Labor Supply, Wealth Dynamics, and Marriage Decisions

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Abstract

Evidence collected using the Panel Study of Income Dynamics (PSID) indicates that labor supply, saving, and marital decisions are strongly linked. This paper has two main goals. The first is to develop a realistic model of household behavior that captures the empirical features of labor supply, saving, and marital choices. The second goal is to simulate the model using the PSID. The results indicate that the proposed model can match most of the features displayed by the data. They also suggest that the relationships between labor supply, saving, and marital status decision are important features of household behavior that should be considered by economists and policy makers when designing and implementing policies formulated to change the welfare of household members.

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1 Introduction

Evidence collected using the Panel Study of Income Dynamics (PSID) indicates that labor supply, saving, and marital decisions are strongly linked. For instance, saving per adult of couples is more than twice saving of singles. Labor supply of single women is significantly larger than labor supply of married women, whereas single men supply less hours of labor than married men. The strongest evidence of the links, however, can be found in the periods before and after a change in marital status. In the year before divorce, saving per adult is similar to the level displayed by single individuals. In the years preceding divorce, unconditional labor supply of married men drops slightly and unconditional labor supply of married women increases by more than 200 hours a year relative to the average couple.  

Four years before marriage, women work on average 200 hours more than the average single woman. In the following three years, their labor supply decreases gradually and at the time of marriage it is 200 hours lower than labor supply of the average single woman and 300 hours higher than labor supply of the average married woman. After marriage, women’s labor supply continues to gradually decline until the fourth year of marriage, when it reaches the level of labor supply of the average married woman. A similar pattern characterizes the labor supply of men before and after marriage, with a gradual transition from the level of labor supply of single men to the level of married men.

These findings indicate that the evaluation and implementation of public policies designed to affect labor supply, saving, or marital decisions require a clear understanding of the relationships between these choices. Some examples of such policies are changes in tax rates on pension assets, asset-based means-tested welfare programs, and marriage penalty relief programs.

This paper has two main goals. The first is to develop a realistic model of household behavior that captures the main features of labor supply, saving, and marital choices. The second goal is to simulate the model using the Panel Study of Income Dynamics (PSID) to determine if it can capture and explain the relationships between these decisions.

The model proposed here is characterized by the following features. Couples make efficient decisions with the constraint that individual members cannot commit to future allocations of resources. The lack of commitment implies that variation in the individual outside options changes the bargaining position of each household member and through it household decisions. The best outside option is represented using the value of divorce, since for the majority of married individuals this is the best available alternative to marriage. The value of divorce varies over time with changes in wages, human capital, saving, children, marriage market, and divorce laws. Variations that increase the value of divorce of one spouse improve her bargaining position and therefore

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1 The last finding is consistent with the results reported in Johnson and Skinner (1986).
increase the weight assigned to her preferences in the household decisions process. Consequently household behavior will change. Finally, married and single agents can transfer resources over time by investing in financial assets and human capital. This feature of the model enables us to take into account that some investments can be easily transferred across agents, whereas others can only be partially transferred.

The model is simulated using data from the 1984-1996 waves of the PSID and the 1984, 1989, and 1994 Wealth Supplement Files. The sample is restricted to include the cohort of individuals that are between the ages 22 and 32 in 1984. In 1996 this cohort ranges in ages between 34 and 44. This restriction is imposed to reduce the heterogeneity of the sample and because most of the changes in marital status occur early in life. The model is then simulated for 25 periods, which correspond to the years 1984-2009.

The results indicate that the proposed model can match most of the features displayed by the data. We can explain the difference in labor supply and saving behavior between married and single agents, and between men and women. More important, the simulation results replicate most of the variations in labor supply and saving decisions before and after a change in marital status.

