Marriage and Cohabitation *
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Abstract

Despite the large occurrence of cohabitation and its strong link to important behavioral outcomes, it has received little attention in the literature. We use data from the 1979 cohort of the National Longitudinal Survey (NLSY79) to document the labor supply, housework hours, and fertility patterns of cohabiting partners. The data suggests that in comparison to marriage, cohabitation is associated with a lower degree of household specialization, higher relationship instability, and greater degree of positive assortative mating. We develop and estimate a dynamic model of household formation and dissolution, fertility and labor supply and use the estimated model to perform policy experiments that investigate the welfare implications of different institutional arrangements regarding divorce regulations. In a dynamic model of the household with limited commitment, marriage leads to equilibrium outcomes that are closer to the efficient allocation when there are gains from specialization. On the other hand, cohabitation enables partners to insure themselves against uncertainty regarding the match quality of the relationship. Each match has different gains from either living arrangement, depending on their observable characteristics, and match quality. Cohabitation provides a tradeoff between the advantages and disadvantages of getting married and remaining single. Our goal is to use the estimated model to assess the welfare implications of inefficiencies that may arise in co-residential relationships due to lack of commitment.

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1 Introduction

The number of unmarried couples living together has increased significantly between 1960 and 2000. Today, there are 9.7 million Americans living with an unmarried different-sex partner. More importantly, empirical evidence from the NLSY 1979 cohort shows that marital stability, labor supply, and fertility of men and women differ considerably by whether they are cohabiting or legally married. This suggests that cohabitation constitutes a separate state of union to marriage, either in terms of the different characteristics of couples who choose to cohabit, or as a different institutional framework that changes the way in which partners interact. For example, it is legally more difficult for married partners to separate than cohabiting partners. Moreover, married couples face a different tax schedule than single and cohabiting individuals do. In this paper, we study the welfare implications of family policies, such as divorce regulations and marriage tax benefits (or penalties), on intra-household allocations, fertility, household formation and dissolution patterns.

Using the 1979 cohort of the National Longitudinal Survey (NLSY79), we find that in comparison to marriage, cohabitation is associated with a lower degree of household specialization, higher relationship instability, and greater degree of positive assortative mating. In other words, married women work less than single women, but that the difference between cohabiting women and single women’s labor supply is statistically insignificant. A similar analysis for men reveals that both cohabiting and married men tend to work more than single men, with married men working more than those cohabiting. Patterns of marital sorting are quite different for cohabiting unions compared to married unions. For example, in cohabiting unions partners are much more similar to each other in terms of education levels, compared to partners in married unions.\footnote{A detailed exposition of these empirical facts including the controls included in these analyses can be found in the data section.}

This paper contributes to a growing literature in economics and demography on marriage and cohabitation in relation to household formation, dissolution and labor supply.\footnote{Brien, Lillard and Stern (2006) study cohabitation decisions and find that individuals cohabit in order to learn about their potential partners and hedge against future bad relationship specific shocks. Choo and Siow (2005) investigate marriage and cohabitation behavior in Canada. Blau and van der Klaauw (2006) investigate the effect of labor market and policy variables on the family structure experience of children. Blau and van der Klaauw (2010) analyze the determinants of family structure. Light and Omori (2008) use NLSY 1979 data to analyze the economic determinants of marriage, cohabitation and divorce, and Light (2004) investigates the effect of marriage and cohabitation on total family income. Reinhold (2007) investigates the relationship between premarital cohabitation and subsequent marital instability, and more importantly, how this relationship has changed significantly over time. Chade and Ventura (2004) analyze the equilibrium and welfare effects of income taxation on marital decisions, and allow for the possibility of cohabitation as an alternative to marriage, but they do not model labor supply or fertility decisions.} The goal of this paper is to assess the implications of family policies, such as divorce regulations and
marriage tax benefits (or penalties), on intra-household allocation, fertility, household formation and dissolution patterns. In order to do this, we develop and estimate a dynamic model of household formation and dissolution, fertility and labor supply and use the estimated model to perform policy experiments that investigate the welfare implications of different institutional arrangements regarding divorce regulations. The point of departure from the previous literature is that we take into account the intermediate stage of non-marital cohabitation. In other words, for many couples the choice is not just between being married and remaining single, but there is a third option that is non-marital cohabitation, which offers a different combination of the advantages and disadvantages associated with getting married and remaining single.

There are various ways in which cohabitation may differ from legal marriage. For example, there are significant differences in the legal regulations unmarried cohabitants and married couples face in the United States. The first important distinction is that unmarried cohabitants do not need to follow strict procedures to dissolve the living arrangement. This leads to an important feature of cohabitation, which is that it enables partners to take advantage of the benefits of living together, without the commitment that legal marriage requires. For example, Brien, Lillard and Stern (2006) show that the lower cost of separation makes co-residential relationships attractive for couples, as it gives the opportunity to hedge against future bad shocks to the relationship quality while taking advantage of benefits of living together such as joint consumption of a public good, returns to specialization, and children. However, the lack of commitment in a cohabiting relationship relative to marriage has disadvantages, as the increased chance of dissolution may prevent the couple from fully realizing some of these benefits. Therefore, the option of cohabiting rather than being married and remaining single has advantages and disadvantages relative to the other options. The second distinction is that cohabiting partners face a tax schedule that is different from married couples. Married couples are taxed based on their joint income, which, depending on the income levels, may lead to higher or lower tax payments than the two partners would pay separately. Cohabiting couples on the other hand face the same tax schedule as single individuals does.

In the model, in each period a single individual meets a potential partner with an exogenous probability and decides whether he/she is going to continue being single, start cohabiting with the partner, or get married. In addition to their relationship, the agents choose in each period how to divide their time between housework, labor market work and leisure, and whether to have children or not. Working at a given period increases their human capital, and hence future wages. The presence of children increase the productivity of housework and therefore increase the relationship surplus. Agents face uncertainty regarding their earnings, their match quality if they are in a relationship, and whether they will have children. In order to characterize the allocations chosen by married/cohabiting individuals, we employ the collective household model
in a dynamic framework with no commitment so that couples cooperate but they are unable to commit to future allocations as in Mazzocco and Yamaguchi (2007). For the couple’s problem, we make the assumption that the outcomes to the household’s allocation problem are constrained efficient so that the solution to the couple’s problem is obtained by using a Pareto problem with participation constraints. Due to lack of commitment, the share of the total household resources that a partner receives is subject to change depending on his/her outside option each period. In addition, the partners are not able to commit to not separate in the future, and face uncertainty regarding future marital instability. This gives rise to inefficiencies within the relationship since (1) Household members cannot contract over transfers to be made in the future periods of the relationship, (2) Household members cannot make conditional transfers for future separation states. The potential for inefficiencies is higher for higher levels of probability of separation. Holding everything else constant, this probability is higher for a cohabiting couple as their cost of separation is lower. The size of the efficiency concerns depend on the home production technology and preferences. We consider different specifications for the home production technology in the paper.

Gains from living together in the model are: (1) Joint consumption of a public good, (2) Specialization in home production and market work, (3) A match-specific benefit, which is observable to the partners, but is subject to change as the relationship progresses and (4) the ability to have children. The extent to which each of these gains are realized depends on whether the couple chooses to cohabit or get married. The tradeoff that the couple faces in making this choice is as follows. Cohabitation allows the partners to benefit from living together, without the requirement to face legal separation costs in the event of negative match specific shocks. Marriage makes future separation more costly, and this enables the agents to fully specialize. This also has implications on the degree of positive assortative mating for cohabiting unions in comparison to marital unions. This is because the substitution possibilities in the time inputs of the spouses in the household production function translates into different mating patterns depending on the degree of commitment. In this case, patterns of marital sorting observed in the data are strongly linked to the intra-household decision process, as in Del Boca and Flinn (2006).

We are interested in the welfare implications of partners’ inability to make binding agreements. Inefficiencies may arise in relationships due to lack of access to a commitment technology. However, more importantly, individuals can choose the degree of commitment they have access to in their relationship, through choosing between marriage and cohabitation. These choices depend on their observable and unobservable characteristics, the characteristics of their potential

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3Lundberg and Pollak (2001) conduct a detailed analysis of inefficiencies that may arise in marriage, due to lack of commitment.
matches, the quality of their match, as well as preferences and the home production technology. In this paper, we develop a framework that allows us to control for such selectivity into different living arrangements (marriage, cohabitation, remaining single).

