Emancipation Through Education

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July 10, 2012

PRELIMINARY AND INCOMPLETE

Abstract

This paper investigates the role of education in the evolution of women's role in the society—specifically, in the labor market and in the marriage market. In particular, it aims to understand the linkages between a set of socio-economic trends since the 1950s, which include (i) the falling marriage rate and the rising divorce rate, (ii) the rising educational attainment of women, which now exceeds that of men's, (iii) the rising average earnings of women relative to men (i.e., the shrinking gender wage gap), and (iv) the substantial rise in the labor force participation (and labor supply) of married women. We build an equilibrium model with education, marriage/divorce, and labor supply decisions in which these different trends are intimately related to each other. We focus on education because divorce laws typically allow spouses to keep a much larger fraction of the returns from their human capital upon divorce compared to their physical assets, making education a good insurance against divorce risk. In turn, as women get better education, the earnings gap between spouses shrinks, which in our framework leads to less marriages. The framework generates a number of powerful amplification mechanisms, which lead to large rises in divorce rates and college enrollment of women and a fall in marriage rates from relatively modest exogenous driving forces. The model is also consistent with women's college attainment overtaking men's during this time, which has previously proved difficult to explain. Overall, we find that the interaction of the marriage/divorce decision with education choice is important for understanding the evolution of both sets of trends.

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1 Introduction [Incomplete]

This paper investigates the role of education in the evolution of women's role in the society—specifically, in the labor market and in the marriage market. In particular, it focuses on the following four socio-economic trends observed in the United States since the 1950s:

1. *Marriage/Divorce Rates:* The marriage rate fell by almost half between 1950 and 2000, whereas the divorce rate doubled during the same time (Figure 1).

2. *Educational attainment of women:* The fraction of women with a college degree rose substantially during this time. For example, during the 1950s, for every college-educated woman, there were about two college-educated men. This gap started to close in the mid 1960s and had completely vanished by late 1980s. Today, the gap is reversed with more women graduating from college than men (Figure 2).

3. *Gender wage gap:* The gender wage gap has been shrinking since the 1960s: an average female worker now earns about 80–85 percent of her male counterpart, whereas this ratio used to be about 60 percent in 1960. Although part of this trend is due to changing composition (as more women get educated compared to men, the relative wage of women is bound to rise), the gender wage gap conditional on education has also been closing.

4. *Female labor force participation:* Finally, married women started joining the labor market in droves, causing the average hours worked by this group to increase four-fold since 1950, which far exceeds the change in any other demographic group (e.g., married men, single women, etc).

These trends have potentially profound effects on the society and raise several interesting questions to study. This paper builds an equilibrium model—with education, marriage/divorce and remarriage, and labor supply decisions—in which these different trends are intimately related to each other. The paper uses this framework to explore and quantify the importance of various mechanisms discussed below. The main focus of our analysis is on the interaction of the first two trends mentioned above: the rising educational attainment of women and the falling marriage/rising divorce rates. Our focus on education is motivated by the fact that divorce laws in the United States typically allow spouses to keep a much larger fraction of the returns from their human capital after divorce compared to their physical capital (**?**), making education a good insurance against divorce risk. This is a key aspect of education that we study. Although a number of studies have examined the effects of marital status on various economic outcomes (e.g., savings, wealth accumulation, assortative matching),[1] there is little research that has focused on the feedback between marriage/divorce and education choice and attempted to understand the observed trends within this context. Because the value of education closely depends on how much it increases an individual's wages (depending on one's gender) as well as how much the resulting human capital is utilized in the market, the latter two trends mentioned above—the gender wage gap and labor force participation of women—are also part of our investigation.

The model we study has the following features. Education can (potentially) have three types of benefits for women.[2] First, it provides income and can therefore make educated women more desirable spouses, in turn allowing them to attract better spouses. Second, by providing higher income, it makes being single more tolerable, allowing them to search for a spouse longer. Third, it provides insurance against divorce risk by improving women's outside option during marriage, which depends on income as a divorcee as well as the likelihood of re-marriage. Put differently, educated women are less likely to be "trapped" in a bad marriage, since their continuation utility upon divorce is higher. The model studied here allows for all three channels to be operational.

The utility function for couples features perfect substitutability in home production and perfect complementarity between spouse's leisure times. This structure generates specialization, such that the spouse with a lower wage (more likely to be the wife) does not enter the labor market until the high-wage spouse works full time. Thus, as the gender wage gap closes, married women have more incentive to join the labor force. This effect will be further amplified in the presence of increased divorce risk, which leads women to get more education and hence earn higher wages.

The love that spouses have for each other ("marital bliss") fluctuates over time, which causes each spouse to reevaluate his/her marital options. A spouse would prefer to divorce when his/her opportunities outside of marriage are better than inside the relationship. However, whether or not a divorce actually takes place also depends on the

[1] See, for example, **?**, **?**, and **?** among others.

[2] Although these benefits can apply to both men and women, as will become clear below, they play a more important role for the spouse that has a lower income.

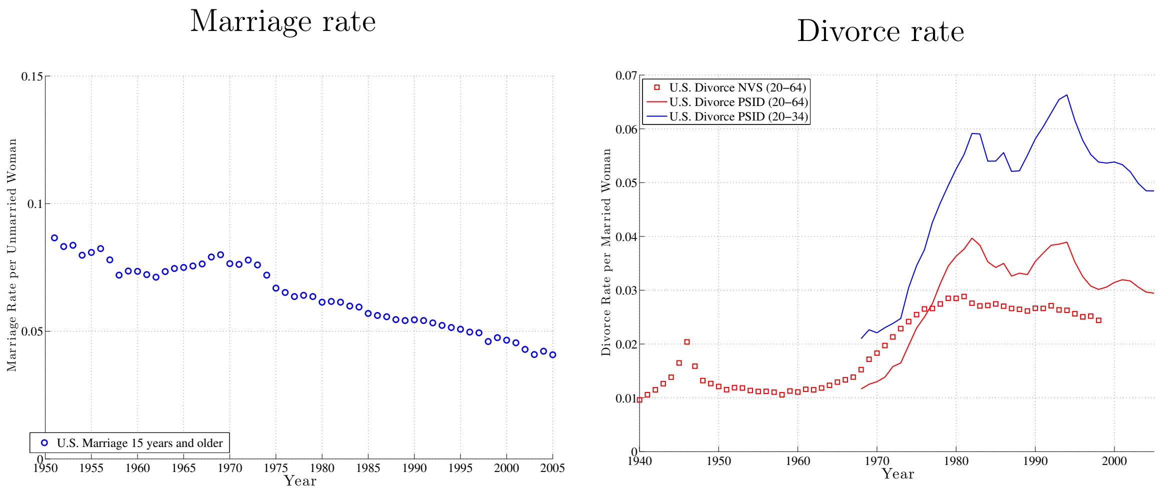


Figure 1: Marriage and Divorce Rates

legal system. Under the "consent" divorce regime, the weaker spouse is protected from involuntary marriage dissolution by requiring both spouses to consent to divorce. In a "unilateral" regime, divorce is granted upon the application of one spouse. Whereas the consent regime was the predominant legal framework in virtually all US states before the 1960s, the 1970s have witnessed a rapid transformation of state laws (what **?** called the "silent revolution"), leading to the current widespread prevalence of unilateral divorce. This change in divorce laws is incorporated into our model. Finally, unlike a single individual who meets a potential spouse every period, a new divorcee cannot meet with others for a period of time (which is one cost of divorce in this model). We also explore various assumptions regarding how the burden of divorce is split between spouses, depending on who gets the custody of children and on the net payments made between spouses post-divorce.

The driving forces in the model are the changes in relative wages by gender and education level,[3] and the change in the divorce laws described above. We calibrate the model to targets in 2005 and examine its behavior from 1950 to 2005. The model generates a number of patterns consistent with empirical trends observed in the United

[3]Specifically, in the model, individuals are endowed with two factors of production—human capital (brain) and raw labor (brawn). A combination of these two labor inputs determines the wage rate an individual can earn in the labor market. Men and women have the same amounts of human capital (which can also be thought of as cognitive abilities), but women have less brawn than men. As the returns to brawn fall overtime (due to skill-biased technical change), the gender wage gap closes. We also allow for wage dispersion within each gender, so the statements about the gender wage gap are about the averages of each distribution.

States (Table III). For example, the divorce rate rises very slowly in the 1950s and 1960s, then surges during the 1970s, and then reverts back—but only mildly—after the 1980s, the marriage rate also falls throughout the period, albeit less than in the data. The latter decline in the divorce rate is due to the better matching of spouses in "new" marriages under the unilateral regime (i.e., selection effect). Furthermore, the stability of marriages, measured as the fraction of marriages that survive to the 15th anniversary, falls substantially as in the data. Second, the model generates the crossing-over of educational attainment between men and women observed in the data. The model reproduces not only the magnitude of the education gap, but also the timing of the reversal. Third, and finally, the model generates little change for labor supply of single agents and a large rise for married women—all consistent with the data. However, (in the current calibration) the model predicts a large fall in the labor supply of married men, which is not borne out in the data. This last point remains a challenge for the model given the strict assumptions on time substitution between spouses.

We conduct counterfactual experiments to gauge the importance of various driving forces in the model. Most notably, when the change in divorce laws from consent to unilateral is eliminated, the model generates much weaker trends for some key variables. First, and perhaps not too surprisingly, the changes in marriage and divorce trends are substantially weakened—the divorce rate barely changes and the stability of marriages remains the same. However, individuals still marry a bit later over time, so the marriage rate falls, although substantially less than in the baseline model. More importantly perhaps, both men and women get significantly less education than before and the cross-over never happens. That is, men have higher college attainment than women from 1950 to 2005. The labor force participation rate for married women is also lower than the baseline model (by about 2.5 percentage points). Overall, this analysis suggests that the change in divorce laws had an important effect on educational attainment and labor supply—especially for women—during this time. Similarly, a counterfactual related to the marriage market expectation, i.e., keeping the relative probabilities of meeting an educated individual relative to an uneducated individual fixed, leads to a large drop in educational attainment and a reversal of the crossing. The knowledge that a woman is more likely to meet a "better" (higher earning) spouse is an important driver in the relative rise of women's college graduation rates, especially for the 1990s and onward. Combining the two counterfactuals leads to an even larger drop in educational attainment.

1.1 Related Literature

In explaining the reversal in the education gap, previous research has focused on the higher returns to education for married women. For example, in **?** the gender ratio in the marriage market is tipped toward women, who end up competing for men in the marriage market. Consequently, even though women receive lower returns to education in the labor market, they invest more in education as it gives them a competitive edge when searching for better spouses. **?** argue that the smaller gender wage gap for higher education levels, combined with the fall in household labor hours, can explain women's higher educational attainment. **?** develop a model to account for the gender education gap prior to the 1970s, in which the key feature is that women are more expensive to educate (because of the opportunity cost of lost home production when they are young). Finally, **?**study the effects of increasing divorce probability on male-female education rates. The paper in topic most closely matches this study, nonetheless, it abstracts from the endogenous marriage and divorce decisions, one of the central mechanisms in our model.

