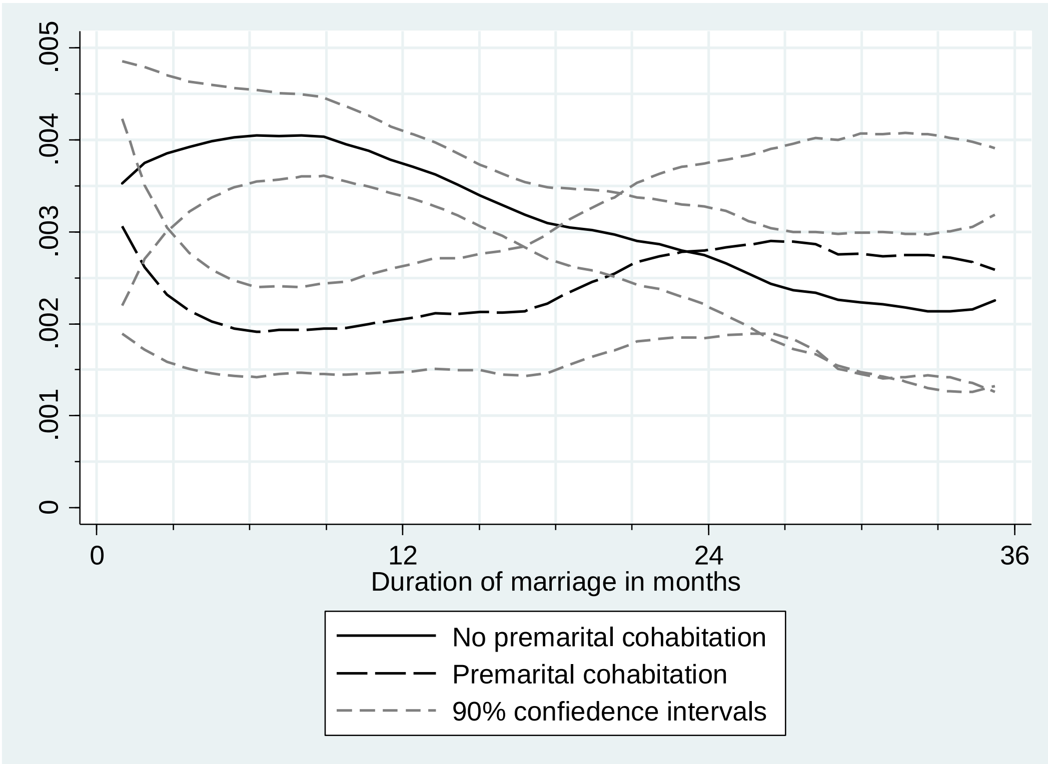
Note: An observation is a marriage*month.
Source: Survey of Income and Program Participation, 1990, 1991, 1992, 1993, 1996, 2001, 2004.

Figure 5: Divorce hazard



Notes: Kernel-weighted local polynomial smoothing using an Epanechnikov kernel, degree 1, bandwidth 8. The smoothing was achieved using durations up to 300 but the hazard is only graphed up to duration 240.
Source: Survey of Income and Program Participation, 1990, 1991, 1992, 1993, 1996, 2001, 2004.

Figure 9: The hazard of divorce for marriages preceded by cohabitation or not



Notes: Kernel-weighted local polynomial smoothing using an Epanechnikov kernel, degree 1, bandwidth 3.5.
Source: Survey of Income and Program Participation, 1990, 1991, 1992, 1993, 1996, 2001, 2004.