# The Value of Remarriage: Welfare Effects of Divorce Legalization

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**Abstract**

Until 2004, divorce in Chile was illegal and separated individuals were unable to remarry. This paper examines who benefits or looses from the option of exiting a marriage and remarrying. Using longitudinal survey data, we first document the effects of the reform on couples formation and separation. We then use this variation in the data to structurally estimate and validate a dynamic equilibrium model of marriage and remarriage over the life cycle and estimate the welfare impacts of legal divorce across genders, schooling levels and ages. We then simulate the effects of mutual consent vs. unilateral divorce and of different separation time requirements on marital decisions and welfare.

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## 1 Introduction

In modern societies, divorce and remarriage have become increasingly commonplace. For Americans born between 1950 and 1955, Stevenson and Wolfers (2006) report that 41 percent of first marriages had ended in divorce by age 45, up from 33 percent for the 1945-50 cohort. 69% of those divorcees had remarried by age 45 and 36% of those had divorced again. In the U.S., the evolution towards a "high turnover" marriage market coincided with the passing of legislation making it easier to divorce, notably by reducing separation times required to file for divorce, and by allowing no-faults divorce and unilateral divorce.[1]

This paper attempts to advance three fundamental questions. Firstly, we contribute to the study of the impact of divorce legislation on marital decisions by documenting the effects of divorce legalization in Chile in 2004. arguably a more dramatic policy variation than the ones exploited in the literature (with the notable exception of Bargain, Gonzalez, Keane, and Özcan (2010) and Gonzalez and Ozcan (2008) - see next section). Second, we assess the aggregate and distributional welfare implications of allowing divorce by structurally estimating an equilibrium model of marital decisions over the life cycle. Finally, we consider whether governments should make it harder or easier for couples to divorce. In particular the estimated model can be used to simulate the effects of different separation time requirements, as well as unilateral vs. mutual consent divorce.

In our model, individuals decide every period whether to marry (if unmarried), separate (if married) or divorce (if separated and if divorce is legal). Unmarried individuals draw a potential spouses every period from the pool of unmarried individuals. The distribution of characteristics (age, schooling) within that pool is determined in equilibrium. Married individuals split a common marital output (including a stochastic but persistent match quality component) using Nash bargaining. Couples can separate whether divorce is legal or not. Separated individuals cannot, however, remarry. Divorce legalization allows separated couples to dissolve their union (after the time in separation required by the law) and become unmarried again. This effectively renews their access to the marriage market. Because of the dynamic nature of the model, the divorce law has repercussions not only for separated men and women, but also for married couples and singles, as better remarriage prospects might imply receiving a higher share of the marriage surplus. The life

[1] Whether the change in rules actually caused the increase in divorces is the subject of a number of studies, notably Friedberg (1998) and Wolfers (2006). Exploiting the different timings of divorce reforms in different states, both find significant increases in divorce rate, though Wolfers (2006) finds that the effect is temporary.

cycle dimension of the model allows us to exploit age patterns in marriage and separation rates to identify flow utility of unmarried, married and separated individuals.

The model is estimated using a simulated method of moments estimator.[2] The data moments are extracted from a longitudinal survey ("Encuesta de Proteccion Social", or EPS) administered to a representative sample of the Chilean population, in 2002, 2004, 2006 and 2009. The moments used in estimation include the age and schooling profiles of marriage and separation rates from one survey round the next, as well as measures of assortative matching on age and schooling.

In this version of the paper, we estimate the model parameters using the pre-reform data. We then examine whether there exists a cost of divorce that allows the model to accurately predict the post-reform marriage and separation rates and degree of assortative matching. The welfare implications of divorce legalization are then evaluated at the different costs of divorce.

### 1.1 Related literature

A number of studies have exploited institutional variation in divorce laws to examine whether relaxing the requirements to obtain a divorce leads to changes in the way individuals behave. Johnson and Skinner (1986), Parkman (1992), Gray (1998) and Stevenson (2008) study the effect of divorce laws on female labor supply; Voena (2012) studies how divorce laws affect the way households save over the life-cycle; Stevenson and Wolfers (2006) show how unilateral divorce in the US reduced domestic violence and spousal homicide; Drewianka (2008) relates divorce laws and fertility; Friedberg (1998) and Wolfers (2006) show that a significant fraction of the increase in the break-up rates of marriages in the 70s can be attributed to changes in the legislation. We complement these findings by documenting the impact of divorce legalization on marriages, separations and assortative matching in the Chilean case.

Our paper is related to Bargain, Gonzalez, Keane, and Özcan (2010) and Gonzalez and Ozcan (2008), who use variation in the data after the legalization of divorce in Ireland in 1996, to study female labor force participation and savings behavior respectively. These two papers deal with a significant change in the legislation with respect to marriage (as opposed to the rest of the literature which deals mostly with changes in divorce law in the US, or their variations across states) and resemble the case of divorce liberalization in Chile, which has received no attention in the literature.[3]

[2]See McFadden (1989), Gourieroux and Monfort (1996)

[3]an exception is Heggeness (2010) who shows that school enrollment was positively impacted by the legalization

The interpretation in the literature is that marital instability and remarriage considerations reduce incentives to specialize in home production, leading more women to participate in the labor market. Similarly, how easy it is to get a divorce and which laws determine asset allocation after a break-up, affect optimal savings decisions of rational agents inside marriage. However, even though the literature has made clear that the structure of divorce laws can have a first order effect on important individual decisions, welfare effects have not been widely studied. We contribute to the literature in this regard: we consider a structural, general equilibrium model of the marriage market, which allows us to compute welfare for different divorce law regimes and, more importantly, we can compute welfare for all participants in the marriage market, *not only* married individuals Given that marriage, separation/divorce and remarriage decisions have a clear timing over the life-cycle, our model is suited to study heterogeneous responses to changes in the law by different age groups and possibly, formulate age-differentiated policy recommendations.

The model in this study is related to the quantitative equilibrium marriage models in the macroeconomics literature. Aiyagari, Greenwood, and Guner (2000) build and calibrate a model with marriage, divorce, and investment in the human capital of children to study intergenerational mobility. Greenwood, Guner, and Knowles (2003) calibrate a model of marriage, fertility, and employment to study the implications of family policies for the income distribution. We also build on a number of structural empirical studies that model both marital status choice and labor supply in a life cycle framework including Van der Klaauw (1996), Keane and Wolpin (2010), Gemici and Laufer (2011), Brien, Lillard, and Stern (2006). These papers use decision models whereas we consider an equilibrium search model. Our model is closest to Seitz (2009), also in equilibrium and with additional decisions besides marital status. Contrary to that study, however, we model divorce legislation and exploit institutional variation from the Chilean reform to identify and validate the model.

## 2 Background: The introduction of divorce in Chile

Before 2004, the law that governed marriage dated from 1884. It did not provide for marriages to be legally dissolved. The term "divorcio" was used to refer to legal separations. These were pronounced by a judge, for example if a spouse abandoned the household or committed adultery.

of divorce.

The judge could specify the amount of the alimony owed by either spouse, which could not exceed half of the payer's income and had to be higher than a minimum amount called "sueldo vital". The legal separation also changed the rules governing the administration of the household assets. However it did not terminate the conjugal bond, so in particular remarriage was not possible. The only cases in which a marriage could be dissolved is if one of the spouses died or if the marriage was annulled. Annulment required a lawyer, as well as three witnesses who would attest to facts, whether true or false, that vitiate the original proceedings, such as asserting that the couple does not reside where they said they did when they were married. In particular, the process required mutual consent of the spouses (if the marriage was not in fact legitimately void), and was costly (anecdotal evidence suggests the equivalent of 5 months of the minimum wage).

Proposals for a new family law that would recognize divorce were introduced in parliament 1995, then 1997, 1999, and finally in 2002. That last proposal was debated until march 2004, and promulgated in May of that year, effective in November. The new law allows for the dissolution of marriage under [insert conditions here]. It also regulates alimony: a judge may take into account marriage duration, assets, age, health, pension savings, earning power to determine the amount of the payments.Two types of divorce are effectively in place. Mutual consent divorce requires proof of 1 year separation . Unilateral divorce requires proof of 3 years separation.

## 3 The model

The model is an equilibrium dynamic discrete choice model of matching with frictions, in the sense that agents are matched at random.[4] Time is discrete and goes on forever. The economy is populated by heterogeneous agents, who differ by gender and productivity (education) level. They live finite lives and interact in a marriage market each period. We assume that the environment is stationary.

### 3.1 The individual decision problem

Agents of two genders $g = \{m, f\}$ make marital decisions for T periods. Age is denoted as $a \in \{1, ...T\}$. In a given period, agents can be married ($s = M$), married but separated ($s = X$)

[4] Our framework, in line with the rest of the literature so far, considers frictions in the marriage market in the form random search for partners. One notable exception is Kennes and Knowles (2012) who develop a model of directed search of marriage and fertility decisions.

or unmarried ($s = S$), where $s$ denotes the individual state. Besides gender and marital status, individuals are characterized by a vector $z = (a, x)$, where $x \in \mathcal{X}^g$ is their productivity or potential earnings, which is exogenously determined before birth.

We assume that only unmarried agents are in the marriage market. At the beginning of every period, unmarried agents search randomly for a match within the available pool of unmarried agents. Denote as $f^g(z^+)$ the density of potential matches with characteristics $z^+ = (a^+, x^+)$ for an individual of gender $g$. In what follows, a superscript "+" denotes the characteristics of a potential/current spouse.

Once they are matched, two potential partners draw a match quality $\theta$ from a distribution $F_\theta^0$. Married agents draw a new match quality from distribution $F_\theta(./\theta)$, which potentially may exhibit persistence. We assume that decisions of married and separated individuals also depend on $d$, the duration of the marriage in periods. For married individuals, this dependence affects the decision of getting a separation;[5] for the separated, this dependence will capture legal requirements in order to get a divorce (e.g., being separated for certain amount of years is a requisite in order to get a unilateral divorce in Chile). Thus, the information set which determines agents' decisions is denoted by $\Omega = \{\theta, z, z^+, d\}$. For the unmarried, the working assumption is that $d = 0$ (no prolonged dating nor cohabitation). We denote the information set of a prospective/current partner as $\Omega^+ = \{\theta, z^+, z, d\}$.

### 3.2 The Marriage Market

An unmarried agent with a potential partner might decide to offer to marry. In order for the marriage to happen, both matched individuals must prefer marriage to being unmarried. Married agents can decide between separating (we assume unilateral decisions for separation) or remaining married. Separated individuals decide between remaining separated or file for divorce (in case the latter is legally allowed). Divorce can be unilateral or bilateral, and can depend on the duration of the separation $d$.

Let $\widetilde{v}_s^g(\Omega)$ be the value of entering age $t$ in marital state $s$ with a current or potential partner characterized by $z^+$. In other words, this is the value function *before* the marriage state decision takes place. Denote as $V_s^g(\Omega)$ the choice-specific value function containing the expected lifetime

[5] This dependence might reflect different utility costs of separation from marriages of different durations.

utility of an agent of gender $g$ who has chosen marital status $s$.

Marital transitions carry a utility cost $\kappa^g_{ss'}$, where $(s, s') \in \{M, S, X\}^2$. Then we can define the value of entering age $t$ for an unmarried individual of gender $g$ with characteristics $z$, and potential partner $z^+$ as:

$$\widetilde{v}^g_S(\Omega) = I^g_S(\Omega) I^{g^+}_S(\Omega^+) \cdot [V^g_M(\Omega) - \kappa^g_{SM}] + \left[1 - I^g_S(\Omega) I^{g^+}_S(\Omega^+)\right] \cdot V^g_S(z) \tag{1}$$

note that the relevant state space is given by $\Omega = \{\theta = \theta_0, z, z^+, d = 0\}$, where $\theta_0$ is the initial match quality, $I^g_S(\Omega)$ is an indicator function that equals one if an agent of gender $g$ and characteristics in $z$ prefers to get married with someone with characteristics in $z^+$ rather than remaining unmarried.[6] Analogously, $I^{g^+}_S(\Omega^+)$ is the decision of the prospective partner. The last component of the equation above takes into account that the value of being unmarried this period $V^g_S$ only depends on own characteristics $z$.