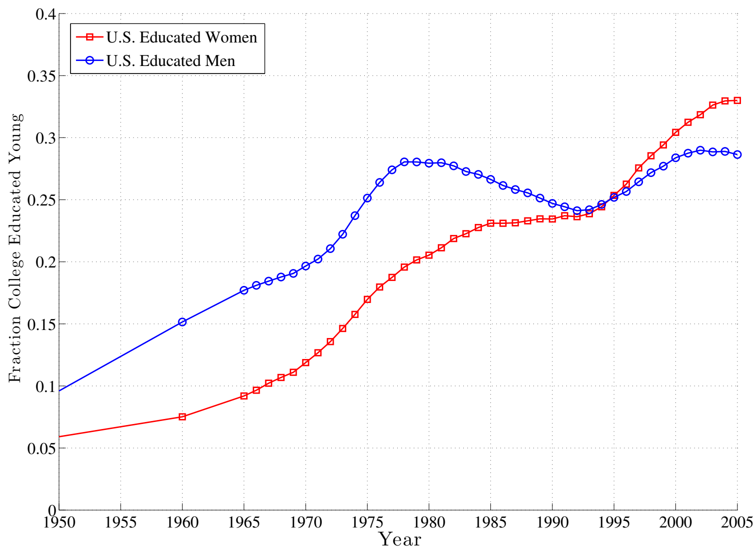
While there exists a literature examining the effects of endogenous marriage decisions on various economic outcomes, i.e. savings, wealth accumulation, assortative matching, two our knowledge there is little research that has focused on the dual-link between marriage, divorce and education. Complimentary in spirit, **?** analyze differences by education type in marriage/divorce and employment rates, allowing for individuals to educate when young. However, rather than focusing on the returns to education in marriage with the declining marriage rates, we focus on the effects of divorce risks on educational choices and vice versa.

2 Stylized Facts

The facts on educational attainment, the marriage market, and the labor market central to the discussion are outlined below. All statistics reported in this section are derived from the 1962–2005 Current Population Survey Integrated Public Use Micro-data Samples (IPUMS-CPS), unless otherwise noted.

Educational Attainment. The fraction of the population aged 25 to 29 with at least a college degree started rising in the late 1960s. However, whereas the college attainment of

Figure 2: Fraction of 25–29 Year-Olds With At Least a Four-Year College Degree



women has steadily risen, college attainment of men leveled off in the early 1980s, leading to women overtaking men in educational attainment (see Figure 2). Similarly, according to estimates by **?**, the gap between male and female college enrollment reached a ratio of 2.3 men to 1 woman in 1947. However, starting in the 1960s, the proportion of women enrolling in college has risen continuously compared to men. In 1960, 24 percent of men aged 25 to 30 had some college education, compared to 18 percent of women, implying a ratio of 1.3; in 2000, the corresponding figures were 55 percent and 61 percent, implying a ratio of 0.9; and by the mid-1980s the gender education gap of men and women with at least some college education had disappeared.[4] As previously mentioned, some papers have explained this reversal by appealing to the higher returns women receive from education in the marriage market (e.g., by allowing them to better compete for desirable spouses). However, notice that since the 1970s *increasing* educational attainment has been accompanied with a *declining* marriage rate, which suggests that there are some additional forces at play. Furthermore, as we show below, even today women's wages and labor force participation rates are lower than men's for all education levels, in light of which the reversal of the education gap can be puzzling. Increasing divorce risk is one such force that we investigate in this paper.

[4]Source: 2000 Current Population Survey Integrated Public Use Micro-data Samples (**?**, IPUMS-CPS).

Marriage and Divorce. Data from various *National Vital Statistics Reports* show that the marriage rate declined by nearly half in the the last five decades going from about 90 marriages per 1,000 unmarried women over the age of 15 to only 45 marriages. At the same time the divorce rate nearly doubled, from roughly 10 divorces per 1,000 married women (ages 15 and older) to about 19 (Figure 1). Interestingly, these patterns are not specific to the United States but seem to hold more broadly: **?** find that almost all European countries had divorce rates below 2.5 divorces per 1,000 married people in 1960, including many with less than one. But by 2002, most of Europe experienced five or more divorces per 1,000 married people, implying a doubling of divorce rates. Thus, studying the link between divorce and education is of greater interest, especially starting in the mid-1970s when divorce rates rose drastically, partially due to the introduction of unilateral divorce laws (for a discussion of the effects on the divorce rate in the switch to unilateral divorce laws see, **??**).[5]

College Premium and Gender Wage Gap. During much of the period under study, we observe women's wages "catching up" with men's, even when controlling for education levels. This can be seen in Table I, where the average wage of male workers with some college education in 1950 is normalized to one. The table also reports the implied compounded annual growth rates (CAGR) in wages from 1950 to 2005. Two important points should be noted. First, the rise in the college wage premium is evident, particularly for women with a 0.27 percent higher per year from 1950 to 2005. Nonetheless, growth rates for women with a college education have closed the gender gap slower, with educated women's wages growing annually 0.17 percent faster than educated men's wages compared to a 0.33 percent growth difference for uneducated individuals. Consequently, women overtaking men in educational attainment could be puzzling. This paper shows, that interactions between the marriage market, labor market and education choices are key in accounting for this fact.

Labor Force Participation and Labor Supply. Finally, **?** find that the average weekly market hours of married women aged 35 to 54 rose from less than 10 hours in 1950 to over 25 hours at the end of the 20th century, while it has remained fairly steady for

[5]To insure against the rise in divorce rates, women who foresee a divorce are more likely to enter the labor market. For example, **?** find that a divorce is associated with a 20% rise in the the probability of participating in the labor market within the last three years of marriage.

Table I: Wages and Wage Growth Rates by Gender and Education

Education Group	**1950**	**2005**	**CAGR** (%)
Male with College	1	1.83	1.10
Male with No College	0.70	1.03	0.70
Female with College	0.67	1.34	1.27
Female with No College	0.45	0.79	1.03

both married and single men, as well as for single women. Estimates for the population aged 20-64 confirm these general trends. That is, married women spend roughly 8 percent of there disposable time working in the labor market in 1950, and in 2005 this share had risen to 26 percent.[6] Single women spend 28 percent in 1950 and 30 percent in 2005. In contrast, married men's hours dropped slightly from 41 percent to 40 percent and single men's hours remained constant at 33 percent.

In the following section, we develop a model of educational investment, labor supply, and marriage/divorce decisions that can speak to the facts described here.

3 Model

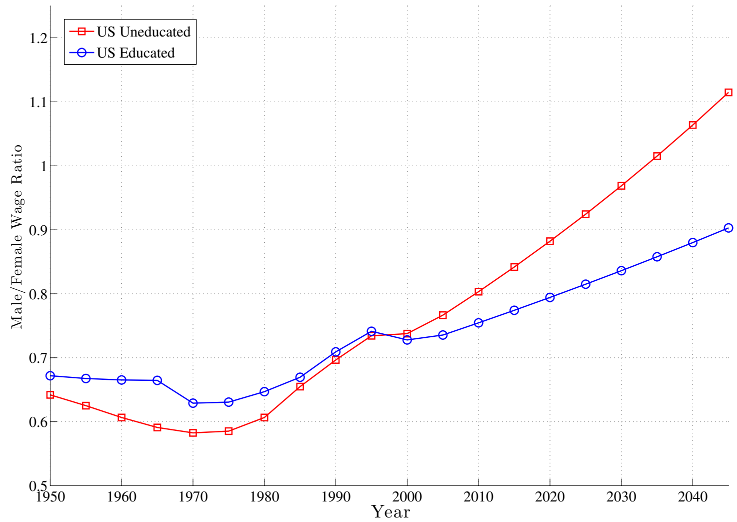
Consider an economy populated with equal numbers of men and women. Individuals live for $T < \infty$ periods and make (i) a one-time education decision when young, (ii) dynamic marriage/divorce decisions every period, and (iii) a static time allocation decision—between market work, home production, and leisure—every period.

3.1 Education decision

Educational attainment and the evolution of the gender wage gap will be central in this framework. To get educated, individuals pay a fixed monetary cost, c_e ("tuition + room/board"), common to everyone as well as fixed utility cost that varies randomly across individuals: $\kappa \sim N(\mu_\kappa, \sigma_\kappa)$. Individuals make their education decision knowing the wage distributions conditional on each education level, but without observing their particular random draw. During college individuals can work at the average uneducated

[6]Discretionary time endowment is assumed to be 100 hours per week (total of 5,200 hours per year).

Figure 3: The Gender Wage Gap By Completed Education



wage rate. After completing their education, agents draw a lifetime "ability" realization from the corresponding, gender and education specific, wage distribution. That is, uneducated individuals draw their ability after making the choice not to go to college, and college graduates do so after graduating. Although the ability does not change over the lifecycle, the wage distributions are allowed to vary by gender and education level, *and* with time. This flexibility allows us to account for the changes in the skill premium, rising inequality, and falling gender wage gap during the period under study.

3.2 Preferences

> Education drew a dividing line for Nancy Vermeer, a 52-year-old resident of Sioux County. She had married her high school sweetheart, a young man from a farming family. He never went further than high school, but she went on to college, and later earned a master's degree. He worked in a window factory. She became a music teacher. He gambled. They grew apart. Eventually, he asked for a divorce. "I grew more confident," Ms. Vermeer said. "We were totally different people."
>
> —The New York Times (March 24, 2011)

After the education choice has been made, individuals enter the economy as singles and meet a prospective spouse (who has either high (or will after graduating) or low education, with the fraction determined in equilibrium), every period until they marry. During marriage, spouses enjoy the company of each other. As such, spouse's leisure times are assumed to be perfect complements: $v(\ell_1, \ell_2) = \min(\ell_1, \ell_2)$.[7] One empirical motivation for this specification is the well-documented fact that on average men and women enjoy very similar amounts of leisure, which is true not only over time but also across education levels. For example, **?**, Table V report that, even though men and women have very different hours of market work and home production (which also varies over time and across education levels), when the two components are added up, they almost add up to the same figures, leaving both genders enjoy slightly more than 100 hours of leisure per week.[8]

Spouses also derive utility from a consumption good, c, which is produced by combining market goods (k) and each spouse's home production time h_i ($= 1 - n_i - \ell_i$, $i = 1, 2$, where n_i is market time) according to the following CES technology:

$$c = \left(\gamma k^\alpha + (1-\gamma)\left(A(h_1 + h_2)\right)^\alpha\right)^{\frac{1}{\alpha}}.$$

Notice that spouses are assumed to be perfectly substitutable in home production, since we view this activity as capturing chores/tasks that either spouse can (arguably) do without the other. This assumption also allows us to generate specialization in market work in a simple fashion: the spouse with a higher wage will work full time before the other spouse joins the labor market. With a positive gender wage gap, this mechanism generates a lower labor force participation rate for women than for men, consistent with the data. While this assumption is not necessary and can be relaxed, it is helpful for accounting for significant non-participation by married women especially in the 1950s. Finally, the estimates of α found in the literature are all consistently less than 1 and greater than zero, so market goods and home production times are gross substitutes in the production function (see **?**, **?**). This is an assumption that we shall maintain in the comparative statics analysis below as well as in the quantitative model.

[7] An alternative interpretation/motivation for this specification is that even if leisure times are not spent jointly, spouses do not enjoy their free time (guilt?) when their partner has little of it. Or as the old maxim goes: You can never be happier than your spouse!