In the simulation, women before divorce increase labor supply above labor supply of the average married woman. This result is generated by couples in which the value of the husband’s outside option and therefore his decision power is high relative to the wife’s. Wives in this group work more relative to the average married woman for two different reasons. First, since individuals enjoy leisure and leisure decreases with labor supply, wives work more if their bargaining position is worse than the average. Second, in this group of household, wives have generally low wages and human capital and therefore a low lifetime utility in case of divorce. Since couples make efficient decisions, the household will choose an allocation that maximizes the welfare of the wife conditional on guaranteeing the husband a level of utility that is greater than or equal to his value of divorce. For this group of households, this requires an improvement in the wife’s value of divorce. The couple can achieve this in two different ways: (i) by increasing household saving, which will be split at the time of divorce; (ii) by increasing labor supply of the wife and therefore her human capital. The first alternative reduces the lifetime utility of the spouse with a strong bargaining position. To see this note that for each dollar saved today each agent receives a fraction of it multiplied by the gross interest rate. If the dollar is consumed today, however, the strong spouse will generally receive more than the fraction allocated at divorce, because of his high decision power. The second alternative improves the lifetime utilities of both spouses, since an increase in labor supply of the wife increases her human capital, but also the total amount of household resources. Consequently, the couple will choose to increase labor supply of the weak spouse and to decrease household saving.

A second result obtained in the simulation is that couples before divorce save less than the
average couple. The explanation of this result can be divided in two parts. First, the previous argument implies that couples before a divorce save less than the average couple. Second, singles save less than married individuals. Moreover, individuals like to smooth consumption. Consequently, couples with a high probability of divorce reduce their wealth holdings to have a smooth consumption path in case of divorce.

An additional result that is consistent with the PSID is that the average labor supply of women at the time of marriage is between the average labor supply of married women and the average labor supply of single women. Then in the first few years after marriage, average labor supply converges gradually to labor supply of the average married woman. A similar result characterizes men at and after marriage. Children play an important role in the explanation of these findings. According to the United States Census, in 85.1% of divorces with children, custody is given to the mothers. This implies that the bargaining position of married women improves with the number of children. In the simulation, the number of children, and hence the wife’s decision power, increase with the duration of the marriage. Married women will therefore gradually decrease labor supply after marriage. An important consequence is that married women will accumulate less human capital relative to married men. For the household it is therefore optimal to increase the degree of specialization by reducing the wife’s labor supply and by increasing the husband’s labor supply even more. The same argument can be used to explain the change in men’s labor supply before and after marriage.

These results indicate that the relationships between labor supply, saving, and marital status decision are important features of household behavior that should be considered by economists and policy makers when designing and implementing policies formulated to change the welfare of household members.

This paper is related to the literature on the collective representation of household behavior. Manser and Brown (1980) and McElroy and Horney (1981) are the first papers to characterize the household as a group of agents making joint decisions. In those papers the household decision process is modeled by employing a Nash bargaining solution. Chiappori (1988; 1992) extends their model to allow for any type of efficient decision process. The theoretical model used in the present paper is a generalization of the static collective model introduced by Chiappori to an intertemporal framework without commitment. The static collective model has been extensively tested and estimated. Thomas (1990) is one of the first papers to test the static unitary model against the static collective model. Browning et al. (1994) perform a similar test and estimate the intra-household allocation of resources. Chiappori et al. (2002) analyze theoretically and empirically the impact of the marriage market and divorce legislations on household labor supply using a static collective model. Blundell et al. (2001) develop and estimate a static collective labor
supply framework which allows for censoring and nonparticipation in employment. Donni (2004) shows that different aspects of a static collective model can be identified and estimated.

This paper also contributes to a growing literature which attempts to model and estimate the intertemporal aspects of household decisions using a collective formulation. Lundberg et al. (2003) use a collective model with no commitment to explain the consumption-retirement puzzle. Guner and Knowles (2004) simulate a model in which marital formation affects the distribution of wealth in the population. Van der Klaaw and Wolpin (2004) formulate and estimate an efficiency model of retirement and saving decisions of elderly couples. Duflo and Udry (2004) study the resource allocation and insurance within households using data from Côte D'Ivoire. Mazzocco (2004a) analyzes the effect of risk sharing on household decisions employing a full-efficiency model. Mazzocco (2004b) estimates the standard household Euler equations for couples and separately for singles and rejects the standard unitary life-cycle model in favor of the collective formulation.