We structurally estimate the model using data from the 1979 cohort of the National Longitudinal Survey (NLSY79) and the Panel Study of Income Dynamics (PSID), which have detailed information on relationship and wage histories, as well as labor market and housework hours of partners. The model is estimated by simulated method of moments, which minimizes a weighted average distance between a set of sample moments and moments simulated from the model.

The paper is organized as follows. In Section 2, we present a two-period version of the full model in order to analyze the main channels at work. In Section 3, we present the details of the full model. Section 4 presents the data. Section 5 gives the estimation method. Section 6 presents the estimation results. Section 6 describes the results of a policy experiment where we decrease the cost of divorce, and Section 7 concludes.

2 A Two-Period Model of Marriage, Cohabitation and Labor Supply

In this section, we solve a two-period version of the full dynamic model in order to demonstrate the main channels at work. Consider an economy made up of individuals who live for two periods. Each individual is endowed with a wage $w_i$. In each period, the agents get utility from their private leisure, $l_i$, and the consumption of a public good $Q$. Agents who choose to live together also get utility from their match specific quality, $\theta$, which is revealed to them in the second period.

Utility in the first and second period is strongly separable in the private leisure and public good, and is given by,

$$u_{i,1}(l_{i,1}, Q) = \frac{l_{i,1}^{1-\sigma_l}}{1-\sigma_l} + \frac{Q_1^{1-\sigma_Q}}{1-\sigma_Q} i = m, f$$

$$u_{i,2}(l_{i,2}, Q) = \frac{l_{i,2}^{1-\sigma_l}}{1-\sigma_l} + \frac{Q_2^{1-\sigma_Q}}{1-\sigma_Q} + \theta i = m, f$$

where $\theta$ is the quality of the couple-specific match. The public good $Q$ is produced with a household production technology which uses the time inputs of the spouses, $d_m, d_f$, and a good, $g$, purchased in the market at a price normalized to 1. Expenditure on the market good $g$ is given by the sum of the total income of the household, so that $g = w_m h_m + w_f h_f + Y$, where $Y = Y_m + Y_f$ is the household’s total non-labor income. The agents divide their time between market work and housework, and leisure. The home production technology is,

$$Q = (d_m^\nu + d_f^\nu)^{1/\nu} g$$
so that the home production technology exhibits increasing returns to scale. In the following section, we consider the implications of different specifications for the production technology, with varying values of $\nu$ which govern the different substitution possibilities between the time inputs ($d_m$ and $d_f$) of the partners. When the agent lives alone, $Q$ is produced with the following home production technology,

$$Q^s = d^s_i g^s_i \quad i = m, f$$

The timing of the two period model is as follows. Each individual $i$ starts the first period as a single agent endowed with wage $w_i$. At the beginning of the period each agent meets a partner with a wage endowment $w_j$ with an exogenous probability $P_{w_i}(w_j)$. The potential partners then decide whether they are going to cohabit together, get married or remain single for that period. At the beginning of the second period, if they are married or cohabiting, they observe their couple-specific match quality and decide whether they are going to stay together or separate. If they start the second period as single agents (which happens if they choose to not match with the partner they met at the beginning of the first period), they only make decisions regarding how to divide their time between market work, home production and leisure in the second period.

We solve the model backwards, starting with the decision problem in the second period. First consider individuals who are single agents in the second period. They can be in the single state in the second period through one of the following ways: (1) They started the period as single, (2) They started the period in a relationship, but chose to separate after observing the match quality $\theta$. The value of being a single agent for person $i$ in period 2 is determined by the solution to the following problem,

$$\max_{h_{i,2},d_{i,2}} \quad u(l_{i,2}^S, Q_{i,2}^S)$$

s.t.

$$Q_{i,2}^S = d_{i,2}^S g_{i,2}^S$$

$$g_{i}^s = w_i h_{i,2}^s + Y_i$$

$$T = h_{i,2}^s + d_{i,2}^s + l_{i,2}^s$$

Now consider individuals who are in a relationship (cohabiting or married) in the second period. Once the match quality is realized, the time allocation of the partners is determined as
the solution to the following problem,

\[
\max_{h_{m,2}, d_{m,2}, h_{f,2}, d_{f,2}, \xi} \quad \mu u(l_{m,2}, Q_2) + (1 - \mu)u(l_{f,2}, Q_2)
\]

s.t.

\[
Q_2 = Q = (d'_{m,2} + d'_{f,2})^{\frac{1}{v}} g_2
\]

\[
g_2 = w_{m,2}h_{m,2} + w_{f,2}h_{f,2} + Y_i
\]

\[
T = h_{i,2} + d_{i,2} + l_{i,2} \quad i = m, f
\]

\[
u(l_{i,2}, Q_2) + \theta \geq u(l_{i,2}^S, Q_2^S) + \kappa
\]

where \(\kappa\) is the separation penalty (with \(\kappa < 0\)), and is equal to \(\kappa_C\) if cohabiting and \(\kappa_R\) for married couples. Given the Pareto weight from the previous period, \(\mu\), the couple maximizes the above problem with respect to their labor market and housework hours as well as relationship status \(\xi\). Let \(\Omega_2 = \{\mu, w_{m,2}, w_{f,2}\}\), so that the optimal solution is \(\{h_{i,2}^*(\Omega_2), d_{i,2}^*(\Omega_2), Q^*(\Omega_2), \xi^*(\Omega_2)\}\).

The wages in the second period are determined by the human capital that is accumulated in the first period. For an agent that works for \(h_{i,1}\) hours in the first period, his second period wages are augmented by that amount,

\[
w_{i,2} = w_{i,1} + \gamma h_{i,1}
\]

In the beginning of the second period, for married/cohabiting partners, the value of match quality \(\theta\) is revealed and each partner decides, given the current weight \(\mu\) determined in the first period, whether or not to stay in the relationship, or to separate. If they separate, each partner becomes single and receives utility from consumption of leisure and the public good as a single person, and also incurs the separation penalty denoted by \(\kappa_M\), if they are married, and \(\kappa_C\) if they are cohabiting.

If the participation constraint binds for both of the partners, they separate. If the participation constraint binds for only one partner, the planner weight for that partner is increased to the point where he or she is indifferent between staying and leaving, as in Marcet and Marimon (1998) and Mazzocco and Yamaguchi (2007). If there is no weight that satisfies both participation constraints, the couple separates. This occurs whenever the total surplus generated outside the relationship, minus the separation penalties, is larger than what can be achieved within it.

The planner solves the second period time allocation problem using updated Pareto weight
\tilde{\mu}, which is determined by the following rule,

\[
\tilde{\mu} = \begin{cases} 
\mu & \text{if } u(l^{*}_{i,2}, Q^*_2) + \theta > u(l^{S}_{i,2}, Q^S_2), \quad i = m, f \\
\bar{\mu} & \text{if } u(l^{*}_{m,2}, Q^*_2) + \theta < u(l^{S}_{m,2}, Q^S_2) + \kappa \\
\mu & \text{if } u(l^{*}_{f,2}, Q^*_2) + \theta < u(l^{S}_{f,2}, Q^S_2) + \kappa 
\end{cases}
\]

where \(\mu\) is the weight at which the solution to the planner’s problem is solved with a binding participation constrain for the male,

\[
u(l_{m,2}, Q_{2}) + \theta = u(l^{S}_{m,2}, Q^S_{2}) + \kappa
\]

and \(\bar{\mu}\) is the weight at which the solution to the planner’s problem is solved with a binding participation constrain for the female,

\[
u(l_{f,2}, Q_{2}) + \theta = u(l^{S}_{f,2}, Q^S_{2}) + \kappa
\]

Now we specify the agent’s problem in the first period. Every agent in the economy starts the first period as single. They meet a partner with wage \(\bar{w}\) with an exogenous probability denoted by \(P_{w}(w_j)\). An individual with \(w\) then solves the following problem to decide whether he/she is going to get together with the person she meets (either through cohabiting or getting married). Consider an agent who is endowed with wage \(w_i\) and meets a partner with wage \(w_j\). In the first period, the solution to the following problem characterizes the optimal hours allocation of the couple conditional on forming a relationship, either cohabiting or married. If setting the Pareto weights in the first period at \(\mu = \frac{1}{2}\) induces both partners to enter the relationship rather than remain single, then we set \(\mu = \frac{1}{2}\). Otherwise, we increase the weight on the agent who would prefer to remain single until the point at which he or she is indifferent between remaining single and entering into the relationship. Having determined the weight \(\mu\), the planner solves the following problem:
The couple maximizes the above problem with respect to their labor market and housework hours as well as relationship status $\xi$. So that:

$$V_{i,1}(w_m, w_f) = u(l^*_i(w_{m,1}, w_{f,1}), Q^*_i(w_{m,1}, w_{f,1})) + \theta + \beta V_{i,2}(\mu, w_{m,1}, w_{f,1}) \quad i = m, f$$

The couple does not observe their match specific quality $\theta$ until the beginning of the second period, so $\theta$ does not enter their problem in the first period.