[8] Of course, this does not provide conclusive evidence that spouses within every marriage enjoy the same amount of leisure. Nevertheless, making the assumption of perfect complementarity ensures that our model to generates average leisure times for the two genders consistent with the data (even conditional on education levels).

The home production function for singles (including divorcees) has the same form but adjusts for the lack of a spouse:

$$c = \left(\gamma k^{\alpha} + (1-\gamma)\,(Ah)^{\alpha}\right)^{\frac{1}{\alpha}}.$$

Individuals are assumed to spend their entire income every period, so spending on market goods are given by $k = (w_1 n_1 + w_2 n_2)$ for couples and $k = wn$ for singles.

Loves Me—Loves Me Not. There is a match-specific, time-varying stochastic term, b, that affects the value of the leisure activity. Its initial value (when two singles first meet), b_0, is drawn from a normal distribution whose mean depends on the education of each individual as specified below; its variance is denoted with σ_b^2. During marriage b_t evolves as a random walk process:

$$b_{t+1} = b_t + \eta_{t+1}, \qquad \text{where } \eta_{t+1} \sim N(0, \sigma_\eta^2) \tag{1}$$

Note that in this formulation, the initial draw b_0 has a permanent effect on the value of love during a marriage. The innovations during marriage, η_t, have zero mean and a potentially different variance of σ_η^2. Substantively, the key point to observe is that there is no presumption that b_t will be positive (marital bliss or love); it can also be negative (marital distress). Despite this, in most of the paper, we will refer to b_t euphemistically as love or bliss. In the latter case, spouses suffer from living together but may nevertheless stay married because of the income/home production benefits of marriage. The modeling of love as a term that interacts with a couple's endogenous decisions (here leisure) allows us to capture the fact that couple's can mitigate or amplify the effects of love or hate through their choices. This specification captures the adaptable nature of marriage that makes it more resilient to fluctuations in love. Moreover, it captures the idea, that love is more important the more one cares to consume leisure. Note, that couples could avoid "hate", $b < 0$ in a marriage by reducing leisure to zero. If individuals spend most of their time working, love has little effect on the married household's utility.

Putting The Pieces Together. To summarize, in its most general form the utility of an individual—whether single, married, or divorced—can be written as:

$$U^p(k, h_1, h_2, \ell_1, \ell_2; b, \psi) = \underbrace{\frac{(c(k, n_1, n_2)/\phi)^{1-\sigma}}{1-\sigma}}_{\text{Utility from Home Production}} + \psi_t^p b \underbrace{v(\ell_1, \ell_2)}_{\text{Leisure}}. \tag{2}$$

The parameter ϕ converts total household consumption into per-spouse units. For example, because couples typically have children, the total consumption good c will need to be divided among several household members. The typical assumption that ϕ is smaller than the number of family members implies economies of scale in household consumption (which we will also allow in the calibration).

The utility function for singles can be obtained from (2) by setting $\phi = 1$, $n_2 = 0$, $\ell_1 = \ell_2$, and $b = 1$:

$$U^s(k, h, \ell) = \frac{(\gamma k^\alpha + (1-\gamma)(Ah)^\alpha)^{\frac{1-\sigma}{\alpha}}}{1-\sigma} + \psi_t^s \ell.$$

The utility function of divorcees is the same for singles, with the exception that in some formulations we will allow for $\phi^d > 1$ to account for the possibility of childcare and post-divorce expenses. To obtain balanced growth, A_t grows at the same rate as wages (which we denote with $1 + g$), while the weight on leisure, ψ^s and ψ^p grow at rate $(1 + g)^{(1-\sigma)}$.

3.3 Static Labor Decision[Incomplete]

Suppose that each individual has one unit of discretionary time available each period. Notice that the static labor-leisure-home production decisions can be disentangled from the dynamic marriage/divorce choice and be studied separately.

Singles. We begin with the static problem of a single agent:

$$U^s(w) = \max_{n,\ell} \frac{(\gamma(wn)^\alpha + (1-\gamma)(A(1-n-\ell))^\alpha)^{\frac{1-\sigma}{\alpha}}}{1-\sigma} + \psi^s \ell,$$

where $k = wn$ and $h = 1 - n - \ell$ have been substituted into the objective function. To simplify notation, define $\Phi(w) = (\gamma w^{\alpha})^{\frac{1}{1-\alpha}} + ((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}}$. The optimal leisure choice is

$$\ell = 1 - \frac{\Phi(w)^{\frac{1-\alpha}{\alpha}\frac{(1-\sigma)}{\sigma}}}{\psi^{(1/\sigma)}}, \tag{3}$$

as long as the right hand side is positive and $\ell = 0$ otherwise. Labor supply is:[9]

$$n = \frac{(\gamma w^{\alpha})^{\frac{1}{1-\alpha}} \Phi(w)^{\frac{1-\alpha-\sigma}{\alpha\sigma}}}{\psi^{(1/\sigma)}}, \tag{4}$$

for $\ell > 0$ and reduces to $n = (\gamma w^{\alpha})^{\frac{1}{1-\alpha}} \Phi(w)^{-1}$ when $\ell = 0$.[10]

It is easy to see that with $\sigma < 1$, leisure is a decreasing function of wages, while with $\sigma > 1$, leisure rises as wages rise. In the rest of this paper, we will consider the case with $\sigma \geq 1$, so as to be consistent with the labor supply trends observed in the data.

Divorcees. In our modeling, the only difference between single and divorced agents' utility functions is the potentially higher burden of childcare faced by divorcees, reflected in the $\phi^d > 1$ term. The optimal solutions are

$$1 - \ell^d = \left(\phi^d\right)^{\frac{(\sigma-1)}{\sigma}} (1 - \ell^s),$$

which in turn affects labor supply choice:

$$n^d = \left(\phi^d\right)^{\frac{(\sigma-1)}{\sigma}} n^s. \tag{5}$$

These two equations imply that $h^d = \left(\phi^d\right)^{\frac{(\sigma-1)}{\sigma}} h^s$. Therefore, when the curvature of consumption is higher than log ($\sigma > 1$) and $\phi > 1$, a divorcee will work more hours both in the market and at home compared with a single agent (both by the same proportion $\left(\phi^d\right)^{\frac{(\sigma-1)}{\sigma}}$), and his leisure hours will be reduced by the same factor. This gap disappears with log utility, $\sigma = 1$, in which case divorced and single individuals have the same market, home production, and leisure times.

[9] Do we need to impose conditions so that ℓ stays between zero and one?

[10] For log preferences In the case of log-preference, $\sigma = 1$, we have $\ell = 1 - (\psi^s)^{-1}$, where leisure is strictly positive if $\psi^s > 1$. While, the corresponding labor allocation is, $n = (\gamma w^{\alpha})^{\frac{1}{1-\alpha}} (\psi^s)^{-1} \Phi(w)^{-1}$, if $0 < \ell < 1$, and $n = (\gamma w^{\alpha})^{\frac{1}{1-\alpha}} \Phi(w)^{-1}$ if $\ell = 0$.

Couples. Turning to couples who maximize the objective in (2), notice that since spouses are perfect complements in leisure ($\ell = \ell_1 = \ell_2$) and perfect substitutes in home production, the higher wage earner will specialize in the labor market and the secondary worker will enter only if $n_1 = 1 - \ell$. The latter condition will be satisfied only when $\gamma w^\alpha \geq (1-\gamma)A^\alpha$, that is when the worker's contribution to the production of consumption good is higher through the wage income he/she provides relative to what he/she can provide through supplying labor through home production.

Single-earner Couple. The first order conditions to determine the primary workers' labor choice is

$$\ell = 1 - \left(\frac{\phi}{2}\right)^{\frac{(\sigma-1)}{\sigma}} \left[\frac{\Phi(w_1)^{\frac{1-\alpha}{\alpha}\frac{(1-\sigma)}{\sigma}}}{b^{(1/\sigma)}}\right], \tag{6}$$

if $b > 0$. Note that without any love, $b \leq 0$, the couple will not enjoy any leisure time together. Moreover, similar to the single-agent problem, $\ell < 1$, is always satisfied, but $\ell = 0$ if $b^{(1/\sigma)}\Phi(w_1)^{\frac{(1-\alpha)}{\alpha}(\sigma-1)} \leq \left(\frac{\phi}{2}\right)^{(\sigma-1)}$. That is, with $\sigma > 1$ the more love the more likely the couple will spend time in leisure together.

The labor supply of the primary worker is given by

$$n_1 = (\frac{\phi}{2})^{\frac{(\sigma-1)}{\sigma}} \left[\frac{2(\gamma w_1^\alpha)^{\frac{1}{1-\alpha}}\Phi(w_1)^{\frac{1-\alpha-\sigma}{\alpha\sigma}}}{b^{(1/\sigma)}}\right]$$

if $\ell > 0$; if $\ell = 0$ then $n_1 = 2(\gamma w_1^\alpha)^{\frac{1}{1-\alpha}}\Phi(w)^{-1}$.

Here, unlike the single agent problem, the primary worker's hours can equal one. That is, hours are strictly less than one, if and only if, $\frac{\gamma}{1-\gamma}\left(\frac{w_1}{A}\right)^\alpha < 1$, the primary worker's wage is relatively small compared to the primary worker's home productivity. Also note that, in the case of log-preferences, leisure is

$$\ell = 1 - b^{-1},$$

which is independent of wages and positive, as along as there is sufficient "love" in the marriage (b_{ij} is not too close to zero). Labor supply when one spouse is working is

$$n_1 = 2\left[\frac{(\gamma w_1^\alpha)^{\frac{1}{1-\alpha}}}{b\Phi(w_1)}\right],$$

if $\ell > 0$; and if $\ell = 0$, the primary worker's labor allocation is equal to the case of $\sigma > 1$ and $\ell = 0$.

Dual-earner Couples. If $n_1 = 1 - \ell$, the household's leisure allocation is

$$\ell = 1 - \left(\frac{w_1}{w_1 + w_2} \phi \right)^{\frac{(\sigma-1)}{\sigma}} \left[\frac{\Phi(w_2)^{\frac{(1-\alpha)}{\alpha} \frac{(1-\sigma)}{\sigma}}}{b^{(1/\sigma)}} \right].$$

Again, leisure is always less than 1, and $\ell = 0$ if $b \leq 0$ or $b^{(1/\sigma)} \Phi(w_2)^{\frac{(1-\alpha)}{\alpha}(\sigma-1)} \leq \left(\frac{w_1}{w_1+w_2} \phi \right)^{(\sigma-1)}$. Notice, that by definition $\left(\frac{w_1}{w_1+w_2} \right) \geq \frac{1}{2}$, that is, married couples where both spouse's work are less likely to be constrained to zero leisure, assuming of course $b > 0$ is satisfied. The secondary worker's time allocation is

$$n_2 = \left(\frac{w_1}{w_1 + w_2} \phi \right)^{\frac{(\sigma-1)}{\sigma}} \left[\frac{(\gamma w_2^{\alpha})^{\frac{1}{1-\alpha}} - ((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} \frac{w_1}{w_2}}{b^{(1/\sigma)} \Phi(w_2)^{\frac{\alpha+\sigma-1}{\alpha\sigma}}} \right],$$

and if $\ell = 0$ then

$$n_2 = \frac{\left((\gamma w_2^{\alpha})^{\frac{1}{1-\alpha}} - ((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} \frac{w_1}{w_2} \right)}{\Phi(w_2)},$$

where $w_1 > w_2$. Note that $n_2 > 0$ if and only if $\left[\frac{\gamma}{1-\gamma} \left(\frac{w_2}{A} \right)^{\alpha} \right]^{\frac{1}{1-\alpha}} > \frac{w_1}{w_2}$, a condition similar to hours for the primary worker being strictly less than one. That is, the secondary worker's market productivity is relatively good compared to home productivity, and the primary worker's wages are not considerably greater. Ergo, a secondary earner that is married to a high wage earner is more likely to stay at home. Nonetheless, if $\alpha > 1$, both primary and secondary earner (if he/she works) will increase their labor hours with an increase in wages. Finally, as the curvature of leisure is greater than the curvature on consumption $\sigma < 1$, the economies of scale will induce couples to spend more time at home.