Similarly, marital state decisions in the case of married individuals are defined by:

$$\begin{aligned}\widetilde{v}^g_M(\Omega) &= I^g_M(\Omega) I^{g^+}_M(\Omega^+) \cdot V^g_M(\Omega) \\ &+ \left[1 - I^g_M(\Omega) I^{g^+}_M(\Omega^+)\right] \cdot \left(V^g_X(\theta = 0, z, z^+, d = 0) - \kappa^g_{XS}\right)\end{aligned} \tag{2}$$

where $I^g_M(\Omega)$ is the indicator function for the case in which an agent of gender $g$ and characteristics $z$ prefers to remain married to someone with characteristics $z^+$ in a marriage with current characteristics $\{\theta, d\}$; $I^{g^+}_M$ represents the decision of the spouse. The second element in equation (2) reflects our assumption of unilateral separation decisions. We also allow for the general case that decisions of the separated might depend on $z^+$ , and explicitly show that both $\theta$ and $d$ reset to zero in that case.

Finally, for separated individuals under the unilateral divorce assumption:

$$\begin{aligned}\widetilde{v}^g_X(\Omega) &= [1 - I^g_M(\Omega)] \cdot [1 - I^{g^+}_M(\Omega^+)] \cdot V^g_X(\Omega) \\ &+ \left[1 - [1 - I^g_M(\Omega)] \cdot [1 - I^{g^+}_M(\Omega^+)]\right] \cdot (V^g_S(z) - \kappa^g_{MX})\end{aligned} \tag{3}$$

where $I^g_X(\Omega)$ is the indicator function which equals one if the agent *wants a divorce* and zero otherwise. For the case of bilateral divorce, we have:

$$\begin{aligned}\widetilde{v}^g_X(\Omega) &= \left[1 - I^g_M(\Omega) \cdot I^{g^+}_M(\Omega^+)\right] \cdot V^g_X(\Omega) \\ &+ I^g_M(\Omega) \cdot I^{g^+}_M(\Omega^+) \cdot (V^g_S(z) - \kappa^g_{MX})\end{aligned} \tag{4}$$

where the indicator functions are defined in the same way. In both these scenarios, the law can also

[6] That is, $I^g_S(\Omega) = 1$ if and only if $V^g_M(\Omega) - \kappa^g_{SM} \geq V^g_S(\Omega)$ and equals 0 otherwise.

differ with respect to requirements in terms of the separation duration $d$ before getting a divorce. Further, and as is the case in Chile at the moment, there could be a combination of unilateral and bilateral divorces, depending on the time the couple has been separated. We will discuss this latter case in the counter-factual exercise below.

Agents who reach age T receive a terminal value $T^g_s(x)$ and do not participate in the marriage market, nor make further decisions.

$$T^g_s(x) = \alpha^g_{T,s,0} + \alpha^g_{T,s,x} \cdot x + \alpha^g_{T,s,x^+} \cdot x^+$$

However, we make the simplifying assumption that these agents remain 'faithful', in the sense that any agent with $a < T$, married with someone with $a^+ = T$, can expect to remain married if he/she so desires. Thus, agents who are married to someone of age T can choose to remain married or to separate, with $I^{g^+}_M(\Omega^+)$ equal to one if $a^+ = T$.

### 3.3 Preferences

Preferences inside each period are represented by an per-period utility function which depends linearly on gender, age, productivity and marital status with interaction terms for the age and productivity of spouses in case of marriage. This is a reduced form approach to the modeling of intra-temporal household decisions, regarding labor force participation and consumption potentially. First, the utility for unmarried individuals depends only on their individual characteristics:

$$u^g_S(x,a) = \alpha^g_{S,c} + \alpha^g_{S,x} \cdot x + \alpha^g_{S,a} \cdot a \tag{5}$$

where the $\alpha$'s represent preference parameters and subscripts denote that they are specific to gender and marital status ($c$ stands for the constant term). For separated individuals, we have

$$\begin{aligned} u^g_X(x,a,x^+,a^+,d) &= \alpha^g_{X,c} \\ &+ \alpha^g_{X,x} \cdot x + \alpha^g_{X,a} \cdot a \\ &+ \alpha^g_{X,x^+} \cdot x^+ + \alpha^g_{X,a^+} \cdot a^+ \\ &+ \alpha^g_{X,aa^+} \cdot a \cdot a^+ + \alpha^g_{X,xx^+} \cdot x \cdot x^+ \\ &+ \alpha^g_{X,d} \cdot d \end{aligned} \tag{6}$$

Finally, for married agents, we have a common public value of being inside the relationship, denoted by

$$\begin{aligned}
u_M(x,a,x^+,a^+,d) &= \alpha_{M,c} \\
&+ \alpha_{M,x}\cdot x + \alpha_{M,a}\cdot a \\
&+ \alpha_{M,x^+}\cdot x^+ + \alpha_{M,a^+}\cdot a^+ \\
&+ \alpha_{M,aa^+}\cdot a\cdot a^+ + \alpha_{M,xx^+}\cdot x\cdot x^+ \\
&+ \alpha_{M,d}\cdot d
\end{aligned} \tag{7}$$

During marriage, the choice-specific value function for each member of the relationship depends on a transfer between spouses ($\tau^g$) on top of the per-period values of $u$. Then, the choice-specific value functions are related to the ex-ante value functions in equations (1) to (3)[7] through the following equations:

$$V_S^g(a,x) = u_S^g + \beta \mathbf{E}_{\theta_0,a^+,x^+}\left[\widetilde{v}_S^g(\theta_0,a+1,x,a^+,x^+)\right] \tag{8}$$

$$V_M^g(\theta,a,x,a^+,x^+,d) = u_M + \theta + \tau^g + \beta \mathbf{E}_{\theta}\left[\widetilde{v}_M^g(\theta',a+1,x,a^++1,x^+,d+1)\right] \tag{9}$$

$$V_X^g(\cdot,a,x,a^+,x^+,d) = u_X + \beta \widetilde{v}_X^g(\cdot,a+1,x,a^++1,x^+,d+1) \tag{10}$$

where the expectation operator $\mathbf{E}_{\theta_0,a^+,x^+}$ is taken with respect to the initial distribution of marital bliss values and the equilibrium measure of unmarried individuals of gender $g^+$, with joint characteristics $(a^+,x^+)$. On the other hand, $\mathbf{E}_\theta$ depends on the stochastic process for marital bliss when the couple is already married, $F_\theta(./\theta)$.

The transfer function between spouses solves the following Nash-Bargaining problem:

$$\{\tau^{m*},\tau^{f*}\} = arg \max_{\tau^m,\tau^f} \quad (V_M^m - V_X^m)^{\mu^m}\left(V_M^f - V_X^f\right)^{\mu^f} \tag{11}$$

such that $\mu^m + \mu^{g^f} = 1$ and $\tau^m + \tau^f = 0$, where $\mu$ represent gender specific weighting parameters. The second restriction states that the transfer of an individual to his/her spouse is exactly in the same amount of the opposite transfer. This setup is similar to Jacquemet and Robin (2011) and is standard in most of the search and matching literature for labor markets.

### 3.4 Equilibrium

We assume constant population size: no early deaths and individuals with productivity $x$ reaching age $T$ are replaced by agents with the same gender and productivity, but with $a = 1$. We focus on

[7] Or, alternatively, equation (4), depending on the law regime.

steady state equilibrium in the distribution of agents in different marital states. Denote $G^g(s,a,x)$ as the measure of individuals of gender $g$, marital status $s$, age $a$ and productivity $x$. This is an equilibrium object which agents take as given in order to maker their decisions in the marriage market.

Our definition of equilibrium is straightforward:

**Definition 3.1.** *A steady state marriage market equilibrium is a set of value functions* $\{\widetilde{v}_s^g, V_s^g\}$ *and marital decision functions* $\{I_s^g\}$ *for each gender* $g = 1,2$ *and marital states* $s = \{S, M, X\}$ *and a measure* $Z(g,m,a,x)$ *of individuals across observable states, such that:*

1. *Given* $Z$*, values and decisions are optimal, in the sense that they are defined by equations (1) to (3)*[8] *and equations (8) to (10)*

2. *The distribution of agents across marital states* $Z(g,m,a,x)$ *is consistent with decisions in equilibrium.*

## 4 The Data

We use a longitudinal survey called "EPS" collected in 2002, 2004, 2006 and 2009. The initial 2002 sample was drawn from the universe of pension system affiliates, and was complemented with non-affiliates in 2004 and 2006 to arrive at a sample representative of the Chilean population in 2006 (about 16500 individuals) The information collected by the survey includes retrospective employment from 1980, labor earnings between 2002 and 2009, a history of life time relationship, and spouse characteristics (schooling, labor supply and earnings). In addition, we use a representative cross-sectional survey called "CASEN" (1994, 1996, 1998, 2000, 2003, 2006 and 2009 rounds), to perform robustness checks.

### 4.1 Sample exclusions

We consider individuals between the ages of 19 and 50. For the estimation of the model and descriptive statistics we use the 6195 surveyed individuals who responded to all four waves of the survey. Summary statistics for the initial sample (within the age range) and the estimation sample are provided in table 1.

[8] Or, alternatively, equation (4), depending on the law regime.

Table 1: **Summary statistics**

| Variable | Estimation sample in 2006 | EPS 2006 |
|---|---|---|
| % women | 48.1 | 50.3 |
| Age | 38.0 | 36.8 |
| Attained schooling (yrs.) | 10.9 | 11.2 |
| % unmarried | 37.9 | 42.8 |
| % married | 51.0 | 47.1 |
| % separated | 11.1 | 10.1 |
| Nb. months inactive | 1.8 | 2.2 |
| Annual earnings (million pesos) | 2.7 | 2.7 |
| Net assets (million pesos) | 11.1 | 11.1 |
| Nb. of children | 1.3 | 1.2 |

*Source:* Own calculations.

### 4.2 Marital status variable construction

The reported current civil status in the main survey module can be married, cohabiting, separated, annulled, widow/er,unmarried, divorced. Given the purpose of our paper, we reclassify individuals strictly based on their legal marital status. In other words they can only be: unmarried (which includes people in non-marital cohabitations), married, or separated (that is previously married, but the relationship is over). In mapping responses into the three categories, we face two potential problems. Firstly, individuals who report being "cohabiting" and "single" might actually be legally married to someone, but they chose to answer the question in reference to their current non-marital relationship ("cohabiting") or to the fact that they currently live by themselves ("single"). To obtain a consistent categorization, we need to reclassify them as "separated". Secondly, individuals who report being "separated" might have separated from a non-marital union rather than a marriage, in which case they are unmarried for our purpose. In order to do that, we extract whether respondent has be married before from marital history module, and combine that information with reported current civil status in the following manner:

1. cohabiting + married before → separated
2. cohabiting + not married before → unmarried
3. separated + married before → separated
4. separated + not married before → unmarried

5. single + married before → separated

6. single + not married before → unmarried

More straightforwardly, annulled and widowed individuals are classified as unmarried.

## 5 Descriptive statistics: Effects of divorce legalization on marital decisions

### 5.1 Marital status frequencies

Our first goal is to establish that the reform had a sizable impact on marital decisions that cannot be attributed to existing trends in marital decisions, attrition, or measurement error. To do so we compare the marital status reported by men and women in each round of the EPS and show that there appears to be a large break in the fraction of married men and women. We establish that this cannot be attributed to attrition by looking at data from a repeated cross-sectional survey representative of the Chilean population (CASEN). An additional benefit is that CASEN was administered from 1990 to 2011, which gives us 15 years before the reform to distinguish between time trends and the reform effects.