For a fixed Pareto weight, it is straightforward to derive the closed form solution to the hours choices of the couple in terms of their wages and the parameters of the mode. However, the participation constraints in the second period make the analytical solution less tractable, so we solve the above two period model numerically by discretizing the choice variables of hours. Our main goal here is to demonstrate the implications of limited commitment and household specialization concerns on sorting and living arrangement patterns for different parameter values and different specifications for the home production technology. The parameters of the two period model and the values used for plotting the decision rules are displayed in Table 1. These are not estimated parameters. We plot the decisions rules for the agents for different functional forms for the production technology that specify different substitution possibilities between the time inputs of the spouses into home production. Before we go on to the solution of the two period model, we briefly outline the channels at work in the model.

In the model, the gain from marriage/cohabitation stems from joint consumption of a public good in the household, increasing returns to scale property of the home production technology and potential gains from specialization due to comparative advantage of the spouses in the labor market if they have differing wages. These generate positive economic gains from marriage in the sense that the output the partners generate together is greater than the sum of the outputs that the partners can obtain separately. However, the extent to which each of these gains are realized depends on whether the couple chooses to cohabit or get married. The tradeoff that the couple faces in making this choice is as follows. The couple faces uncertainty regarding their match quality, and this uncertainty is resolved at the beginning of the second period: (1) Cohabitation
provides an opportunity to hedge against a possibly negative match quality in the second period. Therefore, cohabitation allows the partners to benefit from the advantages of living together, without the requirement to face legal separation costs in the event of negative match specific shocks, (2) Marriage makes future separation more costly, and this might enable the agents to achieve a higher level of total surplus through full specialization. The reason for this is the fact that the couple cannot commit to not separate in the second period. However, legal marriage can be viewed as a device to make separation more costly for the partners.

The *ex ante* efficient solution entails full specialization within the household when the partners have different wages. If the couple is unable to make binding commitments to not separate in the future, then they will adjust their period 1 behavior to reflect an expected future separation. The partners’ time in period 1 is divided between market work, and production of a household public good. If they cannot commit to a division of second-period household surplus that compensates the home worker for foregone earnings power, then the family will choose an inefficient level of specialization, and produce too little of the public good. Cohabitation makes this intertemporal commitment more difficult. The lower degree of commitment in a cohabiting relationship can therefore be expected to lead to increased employment rates of women and lower household specialization. On the other hand, the increased labor market opportunities of women might also contribute to increased cohabitation rates, as the equalization of men and women in the labor market means the decline of comparative advantages and hence lower gains from specialization. Marriage moves the family to a more efficient level of production, however this benefit of marriage diminishes with decreasing comparative advantages in the labor market.

### 2.1 Solution of the Two-Period Model

There are two important predictions of the model that we investigate looking at the decision rules of the agents: (1) Labor market hours, (2) Living arrangements (marriage, cohabitation or living alone), (3) Sorting patterns in terms of the wage endowments of males and females. Depending on the parameter values, the prediction of the model is that all three are strongly influenced by the differing degrees of commitment between marriage and cohabitation, as well as the choice of whether to live alone or with a partner. All decision rules considered are those pertaining to the first period and their arguments are the wage pair of the potential match that meets at the beginning of the period, \( w_m, w_f \). In the model, each agent with \( w_i \) meets a potential partner with wage \( w_j \). They then choose hours of work as well as whether they will cohabit, get married or remain single.
2.1.1 Specification 1

We first consider a home production technology where: (1) Housework hours of partners are perfect substitutes, (2) The technology exhibits increasing returns to scale so that, for example, doubling the inputs of home production and market purchases raises the output by a factor more than two. The home production technology is,

\[ Q = (d_m + d_f)g \]

Given this home production technology, the efficient allocation for a couple with differing wages is for the higher wage partner to specialize labor market, and the lower wage person to specialize in home production. However, under limited commitment, this efficient allocation might not be achieved. For example, in a match in which the female has the lower wage, the efficient outcome would have her work in home production. However, when she works at home in the first period, she foregoes higher wages in the second period, decreasing the value of her outside option. Without commitment, the male is not able to compensate her for this with future period transfers. Because of the high separation penalty, marriage is associated with a greater degree of commitment and more specialization.

In Figure 1 we plot labor market and housework hours for the male partner against his wage in the first period, averaging over the possible values of female wage. In this parameterization, the cohabitation penalty is fixed at zero and the marriage separation penalty is sufficiently high that no married couples end up divorcing in the second period. This higher level of commitment for married couples allows a higher degree of specialization in the first period. The male partner specializes in housework at low wages and labor market work at high wages. On the other hand, for those couples who choose to cohabit, the degree of specialization is lower, with much less variation in hours for different wages.

In Figure 2 we plot their decision rules regarding relationship status after they meet in the first period against the wage pairs of each potential match. The plot shows that couples who end up cohabiting are those with similar wage endowments, who stand to benefit less from specialization. Matches with larger wage differentials choose to marry instead to take advantage of the increased specialization that comes with stronger commitment. When both partners have very high wages, neither wishes to forego the benefits of working in the labor market so the gains to specialization are smaller and we see a widening of the region in which the couple chooses to cohabit.
2.1.2 Specification 2

The decision rules discussed above are sensitive to our specification of the home production technology in this specification. To illustrate this we consider an alternative home production technology. The second specification we consider is the following:

\[ Q = \left( d_m^{\nu} + d_f^{\nu} \right)^{\frac{1}{\nu}} g \]

where \( g = w_m h_m + w_f h_f + Y \) and \( \nu \) governs the elasticity of substitution between the housework time inputs of the spouses in the production technology. Compared to the previous specification, this specification nests different degrees of substitution possibilities between the time inputs of the spouses, so that we allow for concavity and some complementarity between partners’ time use depending on the value of \( \nu \). In this case the optimal allocation of hours in the household does not necessarily entail full specialization, and interior solutions will arise. The partner with high wages will still work more in the market. However, in this case, the gains from specialization are smaller. Figure 4 contains the graph of the matches formed given the wage pairs under this home production technology. Compared to the previous specification, there is far more cohabitation and far less marriage. Only for those couples with very large wage differentials do the gains from specialization outweigh the utility loss from being less able to dissolve a match that turns out to be of low quality.

In Figure 3, we plot the hours for male partner against his wage in the first period in this specification of the model, again averaging over the possible values of female wage. For cohabiting couples, for most wage values, labor market hours simply increase in response to increasing wage, with a simultaneous decrease in housework hours. For married couples, the time allocation is dominated by the selection effect. Since the only couples that marry are those with large wage differentials, we see a sudden jump in labor market hours and a corresponding decrease in housework hours as we pass from a region of low-wage males and high high-wage females to one in which high-wage males are paired with very low-wage females.

3 Full Model

Agents make decisions regarding relationship status, employment, and fertility in each period. At each age \( a \), a single individual chooses the following: hours of labor market work \( (h_a) \), hours of housework \( (d_a) \), and whether to cohabit or marry (if he/she meets a potential partner) or continue search as a single person. When married, the individuals jointly choose: hours of labor market work and housework of both spouses, whether to become pregnant or not (if at a fecund age), and whether to stay married or separate. When cohabiting, individuals face the same
alternatives as when they are married, with the addition of the decision to get married or not.

In the model, differences in latent types lead to differences in wages as well as their marriage utilities.