2 Empirical Evidence

This section presents empirical evidence which indicates that labor supply, saving, and marital decisions are strongly related. The discussion is based on data from the Panel Study of Income Dynamics (PSID). The PSID is well suited to analyze the relationship between labor supply, saving, and marital decisions for two reasons. First, the PSID has gathered individual-level data on labor supply and marital status annually each spring since 1968. Wealth data are also collected at intervals of 5 years starting from 1984. Second, since the PSID is a true panel that follows the same households and their split-offs over time, the dataset can be used to examine the dynamics of household decisions.

Table 1 summarizes marriage, labor supply, saving, and consumption decisions made by unmarried females, married females, unmarried males, and married males. The sample covers the period 1982-1996 and is restricted to include the cohort between ages 20-30 in 1982. In 1996 this cohort ranges in age from 34 to 44. The latino and immigrant samples are excluded as well as individuals who did not complete high school. These restrictions are used to reduce the heterogeneity in the sample and because most of the changes in marital status occur at young ages. The PSID does not include a measure of total consumption. However, it does include measures of food expenditure and other predictors of total consumption. Therefore, following Skinner (1987), linear predictions of total consumption are used as a proxy. The coefficients used to create the fitted values are derived using the Consumer Expenditure Survey (CEX), 1980-1999, using regressors that are common to both datasets. Dollar values are reported in 1984 dollars.

Table 1 displays some features of household behavior that are worth discussing. First, labor
supply varies with the marital status and gender of the individual. Conditional on working, unmarried females supply on average almost 300 more hours a year than married females. The annual labor supply of unmarried men is lower than the labor supply of married men by almost 200 hours. Both unmarried and married women supply less hours on the labor market than men. Second, labor force participation of single men is only 1% lower than labor force participation of married men which is equal to 98%. Unmarried women are almost as likely to work as unmarried men, with 93% of unmarried women participating in the labor force. As expected, married women are much less likely to work in the labor market with a participation rate of 81%.²

There are also same features of the saving decisions that are worth discussing. Two measures of wealth are reported: total household wealth and total household wealth minus home equity and the value of vehicles. First, married couples save substantially more than unmarried individuals, even after taking into account that married couples are composed of two individuals. Also, unmarried men have on average considerably more in wealth than unmarried women. Table 2 describes the wealth patterns in more detail. This table describes wealth dynamics as individuals enter and exit marriage. The decisions of couples in the period before divorce are significantly different from the decisions of the average couple. In particular, married couples on average save almost $50,000 whereas couples in the period before divorce save less than $19,000. There are two possible directions of causation. First, couples with low levels of wealth may be more likely to choose divorce. Second, couples at high risk of divorce may choose to decrease their wealth.

Figures 1-4 describe labor supply as individuals enter and exit marriage relative to two baseline comparison groups: married individuals and single individuals. An index is used where 0 denotes the first year of a transition between marital states. The index -t indicates the t-th year prior to the transition and t indicates the t-th year after the transition. These marriages and divorces occur during different years in the sample for different individuals. In many cases particular observations will not be available for particular individuals. For example, an observation for three years prior to marriage will not be available for an individual who gets married in the second year of the sample. For this reason the number of observations will vary at different points in the index. The baseline comparison groups are weighted to reflect the calendar year composition of labor supply for the transition groups.

Figure 1 describes labor supply of women before and after divorce. Unmarried women work more than married women. Here the differences are even larger than conditional labor supply described in 1. Five years prior to a divorce, married women tend to work about 100 hours more than married women as a whole. Labor supply increases steadily in the years prior to divorce.