#### 5.1.1 Evidence from a longitudinal survey (EPS)

The first set of figures show the marital status reported by men and women in each of the four survey rounds (2002, 2004, 2006, 2009). The 2004 survey was being collected at the time when the law was passed, in November 2004. Around 86% of the interviews where completed by January 2005, and 99% by April 2005. We recognize that some behavioral changes might have occurred as a result of the reform by the time the interview was conducted. However we believe it is more accurate to interpret the 2004 numbers as pre-reform, since marital status responses are likely to take longer than a few month to fully take place.

We compare marital statuses reported in 2002/2004 with 2006/2009 for different ages and schooling levels. The data on marital status frequencies reveals a downward break in the fraction of women married after reform (2006 and 2009, vs 2002 and 2004). The effects becomes less pronounced as we consider older women as illustrated in figure 1. As we group women into schooling attainment bins, we observe that the decrease in the frequency of married women is strongest for women with low and high schooling attainments, weaker in the middle (figure 2). Men exhibit similar age and schooling patterns, except that the effect is relatively more pronounced for higher schooling levels and less pronounced for lower schooling levels relative to women (figures 3 and 4.

#### 5.1.2 Evidence from a repeated cross-section survey (CASEN)

In order to verify that attrition correlated to marital status decisions is not responsible for the patterns described above, we turn to a repeated cross-section data set: the representative survey CASEN. We compute the annual change in the fraction of individuals married between successive CASEN rounds, from 1990 to 2011. Ultimately, we are interested in the behavior of marriage and separation rate, i.e. the flows rather than the stock of marriages. A change in the flows in a given year will be reflected in the stocks of future years, for older individuals. In order to mitigate this effect, we restrict the ages considered to be between 25 and 34, which is when the bulk of marriages and separations occur. Table 2 illustrates that an unusual drop in the number of married individuals occurs between the 2003 and 2006 CASEN rounds that bracket the divorce law. This evidence from an independent data source, with a longer time-frame and no attrition issues gives us confidence that the patterns are not an artifact of the particular dataset we use.

Table 2: Marriage frequencies changes in the CASEN survey

| Year | Δ% married (ages 25-34) |
|---|---|
| 1990-1992 | -0.8% |
| 1992-1994 | -0.2% |
| 1994-1996 | -1.8% |
| 1996-1998 | -1.2% |
| 1998-2000 | -2.1% |
| 2000-2003 | -1.8% |
| *2003-2006* | *-3.0%* |
| 2006-2009 | -1.8% |
| 2009-2011 | -2.0% |

### 5.2 Marriage and separation rates

A decrease in the stock of married individuals can be due to lower inflows (from singlehood or cohabitation) or larger outflows (separations and divorces). We now turn to the transitions between the four survey rounds (2002, 2004, 2006 and 2009). The mode in the distribution of interview completions for each round is respectively: June 2002, December 2004 (30 months later), December

2006 (36 months later), and June 2009 (30 months later). In particular, this means that the 2002-2004 and 2006-2009 transition rates are comparable given that the time elapsed between rounds is very similar. By contrast, transition rates between the 2004 and 2006 rounds will be mechanically higher by 20% ($\frac{36-30}{30}$). Thus, in the figures and tables of this section we divide transition rates between 2004 and 2006 by 1.2 in order to obtain 30-month transition rates. We also restrict our attention to individuals older than 22, in order to circumvent the fact that our sample ages through the period (the youngest sampled individuals in 2002 are 15, so they turn 22 at the time of the 2009 round).

The marriage rate exhibits a statistically significant increase from 3.6% between 2002 and 2004 to 5.8% between 2006 and 2009 (figure 5). The increase becomes pronounced only after 2006. By contrast the separation rate increases immediately after the reform, from 3.7% between 2002 and 2004 to 6.2% between 2004 and 2006, and further to 7.8% between 2006 and 2009 (figure 6). In dividing the sample by schooling groups (no High School, some High School, High School graduates and college graduates), we loose statistical significance, but figures 7 and 9 suggest interesting patterns. While all schooling groups exhibit an increase in both marriage and separation rates, the extreme categories (no High School and college graduates) show a larger increase in marriage rates and a more modest increase in separation rates, compared to the middle categories (some High School and High School graduates).

We also break down transitions by age groups. The effect of the law on separation rates appear strongest for younger individuals (5.3 to 11.7% for those under 30, 3.2 to 7.8% between 30 and 39, and 3.8 to 6.8% for those above 40), as illustrated by figure 16. Regarding marriage rates, the effect seems concentrated on individuals between 30 and 39 (figure 13).

### 5.3 Assortative matching

We consider the impact of divorce legalization on assortative matching on the marriage market along the dimensions of age and schooling. To do so we compare the characteristics of the stock of married couples in 2002 with those of new marriages celebrated in 2002-2004, 2004-2006 and 2006-2009. Specifically, for each period we compute the fraction of marriages in which the two spouses belong to the same 5-year age group, and the fraction of marriages in which the two spouses belong to the same schooling group (among the 4 defined in the previous subsection). Figure 11 does not reveal striking differences in assortative matching by age. In contrast 12 strongly suggest a sizeable increase in assortative matching on schooling after the law. The fraction of couples with matched schooling levels was around 55% both for marriages celebrated before 2002 and for marriages celebrated between 2002 and 2004. That fraction jumped to 62% after the reform for new 2004-2006 marriages, and remained at that level in 2006-2009. Comparing all pre-reform marriages with post-reform marriages yields a statistically significant difference of 6.5 percentage points in schooling-assorted couples (55.9% vs. 62.4%).

## 6 Estimation methodology

Model parameters are estimated by the Method of Simulated Moments (MSM). Our estimation approach uses information from the 2002 and 2004 survey to construct the following moments:

1. Marital transitions by 5-year age group cells
2. Marital transitions by schooling group cells
3. Fraction of newly married individuals whose spouse is the same 5-year age group, conditional on own schooling
4. Fraction of newly married individuals whose spouse is the same schooling group, conditional on own schooling

The estimated parameter values are reported in table 3. We next describe how standard errors are obtained. Denote by $x_i^m$ an outcome measure of individual $i$, $i \in 1..N$, pertaining to the $m$th moment, $m = 1..M$. The Method of Simulated Moments estimator that we use is defined as:

$$\hat{\Theta}_N = \arg\max_{\Theta \in \Theta} \left[ \frac{1}{N} \sum_{i=1}^{n} \left[ x_i^m D_i^m \frac{N}{N^m} - \left( \frac{1}{R} \sum_{r=1}^{R} \sum_{k=1}^{K} \hat{x}_{irk}^m(\Theta) \hat{D}_{irk}^m(\Theta) \frac{N}{N^m} Pr(k|\Omega) \right) \right] \right]'_{1\times M} W_N^{-1}$$
$$\left[ \frac{1}{N} \sum_{i=1}^{n} \left[ x_i^m D_i^m \frac{N}{N^m} - \left( \frac{1}{R} \sum_{r=1}^{R} \sum_{k=1}^{K} \hat{x}_{irk}^m(\Theta) \hat{D}_{irk}^m(\Theta) \frac{N}{N^m} Pr(k|\Omega) \right) \right] \right]'_{M\times 1}$$

where $D_i^m$ is an indicator for whether observation $i$ is included in calculating moment condition $m$, $\hat{D}_{irk}^m$ is an indicator for whether the observation is included in moment $m$ under simulation $r$

when the individual is type $k$, and $N^m = \sum_{i=1}^{n} D_i$. The sum over $k$ integrates over the unobserved types. For example, suppose the moment pertains to the wages of males in some age range who are working. In that case, $D_i^m = 1$ for males in a given age range who are working. $\hat{D}_{irk}^m = 1$ for males in that age range who are simulated to be working. The weighting matrix $W_N$ is the identity matrix.[9] Integrating over the unobservables, $k$, and assuming that $R \to \infty$ so that the simulation error goes to zero and the term in parentheses converges (uniformly in $\Theta$) to the limit, we get

$$\mu_i^m(\Theta) = E(\hat{x}_{irk}(\Theta)^m | \hat{D}_i^m(\Theta) = 1) Pr(\hat{D}_i^m(\Theta) = 1) \frac{N}{N^m}. \tag{12}$$

Defining

$$\mu_i^m = x_i^m D_i^m \frac{N}{N^m}, \tag{13}$$

we can rewrite the objective function as:

$$\hat{\Theta}_N = \arg\max_{\Theta \in \Theta} \left[ \frac{1}{N} \sum_{i=1}^{n} \mu_i^m - \mu_i^m(\Theta) \right]'_{1 \times M} W_N^{-1} \left[ \frac{1}{N} \sum_{i=1}^{n} \mu_i^m - \mu_i^m(\Theta) \right]_{M \times 1}$$

Taking first order conditions with respect to $\Theta$ yields [10] :

$$\left[ \frac{1}{N} \sum_{i \in S} \frac{\delta \mu_i^m}{\delta \Theta} |_{\hat{\Theta}_N} \right]' W_N^{-1} \left[ \frac{1}{N} \sum_{i \in S} (\mu_i^m - \mu_i^m(\hat{\Theta}_N)) \right] = 0 \tag{14}$$

A Taylor expansion of $\mu_i^m(\hat{\Theta}_N)$ around the true parameter vector $\Theta_0$ yields:

$$\mu_i^m(\hat{\Theta_N}) = \mu_i^m(\Theta_0) + \frac{\delta \mu_i^m}{\delta \Theta} |_{\Theta^*} \cdot (\hat{\Theta}_N - \Theta_0) \tag{15}$$

for some $\Theta^*$ between $\hat{\Theta}_N$ and $\Theta_0$.

[9] We do not use the optimal weighting matrix (the inverse of the variance of the moments), because of difficulties in inverting the matrix during the course of the optimization. However, the efficiency cost of not using the optimal weighting matrix is probably not that great. Altonji and Segal (1996) provide Monte-Carlo evidence of small-sample bias when the optimal weighting matrix is used.

[10] If the number of simulations $R \to \infty$, then the limiting objective is differentiable despite the original objective function not being differentiable.

We obtain after rearranging:

$$\sqrt{N}(\hat{\Theta}_N - \Theta_0) = \left[\left[\frac{1}{N}\sum_{i\in S}\frac{\delta\mu_i^m}{\delta\Theta}|_{\hat{\Theta}_N}\right]' W_N^{-1}\left[\frac{1}{N}\sum_{i\in S}\frac{\delta\mu_i^m}{\delta\Theta}|_{\hat{\Theta}^*}\right]\right]^{-1}$$
$$\times\left[\frac{1}{N}\sum_{i\in S}\frac{\delta\mu_i^m}{\delta\Theta}|_{\hat{\Theta}_N}\right]' W_N^{-1}\left[\frac{1}{\sqrt{N}}\sum_{i\in S}(\mu_i^m - \mu^m(\Theta_0))\right].$$

Following Hansen (1981), we can obtain the estimator's asymptotic variance-covariance matrix as:

$$Asy.Var(\hat{\Theta}_N) = \left(D_0'W_0^{-1}D_0\right)^{-1} D_0'W_0^{-1}V_0W_0^{-1}\left(D_0'W_0^{-1}D_0\right)^{-1\prime},$$

where $D_0 = E\left[\frac{\delta\mu^m}{\delta\Theta}|_{\Theta_0}\right]$, $V_0 = E\left([\mu_i^m - \mu_i^m(\Theta_0)]\left[\mu_j^m - \mu_j^m(\Theta_0)\right]\right)'$.

In computing the standard errors, $D_0$ is estimated using numerical derivatives of the model's moments at the estimated vector of parameters, $V_0$ is approximated by the sample variance-covariance of $\left[\tilde{x}_j^m - \tilde{\mu}_j^m(\Theta_0)\right]$. The standard errors are corrected for the variance resulting from replacing the true model-implied moments by simulated moments.