### 3.1 Preferences

The individual’s utility flow depends on his/her private leisure, public good consumption (produced by a intra-household production process with domestic labor supplies of the partners as inputs if married or cohabiting, private if single), number of children, and match quality (if married). The utility function of an individual of latent type $j$ is given by,

\[
    u(l_i, Q, n_{i0}, n_{i1}, \theta_{ia}, \xi_a, j) = \\
    \alpha \log(l_i) + (1 - \alpha) \log(Q) + 1\{\xi_a = c \text{ or } \xi_a = m\} \theta_{ia} \\
    + u_{MAR}(j)1\{\xi_a = m\} + a_0 \sqrt{n_{i0}} + a_1 \sqrt{n_{i1}} \\
    + 1\{\xi_{a-1} = m, \xi_a = s\} \kappa_m + 1\{\xi_{a-1} = c, \xi_a = s\} \kappa_c
\]

where $l_i$ is leisure, $Q$ the quantity of the public good produced in the household, $\theta_a$ the match quality. The utility of marriage relative to cohabiting, $u_{MAR}(j)$, is allowed to depend on the latent type. $\xi$ denotes the relationship status and takes on three values: marriage, cohabitation, and being single. $\kappa_M$ and $\kappa_C$ indicate the cost of separating for a married couple and a cohabiting couple, respectively, so that the separation cost is determined by the relationship status in the preceding period ($\xi_{a-1}$).

We also make a distinction between the number of children each individual had prior to meeting their current partner, and the number of children they have with their current match. The child utility is different depending on the current living arrangement of the parents. $n_{i0}$ represents the number of children the agent has from a previous relationship but does not live with, $n_{i1}$ the number of children the agent does live with, either from the current relationship or a previous one. We assume that children of dissolved relationships live with their mothers so that mothers always live with all their biological children. Fathers do not live with children from previous relationships. If currently not living with the child, the father’s valuation of the child will be different as he may be less able to spend time with the child.

### 3.2 Fertility and Children

Each period, married and cohabiting couples determine whether they want to try to have a child. Whether they do have an additional child the following period is a random event whose
probability is determined by this choice.

3.3 Labor Market

Given their marital status, education, labor market experience, and home production, agents decide the number of hours they will work in the labor market. Working in a period more than a certain number of hours ($\bar{H}$) increases the individual's measured by labor market experience by 1 period and this increases the individual's future wages. The wage of an individual depends on his/her age ($a$), gender and education ($ed$) and is given by:

$$\ln w_a = \gamma_0(j) + \gamma_1 male + \gamma_2 ed + \gamma_3 a + \gamma_4 a^2 + \gamma_5 \varepsilon_a$$

where $\varepsilon_a$ is stochastic component of human capital, that follows a Markov process with transition probabilities determined by the number of hours worked: $\pi^e(\varepsilon_a, \varepsilon_{a+1}, h_{ia})$. This lets us capture the effect of working versus staying home on the accumulation of human capital. $a\gamma_0(j)$ and $\gamma_1$ determine gender and type-specific intercept for a person of type $j$, so that differences in the wages obtained may differ due to different initial skill endowments or due to discrimination. We do not distinguish between the two cases.

3.4 Marriage Market and Match Quality

Every period, with probability $p$, a single individual meets a potential partner. If the individual is of latent type $j$, has education $e$, children $n$ (education), and stochastic component of wages $\varepsilon$, we label him/her as type $(e, \varepsilon, n, j)$. The probability that the potential partner is of type $(\tilde{e}, \tilde{\varepsilon}, \tilde{n}, \tilde{j})$ is given by

$$f(e, \tilde{e}, \varepsilon, \tilde{\varepsilon}, n, \tilde{n}) \over \sum_{\tilde{e}, \tilde{\varepsilon}, \tilde{n}} f(e, \tilde{e}, \varepsilon, \tilde{\varepsilon}, n, \tilde{n})$$

where

$$f(e, \tilde{e}, \varepsilon, \tilde{\varepsilon}, n, \tilde{n}) = (1 - \omega_1(\varepsilon - \tilde{\varepsilon})^2) \cdot (1 - \omega_2 1\{e \neq \tilde{e}\}) \cdot (1 - \omega_3 1\{\{n > 0\} \neq 1\{\{\tilde{n} > 0\}\}) \cdot (1 - \omega_4 1\{j \neq \tilde{j}\})$$

Once a potential partner is drawn, the potential couple then draws a match quality of the partnership, given by $\theta$. The couple then decides whether to marry/cohabit or whether to remain single and continue search. The problem that the couple faces when they are making this decision is outlined below in the household’s problem section. If they decide to get married or cohabit, their match quality follows a Markov process during the course of their relationship, so that in each period they draw a new match quality conditional on the match quality in the
previous period. As in Brown and Flinn (2006), we have a finite number of match quality values \( \theta_1, \ldots, \theta_M \). The probability of a match quality of \( \theta_j \) increasing to \( \theta_{j+1} \) is given by \( P^+_\theta \) if \( j < M \). The probability of a match quality of \( \theta_j \) decreasing to \( \theta_{j-1} \) is given by \( P^-_\theta \) if \( j > 1 \).

### 3.5 Home Production Technology

There is a public good that is domestically produced using the domestic labor supplies of the partners as inputs. The intra-household production technology is given by \( Q(d_m, d_f, g) \), where \( d_m, d_f \) are the partners’ number of housework hours and \( g \) is the amount of goods purchased in the market for the production of the public good. The output of the intra-household production process is not observable and is not marketable. At age \( a \), the public good is produced according to the following technology:

\[
Q_a = ((1 + \phi \sqrt{n_{HH}})D_a^\sigma + g_a^\sigma)^{1/\sigma}
\]

where \( g_a \) is the amount of market purchased goods, and \( D_a \) is the effective housework hours. \( D_a \) is defined as,

- Single Males: \( D_a = \delta_m d_{ma} \)
- Single Females: \( D_a = \delta_f d_{fa} \)
- Couples: \( D_a = ((\delta_m d_{ma})^\nu + (\delta_f d_{fa})^\nu)^{1/\nu} \)

### 3.6 Budget Constraint

The couple’s net income is given by the sum of their earnings and non-labor income, \( w_m^a h_m^a + w_f^a h_f^a + Y \). \( Y \) is the total non-labor income of the couple. For a single individual, net income is given by \( wh + Y \). Single individuals and cohabiting couples face a tax rate of \( \tau_s \), while married individuals face a tax rate of \( \tau_m \).

- Single Males: \( g_a = (1 - \tau_s)w_{ma}h_{ma}(1 - cc_m\sqrt{n_m}) \)
- Single Females: \( g_a = (1 - \tau_s)w_{fa}h_{ma}(1 - cc_f\sqrt{n_f}) \)
- Cohabiting: \( g_a = (1 - \tau_s)(w_{ma}h_{ma}(1 - cc_m\sqrt{n_m}) + w_{fa}h_{ma}(1 - cc_f\sqrt{n_f}))(1 - cc_j\sqrt{n_j}) \)
- Married: \( g_a = ((1 - \tau_m)(w_{ma}h_{ma}(1 - cc_m\sqrt{n_m}) + w_{fa}h_{ma}(1 - cc_f\sqrt{n_f}))(1 - cc_j\sqrt{n_j}) \)

where \( cc_m \) and \( cc_f \) is the proportion of income that a single individual spends as expenditures on children and is exogenous to the model. \( cc_j \) is the cost of children for a couple.
3.7 Household’s Problem

The problem of a cohabiting/married couple is as follows. The first best allocation to the couple’s problem can be derived by solving the following social planner’s problem:

\[
\max_{h_m,a,h_f,a,l_m,a,l_f,a,p_a} \mu_m \sum_a \beta^a u(l_{m,a}, Q_a, n_a, n_{m,a}, n_{f,a}, p_a, \theta_a; \varepsilon_{m,a}, \Omega_{m,a}, j) \\
+(1 - \mu_m) \sum_a \beta^a u_f(l_{f,a}, Q_a, n_a, n_{m,a}, n_{f,a}, p_a, \theta_a; \varepsilon_{f,a}, \Omega_{f,a}, j)
\]