Plugging these static optimal allocations into the respective utility function yields indirect utility functions denoted with $V^s(w_m)$, $V^d(w_m, \phi^d)$ and $V^p(b, w_f, j; w_m, i)$ for single, divorced and married individuals.

3.4 Comparative Statics

Singles. For singles, a rise in wages leads to a rise in leisure if $\sigma > 1$:

$$\frac{\partial \ell}{\partial w} = \frac{\sigma - 1}{\sigma} \frac{\gamma^{\frac{1}{1-\alpha}} w^{\frac{2\alpha-1}{1-\alpha}} \Phi(w)^{\frac{\alpha+\sigma-1}{\alpha\sigma}}}{(\psi^s)^{(1/\sigma)}} > 0.$$

Notice that, as usual, log preferences result in no relation between wages and leisure, which can be seen by setting $\sigma = 1$ in this last expression. The labor supply response to a rise in wages is

$$\frac{\partial n}{\partial w} = \Gamma_1 \times \left[\alpha\sigma((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} - (1-\alpha)(\sigma-1)(\gamma w^{\alpha})^{\frac{1}{1-\alpha}} \right],$$

if $0 < \ell < 1$ where Γ_1 is a positive term.[11] That is, market hours increase as long as

$$\left[\frac{\gamma}{1-\gamma} \left(\frac{w}{A} \right)^{\alpha} \right]^{\frac{1}{1-\alpha}} < \frac{\alpha\sigma}{(1-\alpha)(\sigma-1)}$$

The prevailing force, depends on the elasticity of substitution between market and home production, the curvature on consumption versus leisure, and the relative market to home productivity. With log preferences (or $\ell = 0$) the substitution effect drops out yielding:

$$\frac{\partial n}{\partial w} = \frac{\alpha \gamma^{\frac{1}{1-\alpha}} w^{\frac{2\alpha-1}{1-\alpha}}}{(1-\alpha)\Phi(w)^2} \left[((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} \right] > 0.$$

To summarize, for single individuals with log utility, labor supply increases with the wage rate, whereas leisure remains unchanged. With $\sigma > 1$, leisure rises whereas whether labor supply increases or decreases depends on the relationship between the wage rate and efficiency at home production.

Couples. If wages and parameter values are such that the household has a single earner, leisure increases in response to a rise in wages when $\sigma > 1$ and is independent when $\sigma = 1$. This is the same as was the case with singles. If $n_1 = 1 - \ell$, both a change in the primary earner's wage as well as the secondary earner's wage will affect leisure.

[11] More concretely, $\Gamma_1 = \frac{\gamma^{\frac{1}{1-\alpha}} w^{\frac{2\alpha-1}{1-\alpha}} \Phi(w)^{\frac{1-\alpha}{\alpha}\frac{(\sigma-1)}{\sigma}}}{(1-\alpha)\sigma\psi^{s(1/\sigma)}}$

In particular, a rise in w_1 leads to a fall in leisure with $\sigma > 1$ and no effect with log utility. In contrast a rise in w_2 increases leisure for $\sigma > 1$ and has no effect if $\sigma = 1$ (see Appendix A for proof).

Plugging these static optimal allocations into the respective utility function yields indirect utility functions denoted with $V^s(w_m)$, $V^d(w_m, \phi^d)$ and $V^p(b, w_f, j; w_m, i)$ for single, divorced and married individuals.

3.5 Dynamic Programming Problems

Since love evolves over the life of a marriage, it causes spouses to reevaluate every period whether or not they want to divorce. Whether divorce actually takes place or not also depends on the legal system. Under "consent divorce" laws, a divorce request is granted only when both agents prefer to separate (or one spouse is shown to be at fault, such as, committing infidelity). Under this regime, if only one spouse wants to divorce, he/she will be "trapped" in the marriage. While divorce laws vary across US states, consent divorce was the predominant legal framework before the 1970s.[12] An alternative—which has become the dominant framework since the late 1970s—is the "unilateral divorce" regime, which requires only one spouse to request a divorce (without requiring proof of fault) for it to be granted.[13] In the model, the one cost of divorce is that divorcees must remain single for a certain (exogenously given) period of time.

To write the dynamic programming problems of agents, let $\lambda_m^t(i, w_m, k; j, z)$ denote the probability for a woman of education type j that is either single (never married), $z = s$, or divorced, $z = d$, of meeting a man (both aged t) with education level i and wage level w_m and marital history k; $\lambda_f^t(j, w_f, z; i, k)$ is defined analogously. Meetings are random within education group, so these functions depend on the share of educated (single and divorced) males and females in the population and are thus endogenous objects determined in equilibrium. To allow for assortative meeting means that a college educated woman has a higher chance of meeting another college educated male than an uneducated woman. Let θ^{ee}be the degree of assortative meeting if both spouses are

[12] **?** relates some interesting historical evidence, such as trapped spouses hiring firms that specialize in (illegally) concocting evidence about unwilling spouse's infidelity. These desperate measures indicate potentially large welfare losses suffered by trapped spouses.

[13] **?** is an authoritative source on the evolution of divorce laws in the 20th century United States and contains a careful state-by-state analysis of the causes and consequences of theses changes.

educated, the probability of an educated woman meeting an educated man is

$$\lambda^t_m(e, w_m, k; e, z) = \theta^{ee}\hat{\lambda}^t{}_m(e, w_m, k) \leq 1,$$

where $\hat{\lambda}_m(i, w_m, k)$ denotes the fraction of men of education type i, wage level w_m, and marital history k aged t participating in the marriage market. An analogous condition holds for educated men meeting educated women. The remaining assortative meeting parameters, θ^{ij}, the meeting probabilities for a type i education male with an type j female, are such that all single individuals (in the first period everybody is single) meet at most one prospective spouse

$$\theta^{ej}\hat{\lambda}^1{}_m(e, w_m, s; j, s) + \theta^{uj}\hat{\lambda}^1{}_m(u, w_m, s; j, s) = 1,$$

for women and analogous for men.

Notice that we allow individuals to only marry within their cohorts, which is mostly for technical convenience (and is not too unrealistic).[14] Moreover, it is important to distinguish between the share of single, never married, and divorced individuals. Divorce in the model is costly not only in economies of scales, but also in the time required to reenter the marriage market after divorce. That is, newly divorced individuals remain single for a fixed period, before reentering the marriage market. Lastly, individuals do not necessarily meet another individual with certainty, the probability of meeting depends on the share of single eligible people in the economy.

$$\sum_{k=s,d}\sum_{j=e,u}\sum_{w_m}\lambda_m(i, w_m, k; j, z) \leq 1,$$

and an analogous condition holds for women.

Value Functions and Decision Thresholds. Let $J^m(\lambda^t_f, b, w_f, j; w_m, i)$ denote the value function of a man with education level i and wage w_m who is married to a woman with education level j and wage w_f with love level b. Throughout, we adopt the convention that arguments of the value function that pertain to the individual himself (and hence do not change over time) are placed after the semi-colon, whereas those that pertain to the match or the spouse (and hence do change over time) are placed before the

[14] A cohort encompasses a 5 year age group. Meetings take place very period.

semi-colon. Further, let $S^m(\lambda_f^t; w_m, i)$ denote the value function of the same individual when single and $D^m(\lambda_f^t; w_m, i, \phi^d)$ when divorced. Notice that the two value functions will be identical when $\phi^d = 1$.

Now let $\underline{b}^m(w_f, j; w_m, i),\ \ i, j = e, u$ denote the threshold level of love, above which a man with education i and wage level w_m prefers to marry a woman with education j and wage w_f over staying single. Formally:

$$\underline{b}^m(w_f, j; w_m, i) = \min b \qquad \text{s.t.} \quad J^m(\lambda_f^t, b, w_f, j; w_m, i) \geq S^m(\lambda_f^t; w_m, i)$$

Let $\underline{b}^f(w_m, i; w_f, j)$ denote the analogous threshold for the woman who meets the very same man. Similarly, we can define thresholds for married individuals contemplating divorce. Specifically,

$$\underline{b}^{d,m}(w_f, j; w_m, i) = \min b \qquad \text{s.t.} \quad J^m(\lambda_f^t, b, w_f, j; w_m, i) \geq D^m(\lambda_f^t; w_m, i, \phi^d)$$

Clearly, the two thresholds can differ. We assume, as seems plausible, that a meeting turns into a marriage if both potential spouses prefer marriage over being single. So, let $\underline{B}^p(w_m, w_f, i, j) \equiv \max(\underline{b}^m, \underline{b}^f)$ be the threshold that determines the marriage between these two individuals.

Unlike marriage, divorce does not always require both spouse's agreement. In particular, under the unilateral divorce regime, which is the predominant legal framework in most US states today, divorce can be granted by a court with only one spouse's "unilateral" demand. Under this regime, the threshold level for divorce has the same form as the marriage threshold but with different arguments: $\underline{B}^{\mathrm{ud}}(w_m, w_f, i, j) \equiv \max(\underline{b}^{d,m}, \underline{b}^{d,f})$ (the superscript "ud" stands for unilateral divorce). Notice that when $\phi^d = 1$, we have $\underline{B}^{\mathrm{ud}} = \underline{B}^p$. To see why this is the case, notice that as soon as b falls below this threshold, it means one of the spouses prefers to remain single relative to the current marriage. Under a unilateral regime, that spouse would file for and be granted divorce.