## 7 Parameter estimates

We estimate parameters that determine the utility of marriage $\alpha_M$ and the utility of separation $\alpha_X$ (including terminal values) as well as the persistence of and volatility of $\theta$: $\rho_\theta$ and $\sigma_\theta$ (table 3). The utility of being unmarried is normalized to 0 (equivalently, we subtract the coefficients in the utility function of unmarried men and women from the common utility of marriage) as well as the transition costs $\kappa_{SM}$ and $\kappa_{MX}$. Since the estimation sample is pre-reform, we fix the costs of divorce $\kappa_{XS}$ to a very high value. The discount factor: $\beta$ is also kept fixed at 0.95.

## 8 Model fit

The fit of the model is illustrated in figure 13 through 17. The age profile of marriage rates is well approximated, as can be seen in figure 13. In particular the model captures the fact that marriage rates drop very quickly for women and much more slowly for men, resulting in a convex and concave age profiles for women and men respectively (figures 14, 15). The marriage rate of men early in life is underestimated however, which also explains the slightly flatter overall age profile predicted by the model. As shown in figure 16, the separation rate fits closely except at ages 25-30 where the model underestimates it somewhat. The levels of assortative matching predicted by the model fit the data very well, both in the age and the schooling dimension (figure 17).

## 9 Out-of-sample predictions of the effects of divorce legalization

We now evaluate the out-of-sample predictions of the model for the effects of divorce legalization. Specifically, we want to assess whether the model accurately predicts the three statistically significant patterns in the data documented in the descriptive statistic section. These were the increase in marriage rates, the increase in separation rates, and the increase in assortative matching on schooling.

The model accommodates the main legal feature of the Chilean law: namely, mutual consent divorce is allowed after 1 year of separation, but unilateral divorce is only possible after at least 3 years of separation. Obviously, the actual (monetary and psychic) cost of divorce could not be estimated using the pre-reform data, so we show the predictions of the model for different divorce costs. This allows us to determine whether there exists a value of the cost of divorce such that the model offers predictions are qualitatively and quantitatively consistent with the data. [11]

Figures 18 to 20 illustrate the results of this exercise by contrasting the pre- and post-reform data moments with their model equivalent for different divorce costs. As can be seen in figure 18, the model predicts that divorce legalization will increase marriage rates. A cost of 0 would imply a very counterfactual post-reform marriage rate of 21%, whereas a cost of 100 translates into a 3.5% marriage rate. In order to generate an increase that is quantitatively consistent with the data, the cost of divorce must be around 50. Separation rates are also accurately predicted to rise for all divorce costs. Again, a divorce cost around 50 appears to generate the most accurate prediction.

Lastly, the model generates a non-monotonic effect of the reform on assortative matching on schooling: it increases (compared to the no-divorce baseline) for divorce costs up to 50, and decreases thereafter. The best out-of-sample fit would be obtained with a divorce cost between 50 and 75.

To conclude, the model, estimated with pre-reform data only, is capable of generating the patterns observed in the data post-reform. Remarkable, for a divorce cost between 50 and 75, the

[11] This exercise is roughly equivalent to re-estimating the model on the post-reform data, allowing only the cost of divorce to change from the estimates obtained with pre-reform data. Given the high degree of overidentification of such a procedure, it also serves as a form of out-of-sample validation exercise.

model can accurately account for all the dimensions of the data simultaneously, which we interpret as a strong validation of the theory.

## 10 Welfare effects of divorce legalization

In this section, we compute the change in welfare associated to different scenarios of the divorce cost. In our simple model, there is no consumption nor income: thus, standard welfare computations which rely on those variables to make welfare comparisons across economic environments in a consistent way are not available to us. Moreover, given our general characterization of preferences across individuals and marital states (with reduced form parameters in a linear setup) it's not clear that we can even compare value functions across different steady states or even across individuals.

In what follows, we use the fact that the "marital bliss" process is a common factor for everyone in the economy, no matter gender, education (exogenous individual states) nor marital status (endogenous state). More specifically, for the baseline economy, we use Equation (8) as the value of being born into this economy. Further, denote $V_S^g(1, x|\kappa, F_\theta^0, F_\theta)$ the value of a single agent[12] of gender $g$, age 1 and education $x$ who enters a marriage market where divorce costs are given by $\kappa$ and the marital bliss process evolves according to $F_\theta^0$ and $F_\theta$. Thus, when comparing steady states, we will have in general that

$$V_S^g(1, x|\kappa, F_\theta^0, F_\theta) \neq V_S^g(1, x|\kappa', F_\theta^0, F_\theta)$$

since both sides of the equation denote values of being in different steady states. However, we can solve for the following equation for $\widetilde{F}_\theta$

$$V_S^g(1, x|\kappa, F_\theta^0, F_\theta) = V_S^g(1, x|\kappa', F_\theta^0, \widetilde{F}_\theta)$$

where $\widetilde{F}_\theta$ is some process which might equate the individual values of being born in different steady states. This is the same idea as the consumption equivalent increase calculation which is usually performed in macroeconomic models.

Below, we compute an additive shifter $\gamma$, such that if $\theta \sim F_\theta$ and $\theta' \sim \widetilde{F}_\theta$, then $\theta' = \theta + \gamma$. Our benchmark scenario is the economy without divorce, and we compare to the cases with several

[12] We assume all agents enter the economy as singles.

different divorce costs. The sign of $\gamma$ determines whether agents are worse or better off: when $\gamma$ is positive, agents need to be compensated to achieve the same level of utility as in the benchmark, so they are worse off in the new steady state. The opposite is true when $\gamma$ is negative.

Table 4 shows the results from the exercise, for three values of the divorce cost $\kappa = \{0, 50, 100\}$. A striking result we observe is that the effect of the divorce cost on welfare is not monotonic. This is the case for males with the lowest educational level and for all females.

## 11 Mutual consent vs. Unilateral divorce

The 2004 divorce law in Chile requires one year of separation for a mutual consent divorce, and 3 years of separation for a unilateral divorce. In this section we simulate the effect of alternative specifications for the divorce law, varying the requirements for both types of divorces.

[IN PROGRESS]

## 12 Conclusion

This paper examines who benefits or looses from the option of exiting a marriage and remarrying. Using longitudinal survey data, we first document the effects of the reform on couples formation and separation. We then use this variation in the data to structurally estimate and validate a dynamic equilibrium model of marriage and remarriage over the life cycle and estimate the welfare impacts of legal divorce across genders, schooling levels and ages. We then simulate the effects of mutual consent vs. unilateral divorce and of different separation time requirements on marital decisions and welfare.