The couple chooses the male and female labor market hours \((h_m, h_f)\) as well as their housework hours \((d_m, d_f)\), and whether to get pregnant that period or not \((p)\). The couple does not have access to a commitment technology, therefore we formulate the Pareto problem with participation constraints so that the problem becomes:

\[
\max_{h_m,a,h_f,a,l_m,a,l_f,a,p_a} \mu_{m,a} \sum_a \beta^a u(l_{m,a}, Q_{m,a}, n_a, n_{m,a}, n_{f,a}, p_a, \theta_a; \varepsilon_{m,a}, \Omega_{m,a}, j) \\
+(1 - \mu_{m,a}) \sum_a \beta^a u_f(l_{f,a}, Q_{f,a}, n_a, n_{m,a}, n_{f,a}, p_a, \theta_a; \varepsilon_{f,a}, \Omega_{f,a}, j)
\]

\[
\text{s.t.} \sum_{r=a} \beta^{r-a} u(l_{m,a}, Q_{m,a}, n_a, n_{m,a}, n_{f,a}, p_a, \theta_a; \varepsilon_{m,a}, \Omega_{m,a}, j) \geq \bar{V}_{m,a} \\
\sum_{r=a} \beta^{r-a} u(l_{f,a}, Q_{f,a}, n_a, n_{m,a}, n_{f,a}, p_a, \theta_a; \varepsilon_{f,a}, \Omega_{f,a}, j) \geq \bar{V}_{f,a}
\]

We can reformulate this problem in its recursive form using the approach of Marcet and Marimon (2000) and Mazzocco and Yamaguchi (2006) where they expand the set of state of variables by including a new state variable, \(M_{ia}\) that denotes the Pareto weight plus the cumulative sum of the Lagrange multipliers on the participation constraints at all periods from 1 to \(t\). Hence, whenever spouse \(i\)’s participation constraint binds, the weight on this utility function is increased. Divorce is an efficient outcome in this problem and it occurs whenever there are no more gains to staying married.

When a couple first meets, the initial Pareto weight is determined by a Nash bargaining problem that assigns both potential partners equal bargaining weight, where the outside option for both potential partners is to remain single.
4 Data

We use observations from the 1979 cohort of the National Longitudinal Survey of Youth (NLSY79), a nationally representative sample of 12,686 men and women who were 14-22 years old at the time of the initial 1979 survey. We focus on members of the cross-sectional sample, a group of 6,111 youths chosen to be representative of the non-institutionalized civilian segment of the United States population in that age group. Members of this sample was re-interviewed annually from 1979-1994 and bi-annually since then, the most recent available wave being in 2006, when members of the sample were aged 41-49. In each wave, it was determined for all un-married respondents whether they were living with a member of the opposite sex whom they identified as a “partner.” We therefore see all instances of marriage or cohabitation in which the couple are living together at the time of the survey.

The sample is 49.1% male. Racially, 12.3% of the sample identify themselves as black, and 7.3% as Hispanic. Approximately half (48.6%) have attended some college by the end of the sample period. Cohabitation is a extremely common for this cohort with 38.4% of the sample cohabiting at some point during the survey period. Variation in cohabitation rates by race are small, with 38.1% of whites and 40.2% of blacks cohabiting at some point. Differences by education level are more pronounced with 33.6% of those with at least some college cohabiting compared to 43.0% of those with no college education.

Eighty-two percent of respondents enter into legal marriage during the sample period. Unlike cohabitation rates, there is significant variation in marriage rates by race with 85.7% of whites, 79.1% of Hispanics and just 60.7% of blacks marrying. Differences in marriage rates by education are small, 83.6% for those with some college compared to 80.7% of those without. Interestingly, we find that whether a respondent ever marries is uncorrelated with whether or not he or she ever cohabits.

Over the course of the sample period, we observe the respondents in 7,424 relationships with distinct partners. In 38.3% of these, the couple lives together un-married, either before or without ultimately getting married. Of all cohabiting relationships, 47% eventually result in marriage. Conversely, we observe that 23% of marriages begin as cohabiting relationships. The true number is likely higher as our tabulation excludes episodes of pre-marital cohabitation that were sufficiently short that respondent was not interviewed during the period. In Figure 5 and 6, we show the rates at which cohabiting couples marry, plotted against the length of the relationship. We disaggregated by race in Figure 5 and by education in Figure 6. For all groups, as the couple cohabits longer, the likelihood that they convert the relationship into a legal marriage decreases. Cohabiting whites are more likely than blacks or Hispanics to marry, as are those with some college compared to those without.

In Figure 7, we plot the rates of marriage and cohabitation by age for the different racial
groups. We see an high rate of relationship formation into the mid-twenties. By age 24, 8-9% of
the sample is cohabiting, with significantly higher fractions of the group married: 44% for whites,
40% for hispanics and 25% for blacks. As the cohort ages into their late 20's, the percentage of
white respondents who are married continues to rise steadily but the growth of married blacks
and hispanics, while still positive, slows dramatically. Looking at the cohabitation rates during
these years, we see that the relative increase in marriage rates among whites is balanced by a
relative increase in cohabitation rates by blacks and Hispanics. Cohabitation rates among white
respondents peak at 8% at age 27, but continue to increase until age 32 for blacks and Hispanics,
peaking at 11% and 12% respectively. At older ages, all groups reach a steady state with 70%
of whites, 55% of hispanics, and 34% of blacks married. Cohabitation rates decline slowly from
age 30 until the end of the sample period, when they reach 5-7%.

We next wish to examine the difference in behavior between marital and cohabiting relation-
ship. The largest difference is that rate at which the the relationships dissolve. In Figures 8 and
9, we plot the hazard rate of relationship dissolution, defined as the probability that a married
or cohabiting respondent no longer identifies the current spouse/partner as a spouse or partner
in the following year’s interview. We plot this rate by the length of the relationship, and include
only observations before 1994, when the survey switched to a bi-annual format. The results are
dis- aggregated by race in Figure 8 and by education in Figure 9. In general, cohabiting rela-
tionships are roughly two to three times as likely as marital relationships to dissolve in a given
year. For both marriages and cohabitations, the relationships of white respondents are the least
likely to dissolve, those of black respondents the most likely. Respondents with at least some
college tend to have more stable marriages than those without.

Our model predicts that because cohabiting couples have a lower level of commitment and
are more likely to dissolve the relationship, they are less able to specialize. Traditionally, the
male partner specializes in labor-market production and the female partner in home-production,
so we hypothesize that married or cohabiting women should work less in the labor force and
more at home than single women, but that this effect should be stronger for married women. As
a simple descriptive test of this hypothesis, we regress the number of hours worked by women
on dummy variables for marital and cohabitation status, controlling for age and children and
including person-specific fixed effects. The results of this regression are shown in Table 4. We
find that married women do work less than single women, but the effect of cohabitation compared
to being single is statistically insignificant. A similarly specified regression for men reveals that
both cohabiting and married men tend to work more than single men, with married men working
more than those cohabiting.

The other important behavioral outcome of our model is time spent on home production. The
NLSY does not include information on hours worked at home. Instead, we draw information on housework hours from the Panel Study of Income Dynamics (PSID), a longitudinal study that began with 4800 representative households in 1968. Members of these households and of households formed by their descendants were re-interviewed every year from 1968 to 1996 and bi-annually thereafter. The core PSID sample consists of two independent samples: a cross-sectional national sample, known as the SRC (Survey Research Center) sample, and a national sample of low-income families, known as the SEO (Survey of Economics Opportunities) sample. In 1990 and 1997, a supplemental sample of Latino households and Immigrant families were added to the core PSID sample. The estimation sample used in this paper includes only those individuals who are associated with families from the SRC.

Ascertaining marital and cohabitation status is the PSID is not as simple as in the NLSY. For the years 1968-1977, the PSID does not make the distinction between marriage and permanent cohabitation, and identifies a respondent in either kind of relationship as “married.”. Starting in 1978, the survey records the legal marital status of the head, which can be used to distinguish between those who are legally married and those who are cohabiting. After 1993, the survey asks only for the legal marital status so it is no longer possible to distinguish a respondent who is single from one who is cohabiting using these questions.

Alternatively, starting in 1983, the PSID records in greater detail the relationship of each member of the household to the head. First-year cohabiters are identified by a special code, as are “permanent cohabiters,” defined as those cohabiters who have been in the household long enough to have appeared in an earlier wave of the survey. (Information such as hours worked that is collected for wives is also collected for permanent cohabiters.) From the relationship code assigned to the head’s wife or partner, we are able to construct an alternative measure of the relationship’s status.