²The participation rate of married women is higher than in other studies because we only consider women between the ages of 20 and 44.
reaching 1500 hours annually at the time of divorce, and then increasing an additional 200 hours in
the first two years after divorce. These results for women’s labor supply closely follow the results
in Johnson and Skinner (1986). The evidence before divorce for men, which is presented in Figure
2, is more noisy. But also in this case, labor supply displays a gradual transition from the level of
married men to the level of single men.

Figure 3 describes women’s labor supply before and during marriage. During the transition,
average annual labor supply falls from 1950 hours to 1300 hours. This dramatic decrease begins
many years prior to marriage and continues many years into marriage. The fact that the reduction
begins even prior to marriage suggests that the decrease may not be due entirely to child-bearing
and household production. The trend for men is the opposite. While women decrease labor supply
during the transition to marriage, men increase labor supply by 200 hours over the baseline level
of labor supply for unmarried men.

This section provides evidence that labor supply, wealth, and marriage decisions are related.
Traditional studies of labor supply and saving have focused on married individuals or single indi-
nviduals, but not on the relationship between these variables and marital decisions. The remaining
sections are devoted to explaining the evidence on these relationships presented in this section.

3 The Model

In this section a model is developed with two goals. The first goal is to capture the relationships
between labor supply, saving, and marital decisions that characterize the evidence presented in the
previous section. The second goal is to provide a framework that can be used to evaluate policy
interventions aimed at improving the welfare of individual household members.

To that end we develop a model with the following features. Household members cooperate
when making decisions. The cooperative decision process depends on the bargaining position of
each agent. The individual bargaining position is determined by the best outside option available
to the spouses. The best outside option corresponds to the individual value of divorce, since for
the majority of individuals this is the best available alternative to being married. The value of
divorce is allowed to vary over time with changes in the wage distribution, accumulated human
capital, number of children, divorce laws, and marriage market. Any change that improves the best
outside option of one spouse will generally increase her decision power. This will modify household
decisions because the significance of her preferences in the household decision process increases.

To model all this, consider an arbitrary agent $i$ living for $T$ periods in an environment with
uncertainty. In each period and state of nature, agent $i$ can be either single or married. In both
cases, the agent enters period $t$ and state $\omega$ with a given amount of saving $b_i^t(\omega)$, a wage $w_i^t(\omega)$, a
given amount of human capital $H_i^t(\omega)$, and a given number of children $Q_t(\omega)$. If married, agent $i$ is also endowed with a given level of match quality, $\theta$, that describes heterogeneity across marriages that is not captured by the economic variables that characterize the model. It is assumed that the agent’s preferences can be represented using a utility function $u^i$ which depends on private consumption $c_i^t(\omega)$, leisure $l_i^t(\omega)$, number of children, and match quality.

If agent $i$ is married to agent $j$, it is assumed that decisions are efficient, except that the two household members cannot commit to future allocations of resources. In each period the two spouses choose whether to stay married, individual private consumption, individual leisure, and the amount to be saved. It is assumed that the couple can only save jointly using a risk-free asset. If the two spouses decide to divorce, $x\%$ of household saving is allocated to the wife and the rest to the husband, where $x$ is exogenously determined by the divorce law.

If single in period $t$, agent $i$ meets a potential spouse with probability $1$. The two agents then decide whether to marry. If they choose to marry, their decisions correspond to the decisions of a couple entering period $t$ as married. If they decide to stay single, agent $i$ must choose individual consumption, individual leisure, and individual saving.

For both single and married agents, it is assumed that the amount of human capital accumulated by agent $i$ in period $t$, $h_i^t$, is a decreasing function of leisure, $f(l_i^t)$, and that human capital depreciates at a rate $\delta^i$. Children are exogenously determined according to a defined fertility process.