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## A Tables and figures

Figure 1: Married women by age

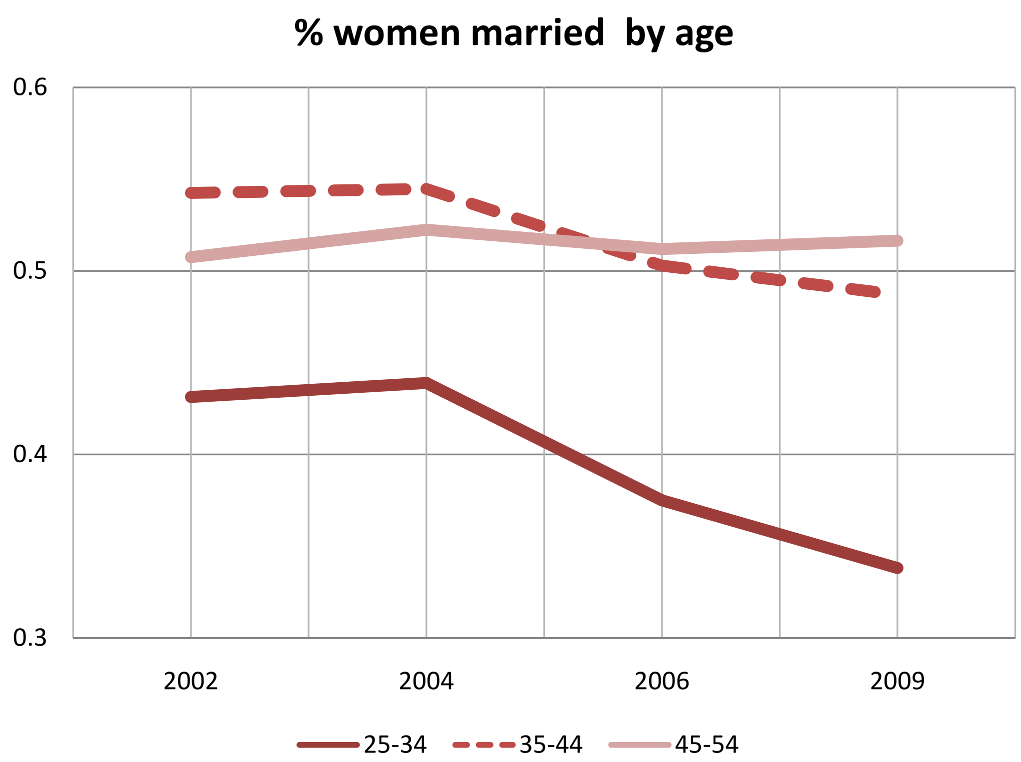

Figure 2: Married women by schooling

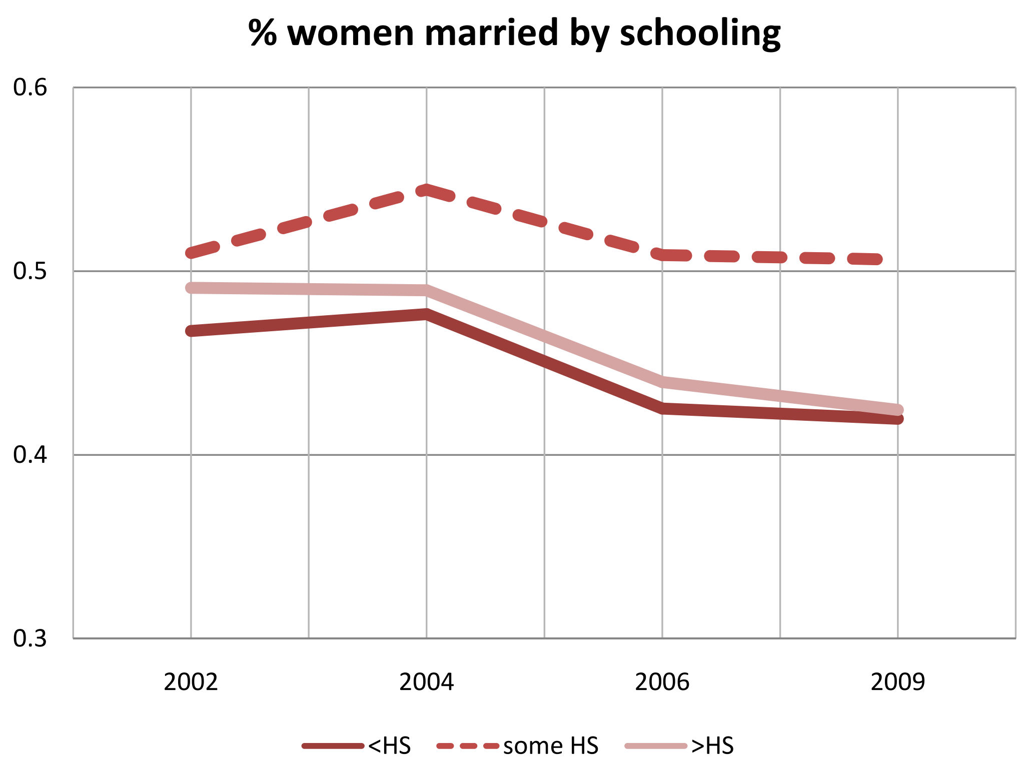

Figure 3: Married men by age

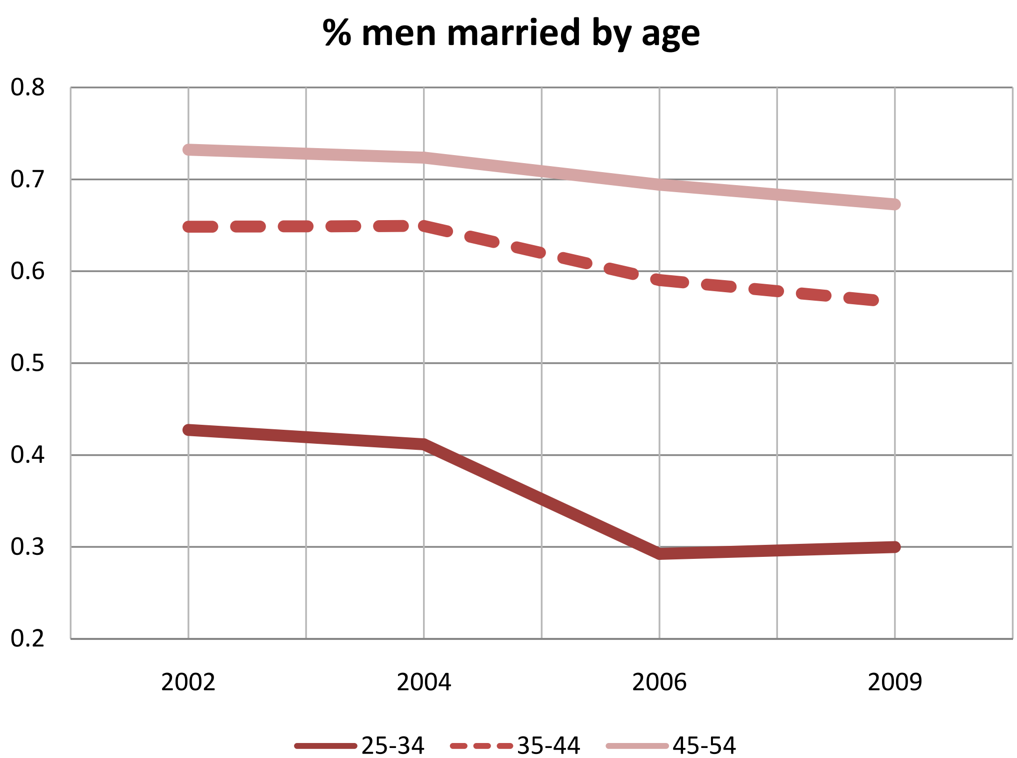

Figure 4: Married men by schooling

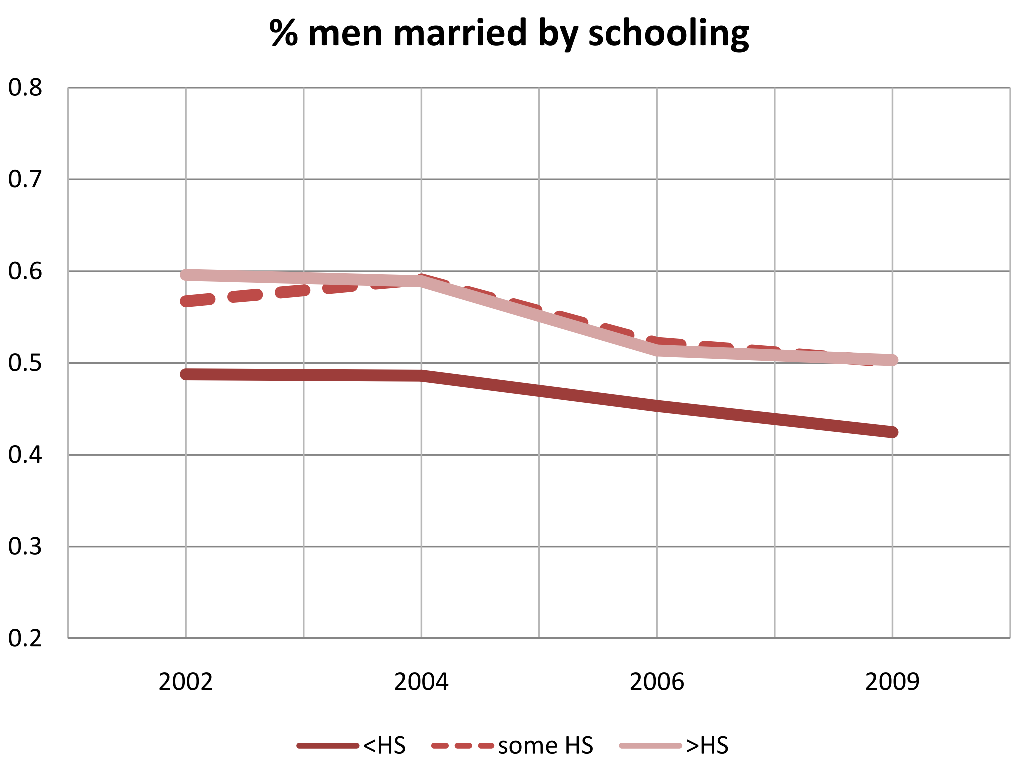

Figure 5: Marriage and separation transitions

Figure 6: Marriage and separation transitions

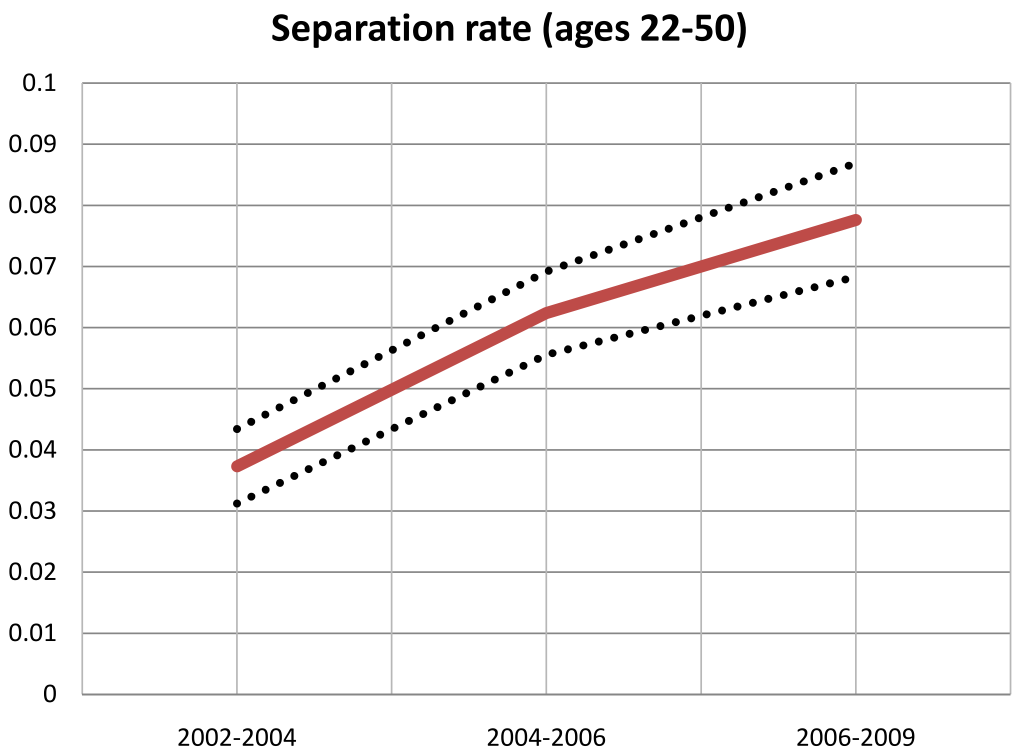

Figure 7: Marriage and separation transitions

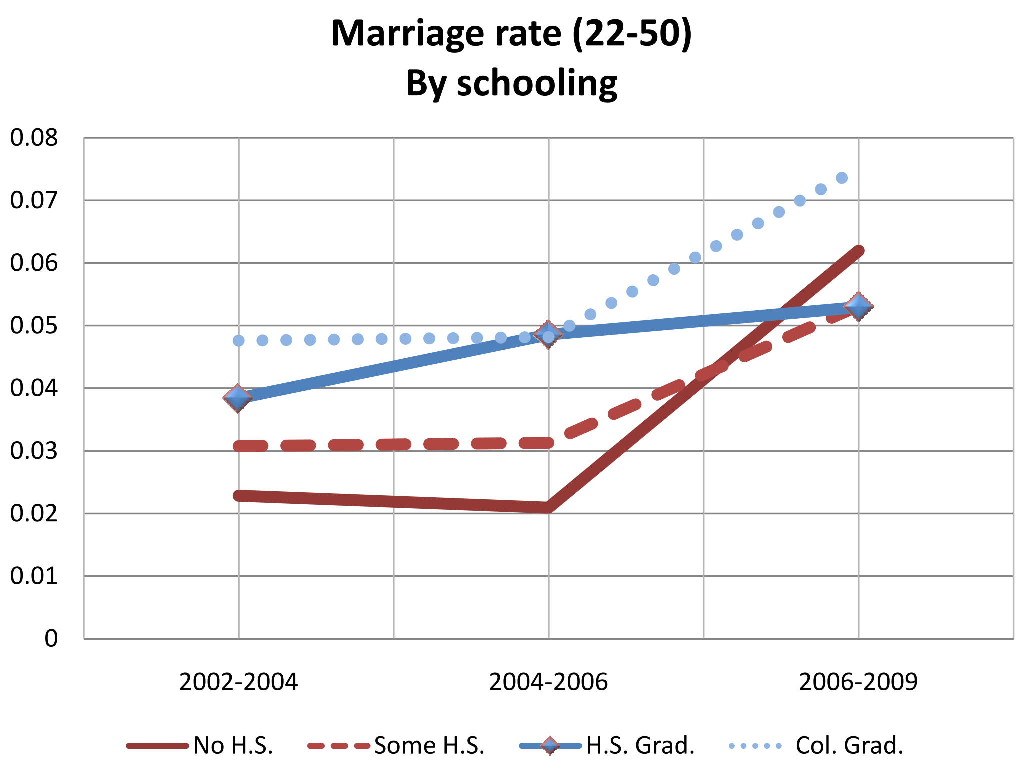

Figure 8: Marriage and separation transitions

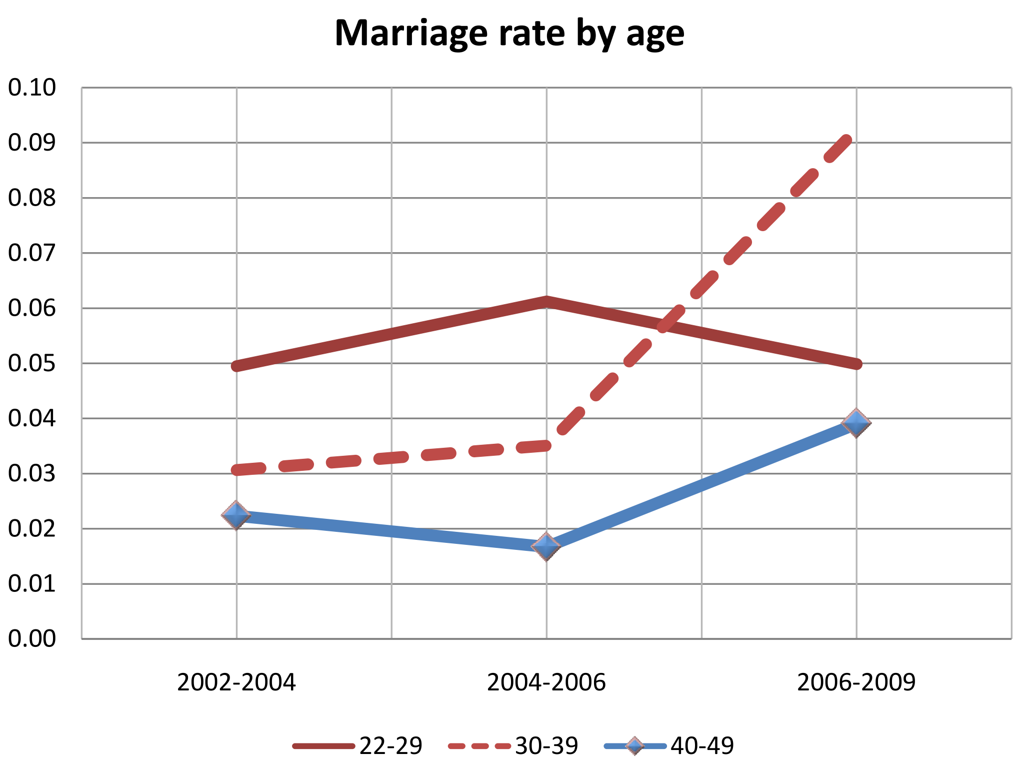

Figure 9: Marriage and separation transitions

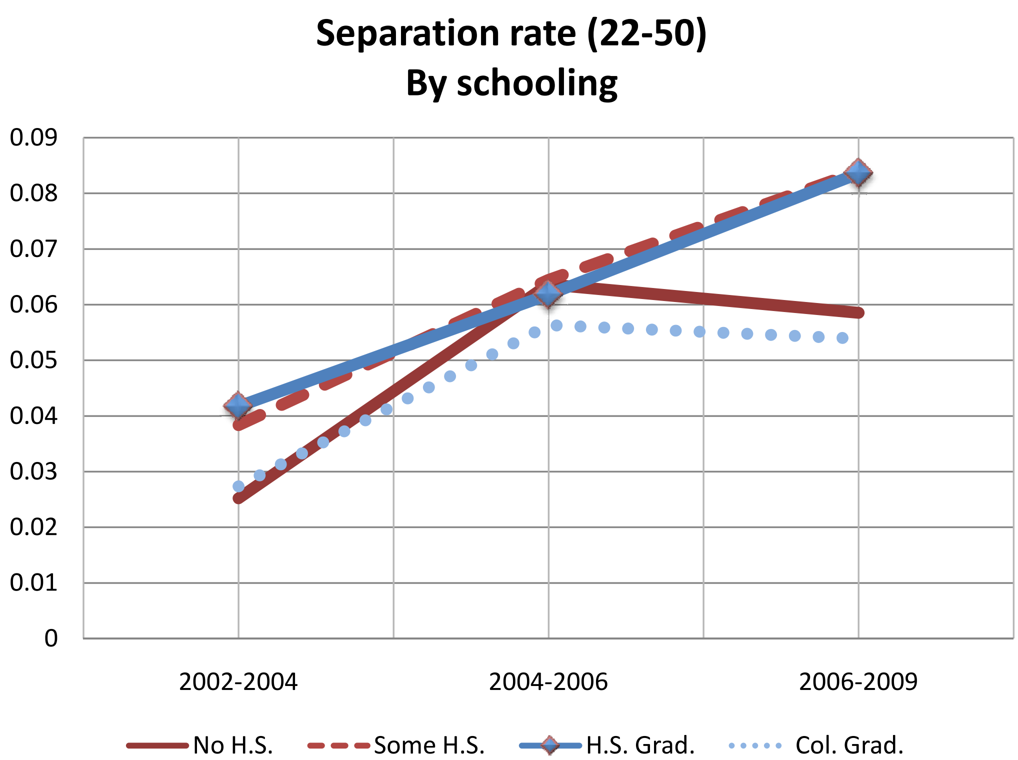

Figure 10: Marriage and separation transitions

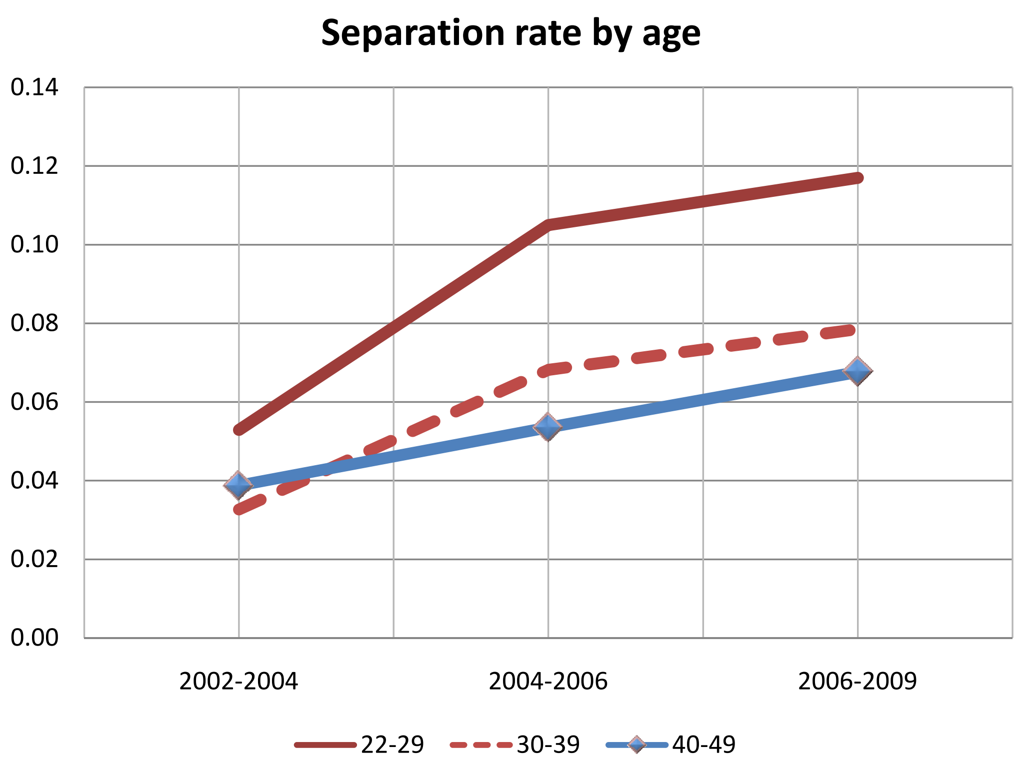

Figure 11: Assortative matching: age

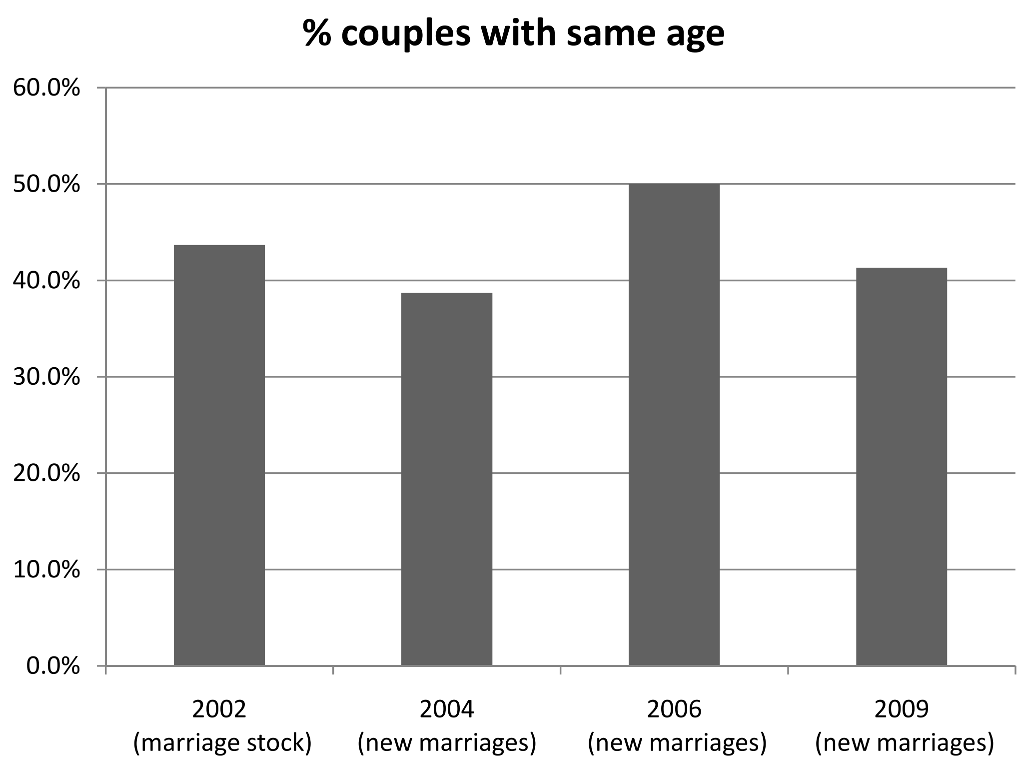

Figure 12: Assortative matching: schooling

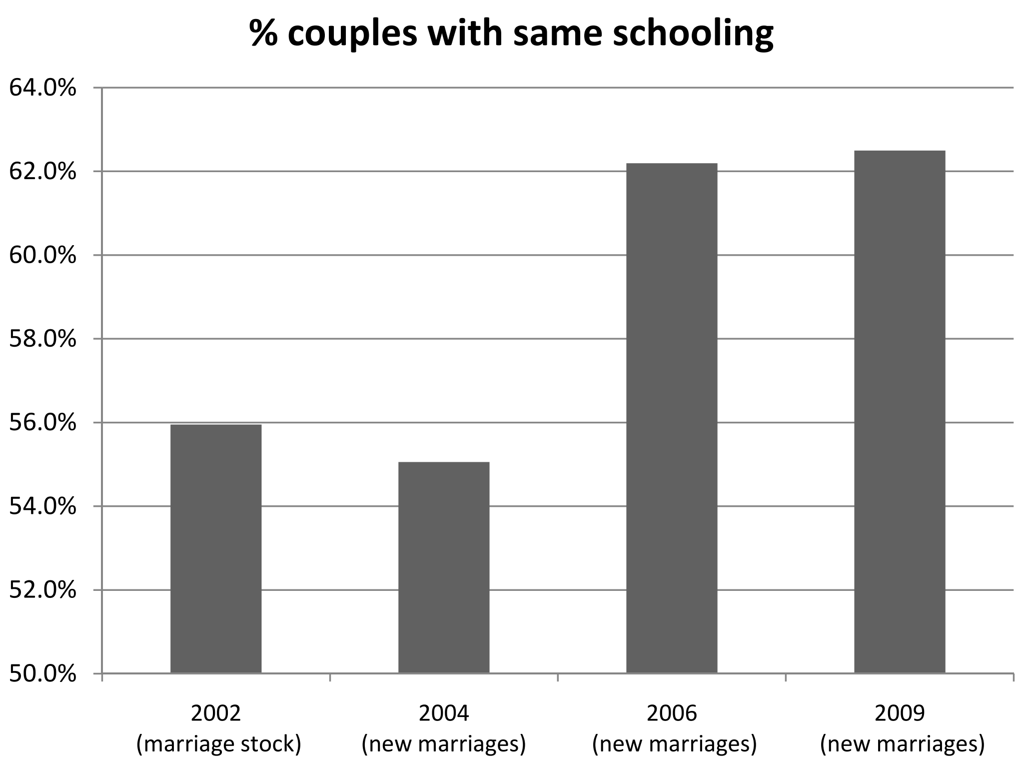

Table 3: Parameter estimates

| Parameter | Value | Parameter | Value | |
|---|---|---|---|---|
| $\alpha_{M,0}$ | 1.14E+01 | $\kappa^m_{XS}$ | 1.00E+06 | * |
| $\alpha_{M,a}$ | -6.00E-03 | $\kappa^f_{XS}$ | 1.00E+06 | * |
| $\alpha_{M,a^+}$ | -2.91E-01 | $\rho_\theta$ | 9.25E-01 | |
| $\alpha_{M,x}$ | -2.80E+00 | $\sigma_\theta$ | 2.00E+00 | |
| $\alpha_{M,x^+}$ | -2.53E-00 | $\alpha^m_{T,M,0}$ | -2.51E+00 | |
| $\alpha_{M,d}$ | 1.63E-01 | $\alpha^m_{T,M,x}$ | 2.50E-01 | |