For our tabulations, we use both approaches to identify married and cohabiting couples, using one if the other is ambiguous, and discarding the few observations where the two measures contradict each other.

The method by which we identify married and cohabiting couples does not let us clearly identify the relationship status of any observations before 1977. We also do not use observations after 1997, when the PSID switched from an annual to a bi-annual format. We use only heads of household and their wives or cohabiting partners. Finally, we restrict our analysis to the original SRC sample and eliminate those respondents for whom a relationship status is ever ambiguous.

This leaves us with a sample containing 170,637 observations of 12,048 distinct individuals between 1977 and 1997. Fifty-one percent of the sample is female, 18.1% have at least some

There is information on housework hours from a time-use survey, but this was conducted only in the 1981 wave.
college, 86.7% identify themselves as white and 10.5% as black.

During the years in which these respondents are surveyed, 45.4% are observed to be married and 9% to cohabit (these include the 6.1% who are observed both cohabiting and married). Because we do not observe typical respondents for as many years as those in the NLSY, these numbers are considerably smaller than the statistics from the NLSY. When broken down by race, we find that white respondents are much more likely to have been married than black respondents (47.5% compared to 29.6%) but just as likely to cohabit (8.1% of white respondents compared to 8.9% of black). Differences are much more pronounced when analyzed by education. Among respondents with at least some college, 75.5% are observed to be married at some point during the sample period and 13.4% to cohabit, compared to just 55.4% married and 10.9% cohabiting for those with less education. These patterns are similar to those observed in the NLSY79 cohort.

We next consider the choice of relationship status by the joint education status of couples. Among couples in which both members have at least some college, 6.4% cohabit at some point, including those who do or do not eventually marry. This statistic is similar, 6.9%, for couples in which neither partner has some college education. Among couples with different educational status, 11.5% of those in which the female has more education cohabit at some point compared with just 6.9% in which the male has more education. Couples in which the woman has more education than the man stand to gain particularly little from specialization into traditional gender roles. The fact that these couples are far more likely to cohabit than any other combination of education supports out hypothesis that couples who form cohabiting relationships are less motivated by the gains from specialization.

Having described the marriage and cohabitation patterns of our PSID sample, we consider the differences in housework hours between couples of different relationship status. Single men supply an average of 9.3 hours per week of housework compared to 14.4 for single women. In married couples, the wife performs an average of 23.9 hours of housework and the husband 7.2. The corresponding numbers for cohabiting couples are 17.1 hours for the female partner and 9.4 for the male partner, suggesting that cohabiting couples do engage in significantly less traditional gender specialization than married couples. To be more careful about other factors that might affect the division of housework, we regress the hours of housework for both partners on dummies for the relationship status, controlling for number of children, hours worked in the labor market by both partners, and person-specific fixed effects. The results of this regression are shown in Table 5. We find that in legal marriages, compared to cohabitation, the wife works an an additional 1.9 hours per week in the house and the husband 2.0 hours fewer. Thus our conclusion regarding the effect of the relationship status on specialization seems fairly robust.
5 Estimation Method

Estimation is carried out by simulated method of moments where the model parameters are chosen to minimize a weighted average distance between a set of sample moments and moments simulated from the model. The moments used in the estimation are listed below. Moments related to the couples’ labor supply behavior are as follows: 1) Hours worked and wages by age and education level, 2) Variance of wages, 3) Correlation between male and female education level in a cohabiting and married union, 4) Transition rates between different relationship states (single, cohabiting, married) by relationship length, 5) Number of children by relationship status, 6) Transition rates between relationship status, and having a child in subsequent periods. The method of moments estimator used is defined as follows:

$$\min g(\theta)'W_g(\theta)$$

(1)

The weights are the inverse of the estimated variances obtained from the micro-data, divided by the number of individuals that contribute to each moment. $g(\theta)$ is defined as follows:

$$g(\theta) = \frac{1}{N} \sum_{i=1}^{N} g_i(\theta) = [\bar{m}^1 - \mu^1(\theta), ..., \bar{m}^K - \mu^K(\theta)]$$

(2)

where $\{\bar{m}_1, ..., \bar{m}_k, ..., \bar{m}_K\}$ correspond to each of the data moments defined above, and $\{\mu_1(\theta), ..., \mu_k(\theta), ..., \mu_K(\theta)\}$ are the corresponding model moments. $N$ denotes the number of individuals in the sample.

6 Estimation Results

Below we present the estimation results. We made a number of choices in the estimation in the interest of keeping the problem at a manageable size for computation. We will be conducting sensitivity analysis to assess the implications of these choices.

We approximate the decision problem by using discrete distributions to represent distributions of the match quality $\theta$, and wage shocks $\varepsilon$. Following Kennan (2004), we specify a continuous distribution for each of the two shocks, and given the parameters of this distribution, we specify a discrete approximation to it. The estimation results are obtained by allowing for $n_\theta = n_\varepsilon = 3$ support points for the discrete approximation. We find that especially marriage and cohabitation rates can be sensitive to higher number of support points for the match quality distribution.

We also discretize the decision variable for labor supply. In the model, there are three choices regarding labor supply and housework hours. For labor supply, choices for daily hours are 0, 4
and 8, which correspond to not working, working part-time, and full-time. For housework hours, choices for daily hours are 0, 3, 6, and 9. These numbers are then translated into their weekly or annual counterparts in the data.

We use a grid for the Pareto Weights, $\mu$, also. The estimation results reported here are obtained by setting $n_{\mu} = 5$. We find that simulated moments are sensitive to the number of grid points allowed for the Pareto weight as well, although to a less extent than they are to the $\theta$ specification. Unobserved heterogeneity in utility of marriage and wages is introduced by allowing for two types.

### 6.1 Parameter Estimates

Tables 6 through 11 report the parameter estimates. Table 6 displays the home production technology parameters. The key parameters are $\sigma$ which governs the degree of substitutability between the market purchased goods and housework hours in the production of the public good; and $\nu$ which governs the degree of substitutability between the housework hours of males and females. Our estimates show that $\sigma$ is $-4.5$, so that market purchased goods and housework hours are close to complements. On the other hand, $\nu$ is 0.9, so that male housework hours and female housework hours are close to perfect substitutes. In the data, both cohabiting and married men work fewer hours in the house than women. When the technology is such that the production technology allows for higher degree of substitution possibilities between the housework hours of men and women, the comparative advantage created by the higher wages of men translates into household allocations that entail specialization. With limited substitution possibilities, we should observe men working as much in the house as women do, despite the fact that they have higher productivity in the labor market. On the other hand, with a production technology that exhibits the property of perfect substitutability between the housework hours inputs of men and women, we should observe men to be not working in the house at all. Neither of the last two scenarios hold in the data; men work less than women in the house, but they do work on average about 10 hours per week. Hence the estimation result is that $\nu$ is 0.9. The estimates also show that men have a comparative advantage in the labor market. Table 7 shows their wage intercept is estimated to be higher.

The transition probabilities that govern the evolution of the match quality $\theta$ is another key parameter in the model. In the data, the level of separation rates and also the pattern they follow over a relationship’s length are the key moments that identify the transition probabilities. Moreover, the degree of uncertainty faced in a relationship determines choices about whether to try to have children (since the partners get less utility from children they do not live with), as well as the degree of specialization partners can achieve in the household given their comparative advantages in the labor market and household. Table 8 shows that the probability of a positive
match quality shock, $p^+_{θ}$, is estimated to be 45%, while the probability of a negative match quality shock, $p^-_{θ}$, is 7%.

Table 8 also shows that meeting probability function is estimated as the probability of meeting someone with similar characteristics, so that each parameter in this function indicates the decrease in the probability of meeting a person if that person has characteristics that are considerably different than the agent. For example, a male with college education is 12% more likely to meet a female with college education, than he is to meet a female with high school degree.

The utility function parameters are $α$, weight on leisure, as well as $a_l$ and $a_n$ which are the utilities the agents get from a child living with the parent, and are presented in Table 11. There is also a utility cost associated with separation, and this is allowed to be different for cohabiting and married unions. Divorce penalty is estimated to be $-3.45$, while cohabitation separation penalty is 0.64. This means that there is in fact a positive utility associated with separating if the couple is cohabiting. In the estimated model, being in a relationship is risky as the probability of a negative match quality shock is very high at 45%. While marriage facilitates the achievement of an efficient production level of public good through specialization, this is not possible in cohabitation. The only way individuals will have an incentive to cohabit in the estimated model is then through the value that children provide for them (since they can only bear children if they are in a relationship) and its tax benefits, together with insurance benefits.