The decisions of agent $i$ will be analyzed using a recursive formulation. In each period $t$ the vector of state variables $S_t$ is composed of agent $i$’s wage and human capital, the wage and human capital of the spouse or potential spouse, saving, number of children, match quality, marital status, and agent $i$’s decision power relative to the spouse, which will be denoted by $M_t$. In any given period and state of nature the relative decision power is defined as the ratio of Pareto weights characterizing the household decision process.

Consider period $T$ and state $\omega$. The value of being single for agent $i$, $V_{0,i}^T(S_T)$, can be easily computed.
computed by solving the following standard problem:\(^4\)

\[
V^{0,i}_T(S_T) = \max_{c^i_T, l^i_T} u^i(c^i_T, l^i_T, Q^i_T)
\]

\[
s.t. c^i_T + w^i_T l^i_T + P_T q^i_T = w^i_T T^i + R_T b^i_T,
\]

where \(P_T\) is the cost of one child, \(T^i\) is the amount of time available, \(R_T\) is the gross return on the risk-free asset, and \(b^i_T\) corresponds to individual saving if agent \(i\) enters the period as single and to half of the couple’s saving otherwise.

Under the assumption that married agents make efficient decisions but without commitment, the intertemporal behavior of a couple in period \(T\) and state \(\omega\) can be characterized using a Pareto problem with participation constraints. This problem can be solved using the following two-step approach. In the first step, optimal consumption and leisure are computed without taking into account the participation constraints and using the relative decision power with which the spouses enter period \(T\), \(M_T\):

\[
\max_{c^1_T, l^1_T, c^2_T, l^2_T} u^1(c^1_T, l^1_T, Q_T, \theta_T) + M_T u^2(c^2_T, l^2_T, Q_T, \theta_T)
\]

\[
s.t. c^1_T + \frac{c^2_T}{2} + w^1_T l^1_T + w^2_T l^2_T + P_T Q_T = w^1_T T^1 + w^2_T T^2 + R_T b^i_T.
\]

Let \(c^i_T\) and \(l^i_T\), for \(i = 1, 2\), be the solution of the couple’s problem (1). Agent \(i\)’s value of being married at the current relative decision power \(M_T\) can then be computed as follows:

\[
V^{1,i}_T(S_T) = u^i(c^{1,i}_T, l^{1,i}_T, Q_T, \theta_T).
\]

In the second step, it is verified whether the individual participation constraints are satisfied, i.e.

\[
V^{1,i}_T(S_T) \geq V^{0,i}_T(S_T) \quad \text{for} \quad i = 1, 2.
\]

Three possible cases may characterize the couple. First, the participation constraints are satisfied for both agents, which implies that the value of being married for agent \(i\) is \(V^{1,i}_T(S_T)\). Second, the participation constraints are binding for both agents. In this case there is no surplus to be divided between the spouses and it is optimal to divorce.\(^5\) Third, only one agent is constrained. Without loss of generality suppose that agent 1’s participation constraint is binding. Ligon, Thomas, and Worrall (2002) show that in this case the optimal allocation of resources is such that agent 1 is indifferent between being single and married. This allocation can be determined by choosing

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\(^4\) The dependence on the state of nature will be suppressed to simplify the notation.

\(^5\) In this model both participation constraints may bind at the same time because of the public good and the possibility of meeting a new spouse if single.
individual consumption, individual leisure, and the new relative decision power $M_T'$ according to
the following problem:

$$
\max_{c_T^i, l_T^i, c_T^{i+1}, l_T^{i+1}, M_T'} \ u^1(c_T^i, l_T^i, Q_T, \theta_T) + M_T' u^2(c_T^{i+1}, l_T^{i+1}, Q_T, \theta_T)
$$

s.t. $c_T^i + c_T^{i+1} + w_T^i l_T^i + w_T^{i+1} l_T^{i+1} + P_T Q_T = w_T^i T^1 + w_T^{i+1} T^2 + R_T b_T$