| $\alpha_{M,aa^+}$ | 7.00E-04 | $\alpha^m_{T,M,x^+}$ | 2.98E+00 | |
| $\alpha_{M,xx^+}$ | 9.80E-01 | $\alpha^m_{T,X,0}$ | -1.02E+01 | |
| $\alpha^m_{X,0}$ | -2.00E+00 | $\alpha^m_{T,X,x}$ | -3.98E+01 | |
| $\alpha^m_{X,a}$ | -6.98E-03 | $\alpha^f_{T,M,0}$ | -1.32E+01 | |
| $\alpha^m_{X,x}$ | 1.50E-00 | $\alpha^f_{T,M,x}$ | -3.37E+00 | |
| $\alpha^f_{X,0}$ | -7.40E+00 | $\alpha^f_{T,M,x^+}$ | 8.61E-01 | |
| $\alpha^f_{X,a}$ | 1.95E-03 | $\alpha^f_{T,X,0}$ | -8.91E+00 | |
| $\alpha^f_{X,x}$ | 2.10E-01 | $\alpha^f_{T,X,x}$ | -1.95E+01 | |

* divorce is illegal in the estimation sample so the cost of divorce is fixed at a prohibitively high value

Table 4: Welfare comparison

| | Divorce cost ($\kappa$) | | |
|---|---|---|---|
| | 100 | 25 | 0 |
| Male <HS | -19.8117 | -19.4482 | -25.7881 |
| Male HS | -14.0446 | -14.1326 | -20.0069 |
| Male some College | -5.5471 | -7.505 | -13.1442 |
| Male College | 3.2781 | 1.9383 | -3.4839 |
| Female <HS | -18.3741 | -18.6539 | -27.2013 |
| Female HS | -21.2951 | -20.8763 | -29.5001 |
| Female some College | -21.2154 | -20.5847 | -31.7024 |
| Female College | -22.2676 | -23.9671 | -34.6363 |

The table presents the amount of added *marital bliss* ($\gamma$, see main text) that agents of both genders and different education levels must receive when in the economy denoted by the specific divorce cost $\kappa$, in order to achieve the same life-cycle value as when living in the benchmark economy (no divorce).