### 6.2 Model Fit

Below we present the within-sample fit for chosen moments in the estimation.

Figure 13 and Table ?? show that the model captures closely the age profile of hourly wages and number of hours worked in the labor market by gender and education. The model fits very well the profiles for high school and college educated males, as well as high school females. However, for college educated females, the model understates the hourly wages.

Figure ?? and Figure 10 show the marriage and cohabitation rates by age for males and females. The model fits reasonably well the marriage rates of females marriage rates of females by their education level. However, the marriage rates of males are overestimated by the model, especially for high school graduates. This is because the production function parameters are very closely linked to the incentives to get married and cohabit in the model, but they also closely govern the labor market hours and housework hours. For example, when the substitutability between the housework hours inputs of males and females in the home production technology is high, the efficient household allocation entails full specialization, given the higher labor market wages of males. However, in the data it is observed that males do not work 0 hours at home. They work positive amount of hours, albeit much less than women (on average, married males work 11 hours per week and married women with kids work 28 hours per week). Home production technology
parameters closely govern marriage rates, as well as housework hours and labor market hours. For example, when we run an experiment to make the housework hours of males and females more complements, so that we set \( \nu = -0.5 \), we observe that marriage rates fall and cohabitation rates increase considerably. When housework hours are complements, there are no gains from specialization. When housework hours are complements, the hours worked at home for both men and women increase considerably, as now men put more hours at home due to the fact that the marginal product of their hour input has increased relative to the labor market wages. Relationship gains in this case are more due to consumption complementarities rather than production complementarities, and marriage no longer has any advantages over cohabitation. In short, the close link between home production technology parameters to labor market and housework hours makes it difficult to match marriage rates as well as we would like.

7 Policy Experiments

The first policy experiment is to decrease the divorce penalty, which is estimated to be \(-3.45\). The model is well suited to study the implications of such a policy, as both labor supply, housework hours, as well as separation are endogenous outcomes, and are all influenced by divorce costs. With a fall in divorce penalty, marriage looks very similar to cohabitation. Figure ?? through ??, and Tables ?? present how moments simulated under this policy experiment look with respect to the baseline case.

Lower cost of separation makes cohabitation attractive for couples, as it gives the opportunity to hedge against future bad shocks to the relationship quality while taking advantage of benefits of living together which are the joint consumption of a public good, returns to specialization, and children. However, when divorce costs are low, cohabitation simply has no advantages over marriage, and in fact, cohabitation rates go to 0. This shows that the only reason couples cohabit rather than get married in this model is due to the insurance cohabitation provides for them in the case of a negative match quality shock. In the absence of it, those who decide to get together choose to marry rather than cohabit.

However, interestingly, marriage rates go down as well. In the estimated model, relationships carry a substantial amount of risk in terms of match quality, as the probability of a negative match quality shock is quite high, at 49\%, while probability of a positive match quality shock is very low at 7\%. Home production technology parameter estimates show that \( \nu \) is 0.9, so that housework hours of males and females are close to perfect substitutes. Moreover, there are substantial comparative advantages in the estimated model. Males log wage offers are higher, and female hours in the home production technology are much more productive (\( \delta_m = 17 \), while \( \delta_f = 34 \)). Hence, the \textit{ex ante} efficient solution entails full specialization within the household.
With lower divorce penalty, dissolution rates increase considerably, which leads to the household allocations to be further from the efficient allocation that entails specialization. Since they cannot commit to a division of future household surplus, and value of separation is now higher due to low divorce penalty, participation constraints bind more frequently, which lead to more frequent renegotiations. The home worker cannot be compensated for foregone earnings power, and the family chooses an inefficient level of specialization, producing too little of the public good. This decreases the value of marriage inducing lower marriage rates, as lower divorce penalty moves the family to a less efficient level of production.

The above explanation can be verified by looking at whether degree of specialization decreases under this policy scenario. The lower degree of commitment (which manifests itself in more frequent renegotiations where the bargaining power is updated), will also be expected to lead to increased employment rates of women and lower household specialization. Figure ?? and Table ?? show that this is indeed the case. When divorce penalty is lower, men work fewer hours in the labor market and women work more. Also, Table ?? shows that compared to the baseline, women work fewer hours at home. Table ?? also show that with higher dissolution rates, fertility decreases considerably. This is due to the fact that agents get less utility from their children once they are separated.

8 Conclusion

The results from the two-period model indicate that choices about non-marital cohabitation have important implications for patterns of marital sorting, and degree of specialization in the household. As returns to specialization fall, the number of cohabiting couples increase, and the degree of positive assortative mating falls for cohabiting unions. The level of the divorce penalty is a strong determinant of these patterns.

More importantly, our results indicate that the patterns of marital sorting by type of union formed, can have important information about the home production technology as well as the degree of commitment the couple has access to in their relationship. The simple two period model is able to generate the differences in the labor supply, housework hours and patterns of marital sorting of members of cohabiting and married unions that we observe in the data. We next estimate the full dynamic model in order to perform policy experiments, and assess the welfare implications of inefficiencies that may arise in co-residential relationships.
References


Table 1: Parameters used for the Decision Rules in the Two-Period Model

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<th>Parameter</th>
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Table 2: Spouse Differences in Hours Worked by Relationship Choice

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<thead>
<tr>
<th></th>
<th>Market Hours</th>
<th>Housework Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Cohabiting</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 1: Hours by Wage and Relationship Choice in First Period

Labor Market Hours by Wage

Housework Hours by Wage
Figure 2: Sorting Patterns by Relationship Choice
Table 3: Spouse Differences in Hours Worked by Relationship Choice

<table>
<thead>
<tr>
<th></th>
<th>Market Hours</th>
<th>Housework Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Cohabiting</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

Figure 3: Hours by Wage and Relationship Choice in First Period
Figure 4: Sorting Patterns by Relationship Choice
Figure 5: Proportion of Cohabiting Unions who Marry By Race

Figure 6: Proportion of Cohabiting Unions who Marry By Education
Figure 7: Marriage and Cohabitation Rates by Age
Figure 8: Proportion of Unions that Dissolve By Race

Figure 9: Proportion of Unions that Dissolve By Education
Table 4: **Regression of Hours Worked**
Dependent variable is the total number hours spent working in the previous calendar year at all jobs. The regression includes dummies for married or cohabiting households, with singles the excluded category. Individual fixed effects are included. The regressions for men includes 55,760 observations of 2,997 distinct respondents. The regressions for women includes 59,599 observations of 3,107 distinct respondents. Standard errors are in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>239 (3.2)</td>
<td>249 (3.3)</td>
</tr>
<tr>
<td>Age squared</td>
<td>-3.23 (.051)</td>
<td>-3.31 (.051)</td>
</tr>
<tr>
<td>one child</td>
<td>19.4 (13)</td>
<td>-416 (11)</td>
</tr>
<tr>
<td>two children</td>
<td>-7.1 (14)</td>
<td>-674 (12)</td>
</tr>
<tr>
<td>&gt;2 children</td>
<td>-33.8 (18)</td>
<td>-842 (16)</td>
</tr>
<tr>
<td>Married</td>
<td>168 (11.2)</td>
<td>-85.5 (9.0)</td>
</tr>
<tr>
<td>Cohabiting</td>
<td>127 (15.6)</td>
<td>-9.32 (14.5)</td>
</tr>
<tr>
<td>constant</td>
<td>-2302 (46)</td>
<td>-2565 (47)</td>
</tr>
</tbody>
</table>