An alternative legal regime is one of "consent" divorce, in which both spouses must jointly want to divorce. In this case the threshold depends on the spouse who has a lower threshold (and is more willing to stay married): $\underline{B}^{\mathrm{cd}}(w_m, w_f, i, j) = \min(\underline{b}^{d,m}, \underline{b}^{d,f})$, where the superscript "cd" stands for "consent divorce." Other variables are defined analogously. It is convenient and not implausible to assume that individuals can marry and divorce over the same period that they are potentially in the labor market: between the ages of 20 and 65, that is for 45 years. Hence the dynamic programs below are written for $t = 1, 2, .., 45$. We assume that all agents die at age of 65.[15]

For a single male with education level i, the dynamic program is:

$$S_t^m(\lambda_f^t; w_m, i) = V^s(w_m) + \beta \sum_{z=s,d} \sum_{j=e,u} \sum_{w_f} \lambda_f^t(j, w_f, z; i, s) \left[\int_{\underline{B}^p(w_m, w_f, i, j)}^{\infty} J_{t+1}^m(\lambda_f^{t+1}, b', w_f, j; w_m, i,) dF_0(b') \right.$$
$$\left. + \int_{-\infty}^{\underline{B}^p(w_m, w_f, i, j)} S_{t+1}^m(\lambda_f^{t+1}; w_m, i) dF_0(b') \right] + \beta \left(1 - \sum_{z=s,d} \sum_{j=e,u} \sum_{w_f} \lambda_f^t(j, w_f, k; i, s) \right) S_{t+1}^m(\lambda_f^{t+1}; w_m, i).$$

For a married man living in a unilateral divorce regime, the problem is:

$$J_t^m(\lambda_f^t, b', w_f, j; w_m, i) = V^p(b, w_f, j; w_m, i) + \beta \left[\int_{\underline{B}^{\mathrm{ud}}(w_m, w_f, i, j)}^{\infty} J_{t+1}^m(\lambda_f^{t+1}, b', w_f, j; w_m, i) \, dF(b'|b) \right.$$
$$\left. + \int_{-\infty}^{\underline{B}^{\mathrm{ud}}(w_m, w_f, i, j)} D_{t+1}^m(\lambda_f^{t+1}; w_m, i, \phi^d) \, dF(b'|b) \right],$$

where

The problem for consent regime is obtained by simply replacing the limits of the integration with the appropriate love threshold. Finally, for a divorced individual, the problem is analogous to a single with slight modifications. For a divorced male with education level i, that is, able to participate in the marriage market, the dynamic program is:

$$D_t^m(\lambda_f^t; w_m, i, \phi^d) = V^d(w_m, \phi^d) + \beta \sum_{z=s,d} \sum_{j=e,u} \sum_{w_f} \lambda_f^t(j, w_f, z; i, d) \left[\int_{\underline{B}^p(w_m, w_f, i, j)}^{\infty} J_{t+1}^m(\lambda_f^{t+1}, b', w_f, j; w_m, i) dF_0(b') \right.$$
$$\left. + \int_{-\infty}^{\underline{B}^p(w_m, w_f, i, j)} D_{t+1}^m(\lambda_f^{t+1}; w_m, i, \phi^d) dF_0(b') \right] + \beta \left(1 - \sum_{z=s,d} \sum_{j=e,u} \sum_{w_f} \lambda_f^t(j, w_f, z; i, d) \right) D_{t+1}^m(\lambda_f^{t+1}; w_m, i, \phi^d).$$

A recently divorced individual's dynamic program is simply, $D_t^m(\lambda_f^t; w_m, i, \phi^d) = V^d(w_m, \phi^d) + \beta D(\lambda_f^{t+1}; w_m, i, \phi^d)$. The value functions at death are all normalized to zero: $J_{T+1}^m(\lambda_f^{T+1}, b', w_f, j; w_m, i) \equiv 0$, $S_{T+1}^m(\lambda_f^{T+1}; w_m, i) \equiv 0$, etc.

[15] It is straightforward to add a retirement period but not much is likely to be gained from this additional generality.

3.6 Education Decision

Assume that individuals choose education when young and single, the cost to education is utility cost κ, and tuition cost c_e. Agents choose on attending college before drawing their educated and uneducated wage, and therefore, base their decision on the average wages by education group. Moreover, in period zero singles do not enter the labor or marriage market. Let $\overline{w}_{fe} \equiv \mathbb{E}(w_f|e)$ and $\overline{w}_{fu} \equiv \mathbb{E}(w_f|u)$ denote the average wages of, respectively, an educated and uneducated female worker. A single woman educates if and only if:

$$U(\overline{w}_{fe} - c_e) + \beta S(\overline{w}_{fe}, e) - \kappa > U(\overline{w}_{fu}) + \beta S(\overline{w}_{fu}, u).$$

Consequently the fraction of educated women is

$$\lambda_f^0 = \Pr(U(\overline{w}_{fe} - c_e) - U(\overline{w}_{fu}) + \beta(S(\overline{w}_{fe}, e) - S(\overline{w}_{fu}, u)) > \kappa). \tag{7}$$

Note, form the static labor choice if $n_2 > 0$ the prospective secondary spouse's wage does matter to the primary earner, since it does contribute to family resources. In this case, if women have lower wages, education does not only benefit women when they are single, but also makes them more desirable spouses. From the dynamic equations, it seems reasonable to conjecture that educated women will have a higher threshold of the b shock to divorce, since their outside option (determined both by their wage as single, as well as their subsequent marriage prospects) look better. Therefore, as education rises the same variance of "love" shocks may lead to more divorces. Then a rise in returns to human capital, should increase female education demand more so than male education even in the face of lower returns to education. The divorce rate, and female labor force participation should also rise. It is not clear whether it will reduce marriage rates, but to the extent that there is a cost of divorce, it should also reduce marriages (even without cost but with complementarity in leisure it should generate a fall in the marriage rate). Finally, to be consistent with balanced growth κ needs to grow at the yearly rate of $(1+g)^{(1-\sigma)}$.

3.7 Aggregate Dynamics

$$MR_t = \sum_{k=s,d} \sum_{j=e,u} \sum_{w_f} \lambda_f^t(j, w_f) \left[\int_{w_f} \int_{w_m} \int_{\underline{B}^p(w_m, w_f, i, j)}^{\infty} dF_0(b') dG_m(w_m) dG_f(w_f) \right]$$

As mentioned previously, there are two possible divorce law regimes. For now, we assume everyone lives in consent-law until 1975 and in unilateral-law states thereafter. In the steady state, that is in 1950, agents, single or married, live in a consent-law state and expect to remain there forever. During the transition with perfect foresight, we assume agents expect to move from a consent state to a unilateral state for certain in 1975, which corresponds to the mid-point when most of US states had switched their law.

We assume that spouses can only marry within their generation and, therefore, die together at age 65.

3.8 Mechanisms

This basic framework generates several interesting feedbacks between the education choice and marriage/divorce decisions. One mechanism that we are particularly interested in is the following. Suppose that in the 1950s, women come to expect that the divorce rate will rise in the future.[16] Since education provides insurance against divorce (in the form of higher income), this expectation will increase the demand for education for young women in 1950s. (Although these effects are similar for men, they are not symmetric because of initial conditions. US males in 1950 had both higher education and higher wages conditional on education than women.) But higher income in turn *reduces* an important benefit of marriage for women, by closing the income gap between the spouses, which then—now endogenously—raises the divorce rate. This happens because, some women who previously did not agree to divorce (despite a low value of b) are now willing to divorce and stay single since they are able to support themselves with their higher income. Thus, the higher education of women which was supposed to insure against divorce risk, itself creates more divorce, which in turn generates more demand for education by women. Consequently, a small exogenous rise in divorce risk can result in a larger rise in actual divorce rates as well as in women's educational attainment in equilibrium due to this amplification mechanism.[17]

[16] This can be due to, for example, an anticipation of the move from consent to unilateral divorce regime, an expected fall in fertility (which makes divorce less costly), a rise in female educational attainment (which makes women financially more independent), and so on. The precise reason for such an expectation is not crucial at this point. We are interested in certain amplification channels that will be active within this framework.

[17] As can be anticipated from this discussion, this framework is open to the possibility of multiple equilibria, although this is nothing new in search models of the marriage market. While this did not

The interaction of education and the marriage market also creates an externality effect: when there are more educated men than women, some educated men are likely to marry uneducated women (rather than remain single), which lowers the returns on education for women. However, as more women get educated, it becomes more difficult for an uneducated woman to attract an educated man, which increases the education demand of all women. Thus, the returns to education can easily be *increasing* in the supply of educated women, which fuels demand for education. Therefore, a change in quality of the marriage market towards high education can lead to an increase in women's educational attainment.

It is also instructive to examine what happens with an exogenous change from consent to unilateral divorce law in this model. Let $\underline{b}_i, i = 1, 2$ be the lower bound on b for marriage to be optimal for i. Consent divorce law requires $b < \min(\underline{b}_1, \underline{b}_2)$, whereas unilateral divorce requires only $b < \max(\underline{b}_1, \underline{b}_2)$), which implies that the divorce rate will rise quickly after the change in the law (from consent to unilateral), consistent with what has been observed in the US data during the 1970s. However, because the new marriages formed under the unilateral law will involve better selection, the rise in the divorce rate is followed with a subsequent but smaller decline.

4 Quantitative Analysis

A model period corresponds to one year of calendar time. As noted earlier, individuals are economically active between ages 20 and 65. Several parameters are pre-set to values from the literature. We have $\beta = 0.98$, $\alpha = 0.45$, and $c_e = 0.105$. The tuition education cost equates to about one third of average educated wages taking into account average hours worked. As will become apparent in the results, for the model to generate time trends in the marriage market consistent with the data, it is necessary to properly account for the cost of marrying previously divorced individuals. Using the Survey of Income and Program Participation (SIPP) it is possible to compute the number of children living in a household of previously divorced versus never divorced couples. Moreover, the data also allows us to distinguish between biological and stepchildren. The economies of scales computed from the SIPP are detailed in Appendix B. The resulting economies of scales

appear to be a problem so far (based partly on the parameter choices we have experimented with), this issue still requires a lot of caution.

Table II: Baseline Parametrization

Parameters	*Description*	*Value*	
σ	Curvature of consumption composite	1.56	1.65
γ	Weight on market consumption	0.58	0.59
ψ^s	Leisure weight for singles	3.80	3.62
θ^{ee}	Degree of assortative matching	2.95	2.89
μ_b	Mean of initial love draw	2.21	1.71
σ_b	Std. dev. of initial love draw	1.11	1.37
σ_ζ	Std. dev. of love innovation	2.77	2.25
μ_κ^m	Men's mean psychic cost of educ.	30.85	33.78
μ_κ^f	Women's mean psychic cost of educ.	29.08	30.63
σ_κ	Std. dev. of psychic cost	17.93	18.41
c_e	Tuition cost of education	0.105	0.105
ϕ	Economies of scale	2.36	2.36
ϕ^{pd}	Economies of scale remarried women	3.06	2.36
ϕ_f^d	Economies of scale divorced women	1.64	1.64
β	Subjective discount factor	0.98	0.98
α	Elasticity of Substitution of CES	0.45	0.45

are $\phi = 2.36$ for married households, $\phi^{pd} = 3.06$ for married households with a previously divorced woman and $\phi^p = 1.64$ for divorced women.[18] For comparison purposes, results with $\phi^{pd} = \phi = 2.36$ are also provided. The remaining parameters are calibrated to match several targets within the model. Specifically, we calibrate the following vector of parameters:

$$\boldsymbol{\theta} \equiv \left(\sigma, \gamma; \quad \psi^s, \theta^{ee}; \quad \mu_b, \sigma_b, \sigma_\zeta; \quad \mu_\kappa^m, \mu_\kappa^f, \sigma_\kappa\right).$$

Note, to match the level in education between gender in men and women are allowed to have different psychic costs of studying. However, these costs remain constant overtime and both distributions have the same standard deviation.