Figure 13: Model fit: Marriage rate by age

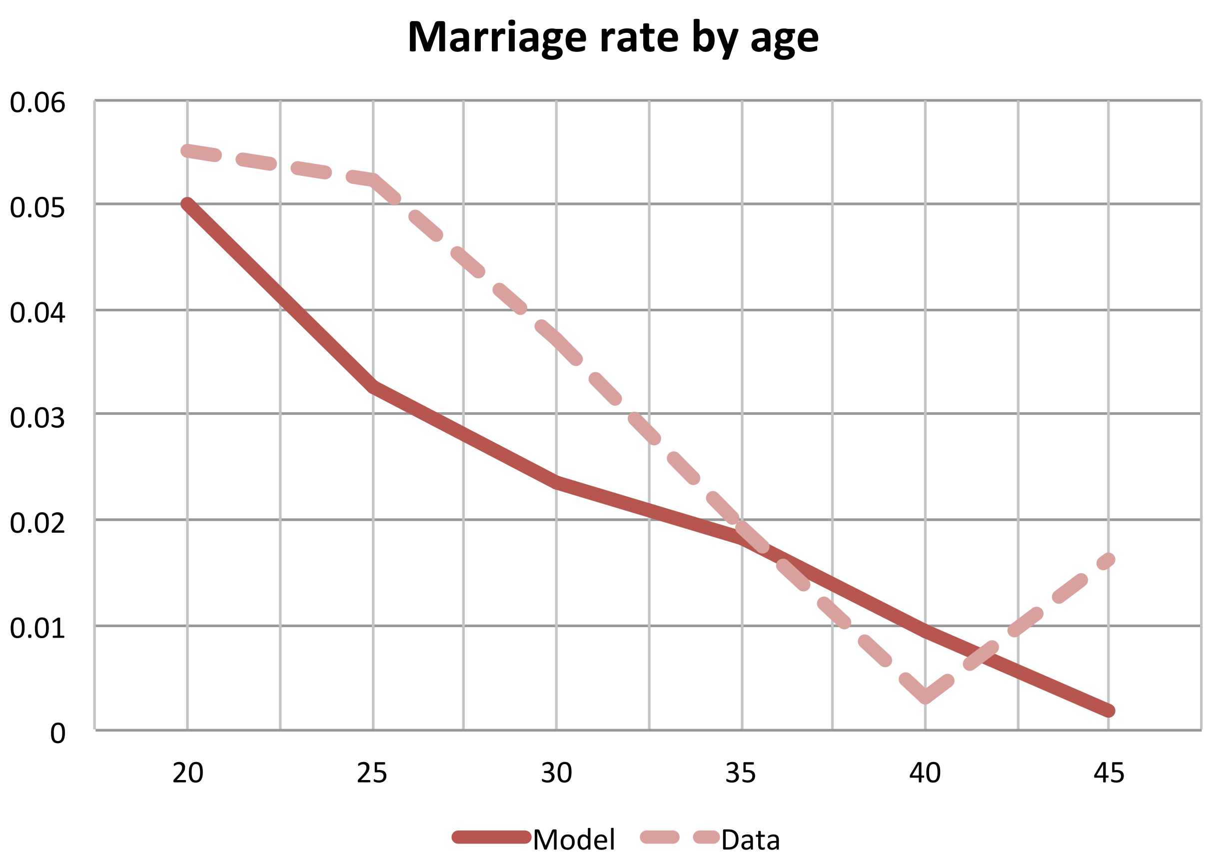

Figure 14: Model fit: Marriage rate of women

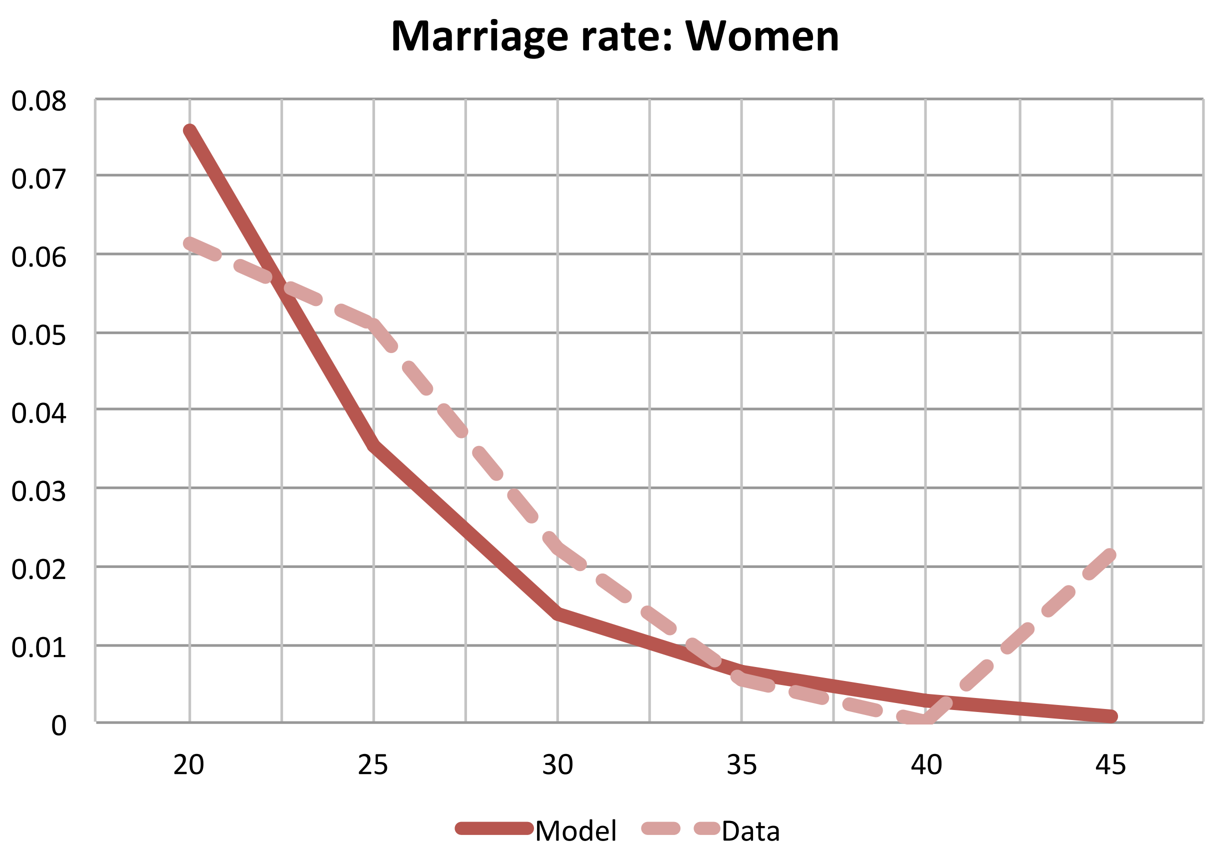

Figure 15: Model fit: Marriage rate of men

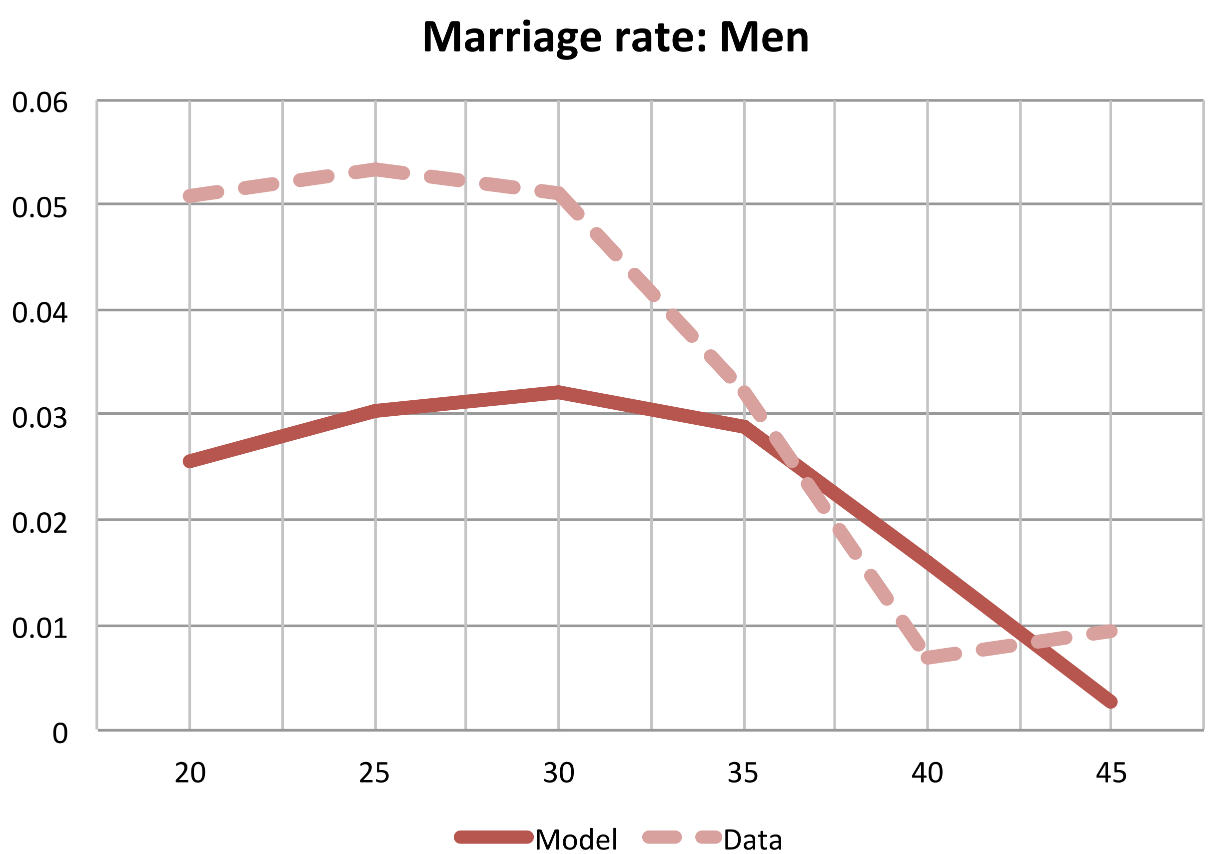

Figure 16: Model fit: Separation rate by age

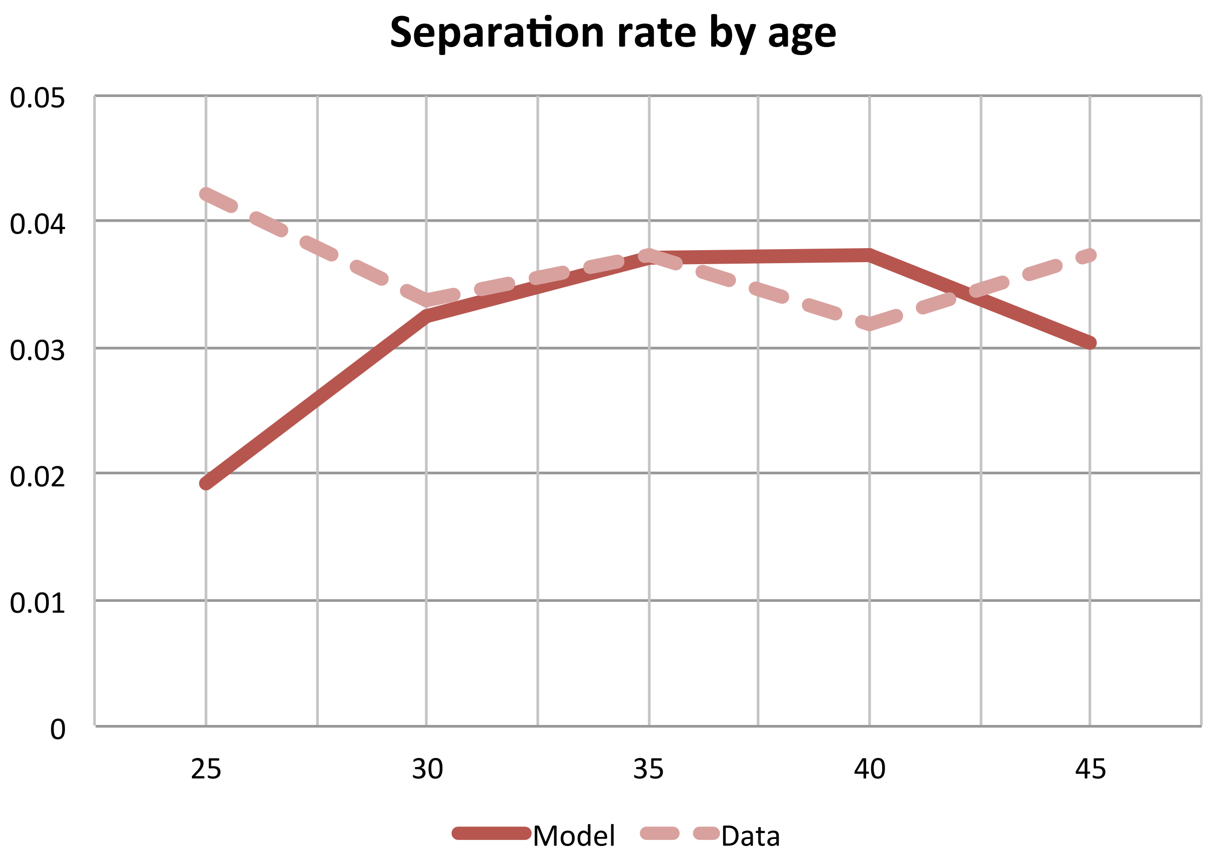

Figure 17: Model fit: Assortative matching