$$
u^1(c_T^i, l_T^i, Q_T, \theta_T) = V_T^{0,i}(S_T). \quad \text{Let } c_T^{i*, l_T^{i*}} \text{ be the solution of this problem. Then if the participation constraint of agent 2 is also satisfied the two agents stay married and the value for agent } i \text{ is}
$$

$$V_T^{1,i}(S_T) = u^i(c_T^{i**, l_T^{i**}, Q_T, \theta_T}).$$

Otherwise they divorce. To summarize, agent $i$'s value in period $T$ is

$$V_T^i(S_T) = \max \{ V_T^{1,i}(S_T), V_T^{0,i}(S_T) \}.$$ 

Given agent $i$'s value in period $T$, the decision process in any arbitrary period $t$ can be outlined. The value of being single in period $t$ is

$$V_t^{0,i}(S_t) = \max_{\{c_t^i, l_t^i\}} u^i(c_t^i, l_t^i, Q_t^i) + \beta^t E[V_{t+1}^i(S_{t+1}|S_t)]$$

s.t. $c_t^i + w_t^i l_t^i + P_t l_t^i + b_t^i = w_t^i T^1 + R_t b_t^i$

$$H_{t+1}^i = \delta H_t^i + h_t^i, \quad w_t^i = g(H_t^i), \quad h_t^i = f(l_t^i), \quad \forall t, \omega.$$ 

where $V_{t+1}^i$ is the value function of agent $i$ in period $t+1$.

As for period $T$, the value of agent $i$ in period $t$ if married can be determined using two steps. In the first step, the couple’s decisions are determined without considering the participation constraints using the current decision power $M_t$:

$$\max_{c_t^i, l_t^i, b_t^i} u^1(c_t^i, l_t^i, Q_t, \theta_t) + M_t u^2(c_t^{i+1}, l_t^{i+1}, Q_t, \theta_t) + E[\beta^t V_{t+1}^i(S_{t+1})|S_t]$$

$$c_t^i + c_t^{i+1} + w_t^i l_t^i + w_t^{i+1} l_t^{i+1} + P_t Q_t + b_{t+1} = w_t^i T^1 + w_t^{i+1} T^2 + R_t b_t^i$$

$$H_{t+1}^i = H_t^i, \quad w_t^i = g(H_t^i), \quad b_t^i = f(l_t^i), \quad i = 1, 2.$$ (2)

The value of being married with relative decision power $M_t$ can then be computed as follows:

$$V_t^{1,i}(S_t) = u^i(c_t^{i*}, l_t^{i*}, Q_t, \theta_t) + \beta^t E[V_{t+1}^i(S_{t+1})|S_t] \quad i = 1, 2$$

where $c_t^{i*}, l_t^{i*}$, and $b_t^{i*}$ is the solution of (2).
In the second step, it is verified whether the participation constraints of both agents are satisfied, i.e.

\[ V_{t}^{1,i}(S_{t}) \geq V_{t}^{0,i}(S_{t}) \quad \text{for } i = 1, 2. \]

If both participation constraints are satisfied, the spouses stay married and agent \( i \)'s value is \( V_{t}^{1,i}(S_{t}) \). If both agents are constrained, there is no feasible renegotiation that makes both agents better off relative to being single and the household dissolves. If only agent \( i \) is constrained, the household renegotiates the allocation of resources so that the constrained agent is indifferent between being single and married, i.e. consumption, leisure, and relative decision power are the solution of the following problem:

\[
\max_{c_t^i, l_t^i, b_t^i, M_t'} u^1(c_t^i, l_t^i, Q_t, \theta_t) + M_t'u^2(c_t^i, l_t^i, Q_t, \theta_t) + \mathbb{E}\left[ \beta^1 V_{t+1}^{1,i}(S_{t+1}) + M_t' \beta^2 V_{t+1}^{2,i}(S_{t+1}) \mid S_t \right] \\
\text{s.t.} \quad c_t^1 + c_t^2 + w_t^{11}c_t^1 + w_t^{22}c_t^2 + P_tQ_t + b_{t+1} = w_tT^1 + w_t^2T^2 + R_t b_t \\
H_{t+1}^i = \delta H_t^i + h_t^i, \quad w_t^i = g(H_t^i), \quad h_t^i = f(t_t^i), \quad i = 1, 2 \\
u^i(c_t^i, l_t^i, Q_t, \theta_t) + \beta \mathbb{E}\left[ V_{t+1}^i(S_{t+1}) \mid S_t \right] = V_{t}^{0,i}(S_{t}).
\]