The empirical wage distributions used in the analysis are obtained by fitting a log-normal distribution to the CPS data (separately for each education and gender group) every year. The productivity of home production is normalized to 1. The growth rate

[18] Since most children live with their mother in the data, economies of scale for divorced men are close to one using our scaling approach. For simplicity we, therefore, set the economies of divorced men equal to the single, never married men and women, $\phi = 1$, and the economies of scales for remarried divorced men equal to married couples which have never been divorced.

of wages is set to 1.87 percent per year until 1975 and 0 thereafter. The remaining 10 parameters are calibrated to match 11 data targets (10 targets in year 2005 and 1 in year 1950). All moments are computed for "young" individuals—those aged 25 to 34—although we will discuss the implications of the model for both young individuals with completed education as well as the whole population. These targets are:

- 3 targets on labor supply: the average annual hours worked of married men, the ratio of annual hours worked in the labor market to hours worked at home for married women, and the average hours worked by single men.
- 3 targets on marriage/divorce: the fraction of singles and the fraction married couples; and the probability that a new marriage survives to its 15th anniversary (last available year, which is 1990). (Note: the marriage rate is determined by the mean and standard deviation of the initial love draw. A higher mean will result in more marriages as will a higher standard deviation. The divorce rate will increase with a higher standard deviation of the iid shock.).
- 5 targets on education and marriage: the fraction of young women and men (age 25 to 34) that obtain a college education; and the fraction of college educated young women in 1950; fraction of marriages between two educated spouses and fraction of marriages between an educated man and uneducated woman.

The wage process is taken directly from the data. That is, we compute the mean by gender and education group for a given year, we take 5-year moving averages, and assume that wages are log normally distributed. The standard deviation of wages is fixed at 0.25, the average during this time period, for all gender/education types.

The main difference between the baseline model and the simplified economies of scale version is that, the mean love shock is lower when women face a short-lived cost of divorcing, that is, marriage does not need to be so attractive. Moreover, in the baseline version, the gap necessary, to match educational attainment, in psychic education cost shrinks.

5 Results

We begin by calibrating the baseline model. The values of the 10 parameters discussed above are chosen to match the 11 moments discussed above. It should be kept in mind that—because the moments targeted are nonlinear functions of the underlying parameters of the model—there is no presumption that each moment could be matched perfectly.

5.1 Targeted Moments

Table III presents the baseline results in columns 3 and 4. The targeted empirical moments are indicated with an asterisk ($*$). We begin with moments related to marriage and divorce. The fraction of young individuals that are single is 34 percent in the US data in 2005, which the model matches perfectly. Similarly, the fraction married is 56.3 percent in the data and 51.3 percent in the model—slight understatement in the model. Third, an important moment that helps us pin down the dynamics of marriage and divorce is the fraction of marriages that survive into the 15th anniversary. This figure is matched fairly well: it is 57 percent in the data vs 52 percent in the model.

The second important dimension of data concerns educational attainment. The model matches all three educational attainment targets—fraction of young educated females in 2005 and 1950 and the fraction of young educated men in 2005—almost perfectly. The ease with which the model matches some moments has to do with the fact that the model has three parameters that are directly linked to the cost of education (μ_κ^m, μ_κ^f, σ_κ) and have little other impact on any other dimension of the model. Turning to the interaction of education and marriage, the calibration targeted two types of couples by education level: first, the fraction of couples in which both spouses are educated and, second, the fraction of couples with an educated male and uneducated female. Both targets are matched almost perfectly: the former fraction is 22.7 percent in the data and 22.5 percent in the model and the latter is 8.8 percent in the data and is again matched closely by the model.

The third dimension of the data concerns labor supply. For both married and single males, the model does a good job of matching the empirical targets, whereas for married females relative labor supply is understated. In particular, in the 2005 US data married women on average spend 66.5 percent of their relative labor time in the market compared to the home, whereas the model generates 45.8 percent.

The model match for the simplified economies of scales is comparable in all dimensions. However, it should be noted the simplified model does generate an even larger share of divorced individuals, than the baseline.

Table III: Key Statistics of Baseline Calibrated Model Compared to the US Data

	US Data		Baseline Calibrated		Basic Scales Calibrated	
	1950	2005	1950	2005	1950	2005
	(1)	(2)	(3)	(4)	(6)	(7)
Divorce rate		0.048	0.004	0.042	0.004	0.057
Marriage rate			0.085	0.061	0.070	0.082
Fraction single	0.130	0.340*	0.311	0.340	0.401	0.332
Fraction divorced	0.045	0.097	0.011	0.147	0.008	0.166
Fraction married	0.825	0.563*	0.678	0.513	0.591	0.502
Survival to 15th.	0.794†	(0.570†)*	0.914	0.519	0.935	0.451
Married male hours	0.423	0.420*	0.617	0.408	0.652	0.442
Single male hours	0.345	0.361*	0.327	0.333	0.381	0.383
Married female hours	0.081	0.262	0.046	0.179	0.045	0.196
Married female mkt/home		0.665*	0.075	0.458	0.366	0.398
Single female hours	0.292	0.322	0.313	0.340	0.070	0.471
Young educ. women	0.059*	0.330*	0.060	0.334	0.065	0.334
Young educ. men	0.096	0.287*	0.113	0.291	0.103	0.291
Couples Ed/Ed	0.002	0.227*	0.021	0.225	0.022	0.215
Couples Ed/Uned	0.071	0.088*	0.121	0.089	0.110	0.086
Couples Uned/Ed	0.018	0.109	0.043	0.068	0.045	0.081
Couples Uned/Uned	0.878	0.577	0.815	0.618	0.822	0.618

†Due to data unavailability, this moment is computed for individuals aged 15 to 65 and not only for those marriages starting between ages of 25 and 35.

5.2 Trends over Time

After having verified that the model does a good job of matching the targets, we now turn to the real interesting question: how does the model perform when it comes to explaining trends over time?

Marriage and Divorce. Starting with marriage and divorce statistics, we see that the model generates patterns that are qualitatively consistent with the trends in the data: a rise in the fractions of singles and of divorcees, and a fall in the fraction of married individuals and the survival probability of marriages to the 15th anniversary. Quantitatively, the effects are somewhat smaller than in the data at least for this young age group. First, the fraction of the population that are single rises from 31.1 percent to 34 percent in the model compared to a rise from 13 percent to 34 percent. So, compared to a 21 percentage points rise in the data, the model generates only a 3 percentage points rise. Second, the fraction divorced rises from 4.5 percent to 9.7 percent in the data compare to a rise from 1.1 percent to 14.7 percent. In this case, the model overstates the rise observed in the data by generating too few divorces in the early period and too many in 2005. Third, the fraction married falls from 82.5 percent to 56.3 percent in the data and from 67.8 percent to 51.3 percent in the model. The decline is 26.2 percentage points in the data and 16.5 in the model. Notice that part of decline in marriages in the data are due to the rise in cohabitation, which is not explicitly modeled here, so the smaller decline in the model is not very surprising.

Finally, the model generates a substantial drop in the stability of marriages, the fraction of surviving marriages dropping from 91.2 percent to 51.9 percent, compared to a drop from 79.4 percent to 57 percent in the data. Overall, the model generates the right behavior in all four dimensions.

In contrast, the model with the simplified economies of scales, generates the wrong trends over time. The results is intuitive, divorced women face high economies of scales, which they can avoid if they remarry quickly. However, in 1950 it is difficult to break-off a marriage, therefore, marriages require much better matches to occur, in consequence we see a larger number of single, never married individuals and the marriage rate goes up over time.

Educational Attainment and Couple Types. Turning to education, the model is consistent with an important and somewhat puzzling feature of the US data: the observation that women overtook men in educational attainment between 1950 and 2005. Recall that, in the calibration, we chose parameters to match educational attainment rates for men and women in 2005 and for women in 1950. Thus, the model correctly has—by construction—women having a higher education rate than men in 2005. The question then is, do we see the reverse pattern in 1950? And the answer is yes. The enrollment rate is 11.3 percent for men and 6.0 percent for women in the model. The corresponding figures are 9.6 percent and 5.9 percent in the data. Thus, women experienced 27.3 percentage points increase compared to 17.8 percentage points for men from 1950 to 2005.

It is also instructive to see what happens to the matching patterns of couples. In the data, the fraction of educated couples (i.e., both spouses have college degree) rose from almost nothing (0.2 percent) up to 22.7 percent, which is matched very well by the model (with a rise from 0.2 percent to 22.5 percent). Similarly, the fraction of uneducated couples (i.e., both spouses have less than college degrees) fell from 87.8 percent to 57.7 percent in the data compared to a fall from 81.5 percent to 61.8 percent in the model. The model does less well in explaining the trends in couples with mismatched of educated men and uneducated women, partially due to the overall higher educational attainment of men in the model in 2005.

Labor Supply. Finally, it is useful to look at the trends in labor supply for different types of agents. First, the main fact about singles (which has already been documented in the existing literature, e.g., **?**) is that there has been little change in their labor supply in the last fifty years. To be precise, there is a small rise for both groups: a rise from 34.5 percent of total time to 36.1 for males and a rise from 29.2 to 32.2 relative market hours for females. But overall, these changes are quite modest. The model is consistent with this small change, generating a comparably small rise for both single males and single females. (from 32.7 percent of total time to 33.3 for males and from 31.3 to 34.0 for females). The real interesting and significant trend in the data has been observed in the hours of married women, going up from 8.1 relative hours in 1950 to 26.2 hours in 2005. The model generates a rise from 4.6 hours to 17.9 hours, which is a fairly good fraction of the change in the data—about 13.3 relative hours rise compared to 18.1 hours in the data, or about 74 percent of the empirical value. Moreover, neither of these statistics were targeted and the initial magnitude in 1950 is not too far off.

The one significant failure of the model happens for the labor supply of married men, which falls from 62 relative hours per week in 1950 to 41 hours in 2005. In the data, there is no comparable downward trend—if anything the labor supply of this group is quite stable (around 42 hours per week). The reason for the downward in the model is the strong assumption of perfect complementarity in leisure coupled with the low wages of women in the 1950s, and perfect substitution in the home. To see why this matters, notice that with the perfect complementarity in leisure, the market and home production hours of both spouses must add up to the same number. Because of the large gender wage gap in 1950, women work very little and thus specialize almost completely in home production, which makes their husbands specialize in market work and supply too much labor compared to the data.[19]

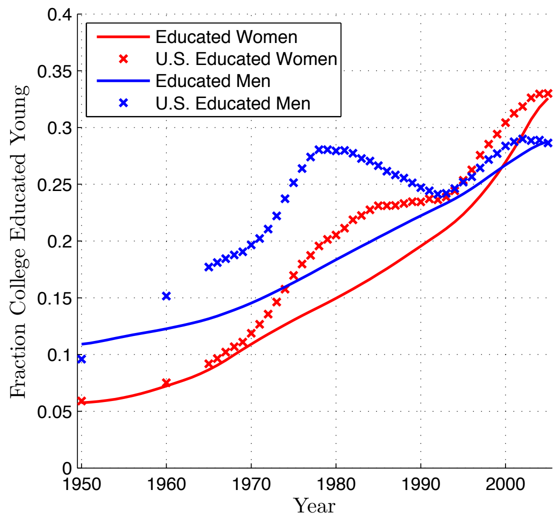
Comparison to the Whole Population (Ages 25–65). We next turn to the implications of the calibrated model for the moments of the whole economy after completed education (individuals aged 25 to 65). Table IV reports the counterparts of all the statistics shown in Table III for young individuals. Without going into too much detail, note that the marriage and divorce statistics for the entire population looks quite similar to the statistics for young and the model's performance here is very similar to what has been discussed before. This is partly because most of the changes in marriage and divorce statistics take place around the change in divorce laws in the 1970s and because our later period is in 2005, the population has adjusted to the new regime (i.e., transitional issues do not matter much). The results are also similar for labor supply for similar reasons. However, we do see important differences when we look at couple types. In particular, the fraction of educated couples in the entire population is only 13 percent in the model compared to 21.2 percent in the data. Recall that the model did a good job of nearly matching the fraction of educated couples among young individuals, which exceeded 20

[19] One problem is that our model predicts too much of a rise in leisure for married individuals with the change in divorce laws compared to the data. The implication is that couples consume too little leisure in 1950 in the model, so men specializing in the market means they supply too much labor. However, despite the quantitative overstatement, qualitatively the model is consistent with the fact that leisure has increased for all education groups and both for men and women during this period. In particular, Panel 3 of Table V in **?** show that most of the rise in leisure in the data (for both genders and all education groups, except for males with less than high school education) has taken place between 1965 and 1985. This is consistent with our baseline model—see figure leisuretype.fig which shows this for each couple type.)