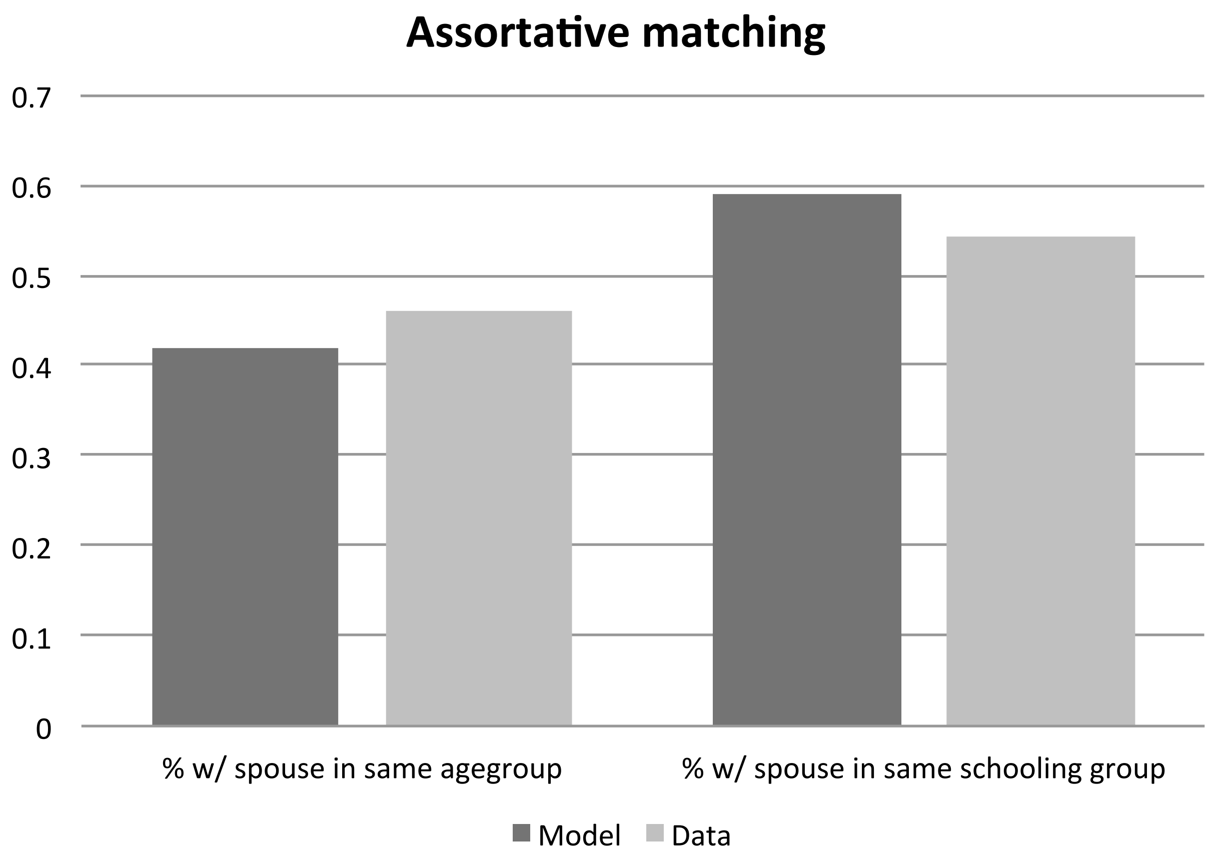

Figure 18: Effects of divorce legalization on marriage rates: data vs. model

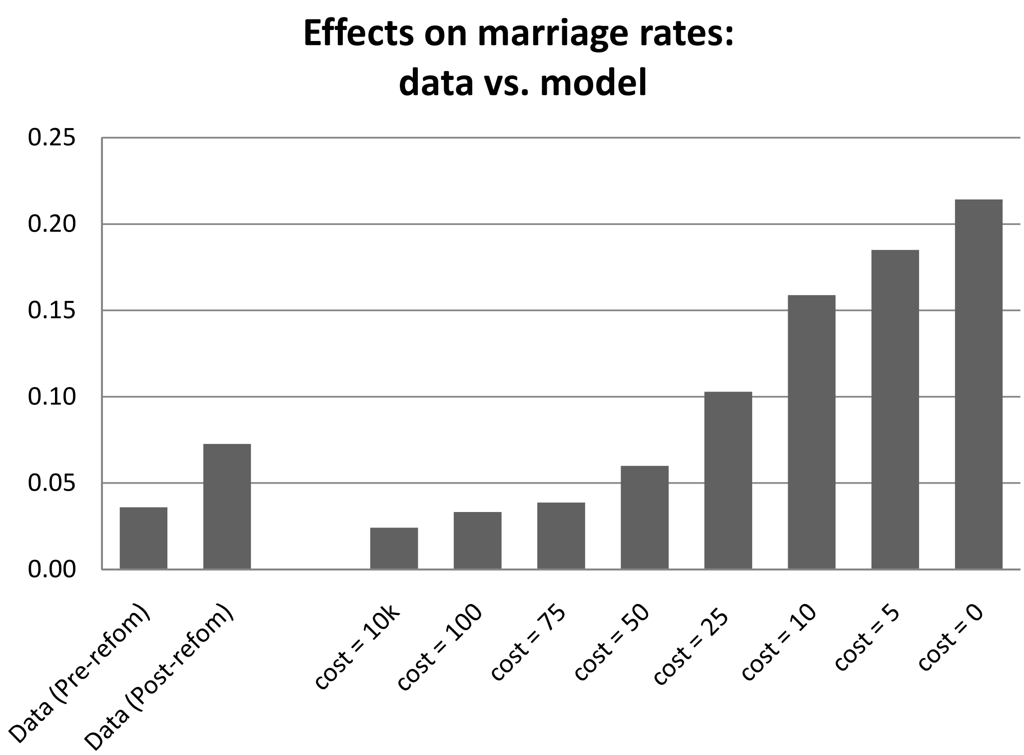

Figure 19: Effects of divorce legalization on separation rates: data vs. model

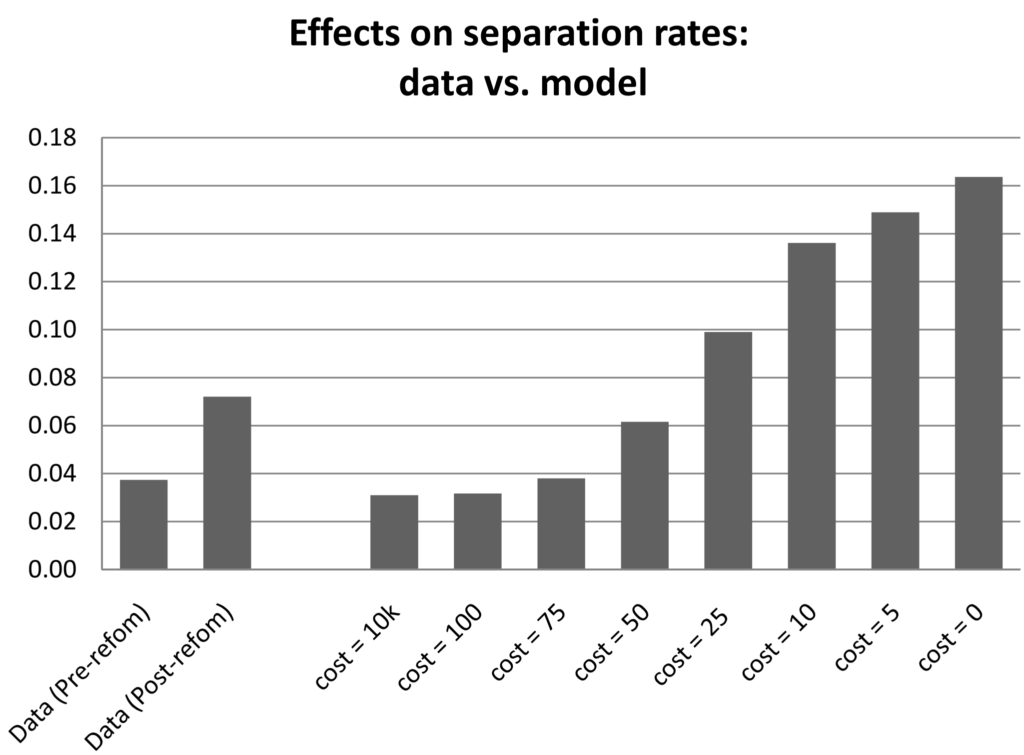

Figure 20: Effects of divorce legalization on assortative matching on schooling: data vs. model