Denote with \( c_t^{1**,}, l_t^{1**,}, c_t^{2**,}, l_t^{2**,}, b_t^{**}, \) and \( M_t^{**} \) the solution of (3). Then if the participation constraint of the spouse is also satisfied the two agents stay married and the value function of agent \( i \) is

\[ V_{t}^{1,i}(S_{t}) = u^i(c_t^{i**}, l_t^{i**}, Q_t, \theta_t) + \beta \mathbb{E}\left[ V_{t+1}^i(S_{t+1}) \mid S_t \right] \quad i = 1, 2. \]

Otherwise they divorce. All this implies that agent \( i \)'s value in period \( t \) is

\[ V_{t}^i(S_t) = \max \left\{ V_{t}^{1,i}(S_t), V_{t}^{0,i}(S_t) \right\} \quad \text{for } i = 1, 2. \]

To provide the intuition behind the couple's decision process, observe that a married couple enters period \( t \) with a given relative decision power \( M_t \). The individual outside options change over time because of variations in household saving, wages, human capital, and children. This implies that at the given relative decision power \( M_t \), the optimal allocation of resources may be such that one or both agents are better off as single. If this is the case, the couple will try to renegotiate the intra-household allocation, to avoid the dissolution of the household. If both agents are better off as single, then there is no feasible renegotiation and divorce is the only alternative. If only one agent is better off as single, the couple will renegotiate the allocation of resources by increasing the decision power of the constrained spouse, and by increasing accordingly the amount of resources allocated to her in the current and future periods. Since the household makes efficient decisions without
commitment, the optimal renegotiation must generate the smallest deviation from the allocation that is ex-ante efficient. This renegotiation corresponds to the intra-household allocation at which the constrained agent is indifferent between being single or married in period $t$. If at this allocation the spouse is also better off being married, the couple will remain married with a new relative decision power $M_t'$.

One last point should be discussed. As mentioned, any individual entering period $t$ as single draws a spouse and then decides whether to get married. The marriage decision requires an initial value for $M_t$. This $M_t$ determines the initial distribution of resources between spouses and therefore affects future decisions. One possible approach is draw $M_t$ randomly for each single agent. The main weakness of this approach is that it generates heterogeneity in individual behavior that is not explained by economic variables. An alternative solution is to assign to each single agent the relative decision power that corresponds to the Nash-Bargaining solution in period $t$. The advantage of this approach is that the initial intra-household allocation of resources satisfies the symmetry condition that characterizes Nash Bargaining. Hence we do not introduce the additional heterogeneity that is produced by the first approach. Because of this in the rest of the paper we will use the Nash Bargaining to determine the initial value of $M_t$. After the first period of marriage, the bargaining position is determined using the method described above.

4 Assumptions on Preferences, Human Capital, Uncertainty, and Household Production

The simulation of the proposed model requires assumptions on preferences, human capital, household production, and the uncertainty that characterizes the environment. The next four subsections outline these restrictions.