Table IV: Key Statistics in the Model and in the Data, All Ages (25–65)

	US Data		Baseline Calibrated		Counterfactuals Law	Counterfactuals Match	Counterfactuals Law & Match
	1950	2005	1950	2005	2005	2005	2005
	(1)	(2)	(3)	(4)	(6)	(7)	(8)
Divorce rate	0.009	0.025	0.008	0.038	0.008	0.038	0.008
Marriage rate	0.082	0.041	0.042	0.037	0.047	0.037	0.045
Fraction single	0.099	0.176	0.160	0.210	0.197	0.196	0.176
Fraction divorced	0.052	0.157	0.094	0.328	0.083	0.334	0.088
Fraction married	0.849	0.667	0.745	0.463	0.719	0.470	0.736
Survival to 15th.	0.794	0.570	0.889	0.307	0.858	0.301	0.850
Married male hours	0.412	0.397	0.553	0.311	0.482	0.311	0.479
Single male hours	0.336	0.336	0.330	0.334	0.329	0.333	0.328
Married female hours	0.080	0.261	0.056	0.157	0.132	0.158	0.136
Single female hours	0.274	0.314	0.336	0.361	0.337	0.362	0.339
Educ. women	0.056	0.295	0.060	0.174	0.126	0.149	0.106
Educ. men	0.079	0.302	0.113	0.204	0.189	0.190	0.176
Young educ. women	0.059	0.330	0.060	0.334	0.244	0.230	0.167
Young educ. men	0.096	0.286	0.113	0.291	0.282	0.261	0.240
Couples Ed/Ed	0.025	0.212	0.020	0.132	0.081	0.099	0.058
Couples Ed/Uned	0.057	0.121	0.107	0.107	0.135	0.123	0.143
Couples Uned/Ed	0.019	0.095	0.043	0.090	0.053	0.097	0.061
Couples Uned/Uned	0.899	0.573	0.830	0.671	0.731	0.681	0.738

Figure 4: Educational Attainment Data versus Model



percent. The reason for the discrepancy is that the timing of the rise in college enrollment in the data and in the model are different. In the data, college enrollment rises the fastest in the 1970s, whereas the fastest rise in the model happens in the 1990s.

Consequently, the stock of educated individuals in 2005 is substantially lower in the model compared to the data because far fewer older individuals are educated by 2005. It follows that the stock of educated couples is also lower in the model. This generational timing effect also explains part of the smaller married hours worked for the whole population compared to the young.

Divorce Counterfactual Given the aim of this study there are three natural counterfactuals, (1) is to compare the 2005 economy with the hypothetical economy where the United States does not move from a consent-law to a unilateral law in the mid-1970s, (2) compare the 2005 economy with the hypothetical were the marriage market quality stays as in 1950, and (3) combining the two counterfactuals. Column (6) through (8) of Table IV summarize the results. For the second counterfactual, marriage market quality refers to individual's expectations on the probability of meeting an educated relative to an uneducated individual each period (the total number of singles and divorcees is allowed to vary in this counterfactual).

For the first counterfactual, given the restrictive divorce regime the fraction divorced falls slightly from 1950 to 2005. While, the rise in education does increase labor force participation of married women, it only explains 42 percent of the rise observed in the United States, rather than 56 percent in the original simulations.

Most importantly, the model now generates a substantially smaller rise in education rates. Education rates still rise due to increases in the college premium and changes in the gender wage gap, but less. For example, the rise in the United States was 27 percentage points for the fraction of educated women from 1950 to 2005, and the benchmark model replicates the rise precisely (see Table III). The first counterfactual only generates a 18.4 percentage point rise–a fall of 9 percentage points. In contrast, men's educational attainment only falls by 1 percentage points and, therefore, the original education gap between men and women from 1950 is replicated. Recall, that in the case of CRRA-preferences an identical divorced woman will have to work longer hours in the home and the labor market with economies of scales greater than one when divorced. In addition, remarrying is less likely given the higher economies of scales of previously divorced women. That is, a women that foresees a possible divorce in her life-time will prefer to invest at a cost in education to guarantee herself better wages in the case of a divorce. Now, if the divorce law doesn't change a divorce for a married woman is highly unlikely if she would be suffering as single. As the "weaker" spouse, she will have the power to decide when to end the marriage under a consent divorce-law state.

The results are similar in magnitude and direction for the second counterfactual, that is, the expectation regarding meetings with potential spouses can also generate a reversal of the education gap. Nonetheless, for match quality the fall in male education is three times as larger with 3 percentage points. Moreover, the timing and transitional effects across the two counterfactuals differ substantially. Remaining in an economy with consent divorce shifts the whole transitional path parallel for both men and women (see figure5). The parallel shift is substantially larger for women than men. In contrast, in maintaining constant expectations on match quality results only in a downward rotation, with the effect becoming more pronounced the further the true educated to uneducated ratios are compared to 1950. So for women, in the 1970s and 1980s, the impact on education attainment of changing expectations regarding the probability of marrying an educated male are fairly small.

Lastly, the interaction of both counterfactuals leads to a substantial drop in female education and to a lesser degree in males education. Female educational attainment drops by 16.7 percentage points (the college graduation rate halves), while male educa-

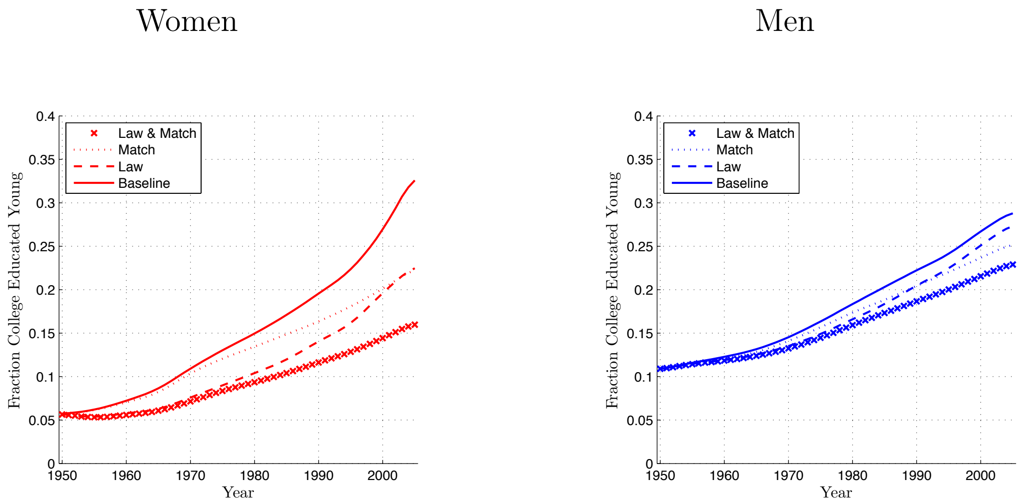


Figure 5: Education Rates Counterfactual

tional attainment drops by 5.1 percentage points. This discrepancy in magnitude follows directly, from the lower returns to education for women and their lower hours worked.

"Coase Theorem" So far we have assumed that the economy moves from a consent-law to a unilateral law. However, the Coase theorem would suggest that if a man wanted to leave a marriage he should be able to negotiate with the "weaker" spouse, and buy-out the marriage. There is some anecdotal evidence suggesting that trapped spouses hired firms that specialize in (illegally) concocting evidence about unwilling spouse's infidelity (see**?**). Table IV uses the same parameters as table IV. However, in 1950, the economy has unilateral divorce laws, and the economies of scale for divorcees now fall onto men not women. That is, upon a divorce the man instead of the woman carries the burden of the divorce costs. Consequently, single women are identical to divorced women. The model produces the correct divorce patterns, and matches the data almost perfectly. However, the model also generates a rise in marriage rates over time, but given the divorce rate, the fraction of married individual falls over time in a similar magnitude to the data. This is partially due to timing, since the results report only on individuals with completed education (population aged 25-64). Including individuals aged 20 to 24, leaves the divorce rate unchanged, but increases the marriage rate from 0.054 to 0.100 in 1950 and from 0.086 to 0.105 in 2005. That is, in 1950 most individuals marry before the age of 25, so judging the model on the fraction married rather than the marriage rate might be more accurate. In addition, the model produces similar changes in hours worked singles and married men, the reversal in the education gap and the levels in 1950. However, married women work substantially fewer hours in 2005, and there is also less assortative matching. Much of this divergence is again due to the generational effect, that is, by 2005 now only 13.3 percent of women aged 25 to 64 have a college degree, compared to 17.4 percent of women in the baseline model. So the composition of married women is substantially different, there are considerable fewer college educated women, and uneducated women tend to, for example work fewer hours.

The last column shows the combination of the two counterfactuals of now changes in divorce laws and match quality. The counterfactual produces a similar reversal in the education rates of men and women compared to the baseline model.

6 Conclusions [Incomplete]

This paper developed a model to jointly study the dynamics of divorce risks and educational attainment. Although, the model abstracts from many potentially related trends, such as social learning and changing social norms, the introduction of the "pill", etc. The model shows that rising divorce risks can have a sizable impact on educational decisions. Moreover, while previous research has struggled in accounting for the reversal in the gender education gap. A model incorporating the marriage market into the education decisions, can account for the now higher female educational attainment. Additionally, the counterfactual shows that divorce risk coupled with assortative meeting is important in generating the reversal in the education gap.

Lastly, an alternative specification of the base model that allows couples to "buy-out" their marriages rather than having to consent, suggests a similar increases in the divorce rate and college education rates (education gap reversals).