$R^2$ = .19 .16
Table 5: **Regression of Housework Hours**

Dependent variable is weekly hours spent on household production, the answer to the question “About how much time do you [or does your spouse] spend on housework in an average week, I mean time spent cooking, cleaning and doing other work around the house.” The regression includes only married or cohabiting households, with cohabiting the excluded category. Household fixed effects are included. The regression for the wife’s hours includes 52,556 observations of 5,169 distinct households. The regression for the husbands’s hours includes 51,525 observations of 5,593 distinct households. Standard errors are in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Husband’s Hours</th>
<th>Wife’s Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>-2.04 (.17)</td>
<td>1.9 (.37)</td>
</tr>
<tr>
<td>Husband’s work hours</td>
<td>-.075 (.002)</td>
<td>.070 (.004)</td>
</tr>
<tr>
<td>Wife’s work hours</td>
<td>.029 (.002)</td>
<td>-.29 (.004)</td>
</tr>
<tr>
<td>one child</td>
<td>.60 (.09)</td>
<td>3.52 (.16)</td>
</tr>
<tr>
<td>two children</td>
<td>.93 (.10)</td>
<td>5.58 (.17)</td>
</tr>
<tr>
<td>&gt;2 children</td>
<td>1.35 (.13)</td>
<td>8.21 (.22)</td>
</tr>
<tr>
<td>constant</td>
<td>11.1 (.19)</td>
<td>23.3 (.21)</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.05</td>
<td>.22</td>
</tr>
</tbody>
</table>
Table 6: **Parameter Estimates - Home Production Technology**

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substitution between housework hours and market purchased good ($\sigma$)</td>
<td>-4.5</td>
</tr>
<tr>
<td>Increase in productivity due to kids ($\phi$)</td>
<td>2.8</td>
</tr>
<tr>
<td>Substitution between male and female housework hours ($\nu$)</td>
<td>0.9</td>
</tr>
<tr>
<td>Productivity of male housework hours ($\delta_m$)</td>
<td>17.4</td>
</tr>
<tr>
<td>Productivity of female housework hours ($\delta_f$)</td>
<td>34.5</td>
</tr>
</tbody>
</table>

Table 7: **Parameter Estimates - Wage Function**

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept - Male Type 1 ($\gamma_0 + \gamma_5$)</td>
<td>1.10</td>
</tr>
<tr>
<td>Intercept - Female Type 1 ($\gamma_0$)</td>
<td>0.73</td>
</tr>
<tr>
<td>Intercept - Male Type 2 ($\gamma_0 + \gamma_5$)</td>
<td>1.31</td>
</tr>
<tr>
<td>Intercept - Female Type 2 ($\gamma_0$)</td>
<td>0.94</td>
</tr>
<tr>
<td>Education ($\gamma_1$)</td>
<td>0.48</td>
</tr>
<tr>
<td>Age ($\gamma_2$)</td>
<td>0.009</td>
</tr>
<tr>
<td>Age Sq. ($\gamma_3$)</td>
<td>-0.0003</td>
</tr>
<tr>
<td>Wage Shock ($\gamma_4$)</td>
<td>0.70</td>
</tr>
<tr>
<td>Sd of initial wage draw - Male ($\sigma_{\varepsilon_{0m}}$)</td>
<td>1.01</td>
</tr>
<tr>
<td>Sd of initial wage draw - Female ($\sigma_{\varepsilon_{0f}}$)</td>
<td>1.28</td>
</tr>
<tr>
<td>Probability of positive wage shock if work full-time $\pi(\varepsilon_t, \varepsilon_{t+1} \mid h_t = 3)$</td>
<td>0.23</td>
</tr>
<tr>
<td>Probability of negative wage shock if work full-time $\pi(\varepsilon_t, \varepsilon_{t+1} \mid h_t = 3)$</td>
<td>0.07</td>
</tr>
<tr>
<td>Probability of positive wage shock if work part-time $\pi(\varepsilon_t, \varepsilon_{t+1} \mid h_t = 2)$</td>
<td>0.05</td>
</tr>
<tr>
<td>Probability of negative wage shock if work part-time $\pi(\varepsilon_t, \varepsilon_{t+1} \mid h_t = 2)$</td>
<td>0.04</td>
</tr>
<tr>
<td>Probability of positive wage shock if not work $\pi(\varepsilon_t, \varepsilon_{t+1} \mid h_t = 1)$</td>
<td>0.16</td>
</tr>
<tr>
<td>Probability of negative wage shock if not work $\pi(\varepsilon_t, \varepsilon_{t+1} \mid h_t = 1)$</td>
<td>0.13</td>
</tr>
</tbody>
</table>
Table 8: **Parameter Estimates - Match Quality**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of initial match quality draw ($\mu_{\theta 0}$)</td>
<td>-1.99</td>
</tr>
<tr>
<td>Standard deviation of initial match quality draw ($\sigma_{\theta 0}$)</td>
<td>8.22</td>
</tr>
<tr>
<td>Probability of positive match quality shock ($p_{\theta}^+$)</td>
<td>0.07</td>
</tr>
<tr>
<td>Probability of negative match quality shock ($p_{\theta}^-$)</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Table 9: **Parameter Estimates - Meeting Probability**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of meeting somebody</td>
<td>0.81</td>
</tr>
<tr>
<td>Decrease in probability of meeting someone by difference in log-wage ($\omega_1$)</td>
<td>0.91</td>
</tr>
<tr>
<td>Decrease in probability of meeting someone with different education ($\omega_2$)</td>
<td>0.12</td>
</tr>
<tr>
<td>Decrease in probability of meeting someone by difference in presence of children ($\omega_3$)</td>
<td>0.98</td>
</tr>
<tr>
<td>Decrease in probability of meeting someone that is of different type ($\omega_4$)</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Table 10: **Parameter Estimates - Fertility Process**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of having a child if decide to not try ($p_{\text{notry}}$)</td>
<td>0.28</td>
</tr>
<tr>
<td>Probability of having a child if decide to try ($p_{\text{try}}$)</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Table 11: **Parameter Estimates - Utility Function**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight on leisure ($\alpha$)</td>
<td>0.33</td>
</tr>
<tr>
<td>Utility from children that are currently living with the parent ($a_l$)</td>
<td>1.57</td>
</tr>
<tr>
<td>Utility of being married Type I ($\varphi_m$)</td>
<td>1.41</td>
</tr>
<tr>
<td>Utility of being married Type II ($\varphi_m$)</td>
<td>0.72</td>
</tr>
<tr>
<td>Utility cost of separation if cohabiting ($\kappa_c$)</td>
<td>0.64</td>
</tr>
<tr>
<td>Utility cost of separation if married ($\kappa_m$)</td>
<td>-3.45</td>
</tr>
</tbody>
</table>
Figure 10: Model Fit: Marriage and Cohabitation Rates

Model Fit: Marriage Rates by Age − Male

Model Fit: Marriage Rates by Age − Female

Model Fit: Cohabitation Rates by Age − Male

Model Fit: Cohabitation Rates by Age − Female
Figure 11: **Model Fit: Log Hourly Wages**

- **Model Fit: Log Hourly Wages by Age – Male High School**
- **Model Fit: Log Hourly Wages by Age – Male College**
- **Model Fit: Log Hourly Wages by Age – Female High School**
- **Model Fit: Log Hourly Wages by Age – Female College**
Figure 12: Model Fit: Hours

Model Fit: Hours by Age − Male High School

Model Data

Model Fit: Hours by Age − Male College

Model Data

Model Fit: Hours by Age − Female High School

Model Data

Model Fit: Hours by Age − Female College

Model Data
Table 12: Model Fit: Hours Worked at Home

<table>
<thead>
<tr>
<th>Model</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
</tr>
<tr>
<td>Cohabit</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
</tr>
</tbody>
</table>
Figure 13: **Model Fit: Relationship Transition Rates**

- **Model Fit: Separation Rates for All Relationships**
- **Model Fit: Separation Rates for Cohabiting Relationships**
- **Model Fit: Percentage of Cohabiting Couples who Marry**

**Relationship Length**

**Percentage**

- Model
- Data
<table>
<thead>
<tr>
<th></th>
<th>Model</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Married</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both High School</td>
<td>5.6%</td>
<td>6.8%</td>
</tr>
<tr>
<td>Male High School, Female College</td>
<td>4.3%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Male College, Female High School</td>
<td>2.2%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Both College</td>
<td>1.8%</td>
<td>3.0%</td>
</tr>
<tr>
<td><strong>Cohabiting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both High School</td>
<td>33.6%</td>
<td>23.2%</td>
</tr>
<tr>
<td>Male High School, Female College</td>
<td>33.3%</td>
<td>20.2%</td>
</tr>
<tr>
<td>Male College, Female High School</td>
<td>38.9%</td>
<td>23.6%</td>
</tr>
<tr>
<td>Both College</td>
<td>52.6%</td>
<td>16.1%</td>
</tr>
</tbody>
</table>