Table V: Changing ϕ : Data Targets and Moments, (25-64), $\sigma = 1.33$

	US Data		Calibrated		Counterf.
	1950	2005	1950	2005	2005
Divorce rate	0.009	0.025	0.009	0.026	0.011
Marriage rate	0.082	0.041	0.054	0.086	0.075
Fraction single	0.099	0.176	0.085	0.108	0.116
Fraction divorced	0.052	0.157	0.102	0.207	0.102
Fraction married	0.849	0.667	0.814	0.684	0.782
Survival to 15th	0.794	0.570	0.813	0.460	0.589
Married male hours	0.412	0.397	0.547	0.459	0.462
Single male hours	0.336	0.336	0.366	0.369	0.357
Married female hours	0.080	0.261	0.071	0.105	0.158
Single female hours	0.274	0.314	0.313	0.324	0.322
Educ. women	0.059	0.330	0.064	0.133	0.102
Educ. men	0.096	0.286	0.113	0.221	0.197
Young educ. women	0.059	0.330	0.064	0.334	0.230
Young educ. men	0.096	0.286	0.113	0.291	0.262
Couples Ed/Ed	0.025	0.212	0.021	0.098	0.064
Couples Ed/Uned	0.057	0.121	0.092	0.137	0.143
Couples Uned/Ed	0.019	0.095	0.041	0.029	0.038
Couples Uned/Uned	0.899	0.573	0.845	0.736	0.755

Notes: This table uses the same parameters as the last one, but instead, in 1950, the economy has unilateral divorce laws. But the economies of scales are reversed. That is, in 1950 men bear all the cost of being divorced, while single women are identical to divorced women. It is assumed that women who remarry, take their children to the next marriage, so economies of married households are unchanged.

A Key Derivations and Proofs

For single agents with $\Phi(w) \equiv (\gamma w^{\alpha})^{\frac{1}{1-\alpha}} + ((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}}$, we have:

$$\frac{\partial \ell}{\partial w} = \frac{\sigma - 1}{\sigma} \frac{\gamma^{\frac{1}{1-\alpha}} w^{\frac{\alpha}{1-\alpha}-1}}{\psi^{s(1/\sigma)} \Phi(w)^{\frac{(1-\alpha)}{\alpha}\frac{(\sigma-1)}{\sigma}-1}},$$

which implies that a rise in wages leads to a rise in leisure if $\sigma > 1$. With log-preferences leisure becomes independent of wages. The labor allocation response to a rise in wages is

$$\frac{\partial n}{\partial w} = \frac{\gamma^{\frac{1}{1-\alpha}} w^{\frac{\alpha}{1-\alpha}-1}}{(1-\alpha)\sigma\psi^{s(1/\sigma)}\Phi(w)^{\frac{\alpha+\sigma-1}{\alpha\sigma}+1}} \left[\alpha\sigma((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} - (1-\alpha)(\sigma-1)(\gamma w^{\alpha})^{\frac{1}{1-\alpha}}\right],$$

if $0 < \ell < 1$. That is, market hours increase as long as, $\left[\frac{\gamma}{1-\gamma}\left(\frac{w}{A}\right)^{\alpha}\right]^{\frac{1}{1-\alpha}} < \frac{\alpha\sigma}{(1-\alpha)(1-\sigma)}$, or

$$\frac{\partial n}{\partial w} = \frac{\alpha\gamma^{\frac{1}{1-\alpha}} w^{\frac{\alpha}{1-\alpha}-1}((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}}(1-\ell)}{(1-\alpha)\Phi(w)^2} - \frac{\partial \ell}{\partial w}\frac{(\gamma w^{\alpha})^{\frac{1}{1-\alpha}}}{\Phi(w)},$$

that is wages increase labor hours worked, due to the substitution effects, but decrease hours worked due to the income effect. The prevailing force, depends on the elasticity of substitution between market and home production, the curvature on consumption versus leisure, and the relative market to home productivity. With $\ell = 0$ (or $\sigma = 1$), the substitution effect drops out:

'

$$\frac{\partial n}{\partial w} = \frac{\alpha\gamma^{\frac{1}{1-\alpha}} w^{\frac{\alpha}{1-\alpha}-1}}{(1-\alpha)\Phi(w)^2}\left[((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}}\right].$$

For divorced individuals, the presence of economies of scales, implies the same qualitative effect on leisure as for single agents. However, the effect for a given wage will be quantitatively larger with $\phi^{\frac{(\sigma-1)}{\sigma}} > 1$

$$\frac{\partial \ell}{\partial w} = \frac{\sigma - 1}{\sigma}\phi^{\frac{(\sigma-1)}{\sigma}} \frac{\gamma^{\frac{1}{1-\alpha}} w^{\frac{\alpha}{1-\alpha}-1}}{\psi^{s(1/\sigma)} \Phi(w)^{\frac{(1-\alpha)}{\alpha}\frac{(\sigma-1)}{\sigma}-1}}.$$

For market hours, the comparative statics are identical, since the economies of scale only enter through differences in leisure,

$$\frac{\partial n}{\partial w} = \frac{\alpha\gamma^{\frac{1}{1-\alpha}} w^{\frac{\alpha}{1-\alpha}-1}((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}}(1-\ell)}{(1-\alpha)\Phi(w)^2} - \frac{\partial \ell}{\partial w}\frac{(\gamma w^{\alpha})^{\frac{1}{1-\alpha}}}{\Phi(w)},$$

quantitatively since divorcees enjoy less leisure than singles at a given wage rate, the first term will be larger, and the second term will be larger. Quantitatively, it is unclear whether single agents or divorcees will respond more to hours.

For married couples we have a similar comparative statics in leisure, with one working spouse,

$$\frac{\partial \ell}{\partial w_1} = \frac{\sigma-1}{\sigma}\left(\frac{\phi}{2}\right)^{\frac{(\sigma-1)}{\sigma}} \frac{\gamma^{\frac{1}{1-\alpha}} w_1^{\frac{\alpha}{1-\alpha}-1}}{b^{(1/\sigma)}\Phi(w_1)^{\frac{(1-\alpha)}{\alpha}\frac{(\sigma-1)}{\sigma}-1}},$$

adjusting for the economies of scales and the love component of married couples. Again if $\sigma = 1$, leisure is independent of spouses wages. If $n_1 = 1-\ell$, both a change in the primary earner's wages, as well as the secondary earner's wages will have an effect on the leisure allocation. A change in w_1, leads to a fall in leisure with $\sigma > 1$

$$\frac{\partial \ell}{\partial w_1} = -\frac{\sigma-1}{\sigma}\frac{\phi^{\frac{\sigma-1}{\sigma}}}{b^{(1/\sigma)}}\frac{w_2\,(w_1)^{-1/\sigma}\,\Phi(w_2)^{\frac{\alpha+\sigma-1}{\alpha\sigma}}}{(w_1+w_2)^{(2\sigma+1)/\sigma}b^{(1/\sigma)}} < 0,$$

and no effect with $\sigma = 1$. Similarly,

$$\frac{\partial \ell}{\partial w_2} = \frac{\sigma-1}{\sigma}\left\{\left(\frac{w_1}{w_1+w_2}\phi\right)^{\frac{(\sigma-1)}{\sigma}} \frac{\gamma^{\frac{1}{1-\alpha}} w_2^{\frac{2\alpha-1}{1-\alpha}}\Phi(w_2)^{\frac{\alpha+\sigma-1}{\alpha\sigma}}}{b^{(1/\sigma)}} + \frac{\phi^{\frac{\sigma-1}{\sigma}}}{b^{(1/\sigma)}}\frac{w_2\,(w_1)^{-1/\sigma}\,\Phi(w_2)^{\frac{(1-\alpha)}{\alpha}\frac{(\sigma-1)}{\sigma}}}{(w_1+w_2)^{(2\sigma+1)/\sigma}b^{(1/\sigma)}}\right\} > 0.$$

The effect on leisure has now two parts, where the first is similar to the single agent problem, and the case with one working spouse, and the second term is related to the complementarity in leisure of husband and wife. As the secondary worker's wages increase the wage difference between w_1 and w_2 falls, leading to a fall in $\frac{w_1}{w_1+w_2}$, and, therefore, a larger leisure time allocation.

The comparative statics for a married household with one primary worker in labor, are also qualitatively identical to the single/divorced household problem.

$$\frac{\partial n_1}{\partial w_1} = 2\left\{\frac{\alpha\gamma^{\frac{1}{1-\alpha}} w_1^{\frac{\alpha}{1-\alpha}-1}((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}}(1-\ell)}{(1-\alpha)\Phi(w_1)^2} - \frac{\partial \ell}{\partial w_1}\frac{(\gamma w_1^{\alpha})^{\frac{1}{1-\alpha}}}{\Phi(w_1)}\right\}.$$

Also note, in the case of log-preferences, with one working spouse,

$$\frac{\partial n_1}{\partial w_1} = \frac{\alpha \gamma^{\frac{1}{1-\alpha}} w_1^{\frac{\alpha}{1-\alpha}-1}}{(1-\alpha) b \Phi(w_1)^2} \left[((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} \right].$$

For a secondary worker, again the labor allocation depends on both spouses wages.

$$\frac{\partial n_2}{\partial w_1} = \left(\frac{w_1}{w_1+w_2}\phi \right)^{\frac{(\sigma-1)}{\sigma}} \left[\frac{1}{b^{(1/\sigma)}\Phi(w_2)^{\frac{\alpha+\sigma-1}{\alpha\sigma}}} \right]$$
$$\left\{ \frac{\sigma-1}{\sigma} \left(\frac{w_2}{w_1+w_2}\phi \right) \left[\frac{1}{w_1}(\gamma w_2^{\alpha})^{\frac{1}{1-\alpha}} - ((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} \frac{1}{w_2} \right] - ((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} \frac{1}{w_2} \right\},$$

the first term in the last brackets, is the rise in market hours worked by the secondary worker due to the fall in leisure hours $\left(\frac{\partial \ell}{\partial w_1} > 0\right)$, with the complementarity in leisure between spouses. The last term is the time devoted to home production rather than market work with the fall in leisure. For a rise in secondary workers wages, we have again the substitution and income effects,

$$\frac{\partial n_2}{\partial w_2} = \frac{\left[(\gamma w_2^{\alpha})^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1-\alpha} + 2\frac{w_1}{w_2} \right) + (1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} \frac{w_1}{w_2} \right] ((1-\gamma)A^{\alpha})^{\frac{1}{1-\alpha}} (1-\ell)}{w_2 \Phi(w_2)^2} - \frac{\partial \ell}{\partial w_2} \frac{1}{\Phi(w_2)}.$$

B Economies of Scales

The economies of scales are computed using the SIPP, individuals aged 25 to 34. It is assumed that the second adult adds 0.7 equivalent members to a household, each biological child adds 0.5, and stepchildren add 0.7 members to a household. [20]

[20] Since most children live with their mother in the data, economies of scale for divorced men are close to one using our scaling approach. For simplicity we, therefore, set the economies of divorced men equal to the single, never married men and women, $\phi = 1$.

Table VI: Children at Home and Economies of Scale by Marital Status and Gender

Marital Status	Own Children	Step Children	Other Children	Economies of Scale
Married	1.31	0.05	0.04	2.36
Married (Div Woman)	0.94	0.69	0.09	3.06
Divorced Man	0.26	0.02	0.01	1.13
Divorced Woman	1.28	0.00	0.04	1.64
Single Man	0.04	0.00	0.01	1.02
Single Woman	0.36	0.00	0.02	1.18

References