4.1 Preferences and Human Capital

Empirical evidence presented in Attanasio and Weber (1995) and Meghir and Weber (1996) suggests that individual preferences are not separable in consumption and leisure. To consider this non-separability in the simulation, the individual utility function is assumed to have the following form:

$$u^i(c^i, T - h^i, Q, \theta) = \left[\left(c^i\right)^{\sigma_i} (T - h^i)^{1-\sigma_i}\right]^{1-\gamma_i} \left(\frac{\alpha_i Q + \xi}{1 - \gamma_i}\right)^{1-\gamma_i} + \left(\frac{\theta + \xi}{1 - \gamma_i}\right)^{1-\gamma_i},$$

with $\gamma_i > 0$, $0 < \sigma_i < 1$, $\alpha_i > 0$, $\xi > 0$. The parameter $\gamma_i$ captures the intertemporal aspects of individual preferences. In particular, $-1/\gamma_i$ is agent $i$’s intertemporal elasticity of substitution, which measures the willingness to substitute the composite good $\bar{C} = \left(c^i\right)^{\sigma_i} (T - h^i)^{1-\sigma_i}$ between
different dates. The parameter $\sigma_i$ captures the intraperiod features of individual preferences and it measures in each period the fraction of expenditure assigned to agent $i$ which is allocated to private consumption.

The preferences for children are assumed to be strongly separable from consumption and leisure. The functional form has been chosen to enable one to compare the utility provided by children with the utility provided by the composite good $\bar{C}$. In particular, $\alpha_i Q + \xi$ represents the amount of composite good $\bar{C}$ required to provide the same level of utility as $Q$ children, where $\xi$ is a constant used to normalize the utility associated with a household with no children.

The preferences for match quality have been similarly chosen. Specifically, for singles $\theta$ is set to zero. Couples with good match quality, $\theta > 0$, experience an increase in utility relative to singles that corresponds to the change in utility generated by an increase in the composite good $\bar{C}$ from $\xi$ to $\theta + \xi$. Couples with bad match quality, $\theta < 0$, experience a drop in utility equivalent to the reduction in utility produced by a decrease in the composite good from $\xi$ to $\theta + \xi$.

Another important component of the model is human capital. In the simulation it is assumed that human capital corresponds to labor market experience. In each period, experience is equal to the number of years in which individual labor supply exceeds 500 hours. It is therefore assumed that a part-time job provides the same amount of human capital as a full-time job. The depreciation rate is assumed to be zero.

### 4.2 Wage Process and Match Quality

In the model, agents face three sources of uncertainty: wages, match quality, and fertility. This subsection discusses uncertainty over wages and match quality. The following subsection analyzes fertility.

Simulating the model requires a distribution of wages conditional on individual characteristics, for both workers and non-workers. The wage process from which individual wages are drawn is derived from the estimation of a standard Heckman selection model. The processes for women and men are estimated separately. The estimates of the models provide the distribution of next year’s wages conditional on individual characteristics. The mean of the distribution is the fitted value of the wage equation evaluated at a particular point of the state space, and the variance is the estimated variance of the error term in the wage equation.

For workers, wages should be reasonably persistent. This is accomplished by allowing the conditional distribution of wages to depend on wages in the previous period interacted with labor force participation during the previous period. This allows wages for workers to be highly correlated over time. This also implies that individuals who did not work in the previous period have a wage distribution that depends on labor market experience only. Finally, different constants are used for
workers and non-workers by including lagged labor force participation in the wage equation.

The selection equation depends on lagged wage interacted with labor force participation, lagged labor force participation, experience, and the number of children in the household. This last variable is assumed to enter only the selection equation. This restriction reflects the common intuition that children at home affect the marginal productivity of household production and thus labor force participation but do not substantially affect productivity in the labor market.

The estimates of the wage process are presented in table 3. Several features are worth mentioning. First, both men’s and women’s wages are highly persistent. Everything else equal, a 100% increase in lagged wages is associated with a 53% and 50% increase in current wages for women and men. Second, for men who were working in the previous year at a lagged wage below $1.15 per hour the mean of the conditional distribution is lower than the corresponding mean for non-workers because of the negative coefficient for lagged labor force participation. For men with lagged wage above $1.15 per hour and for all women the mean of the conditional distribution is higher for workers than non-workers. For women this is unambiguous because the coefficient for labor market participation is positive.

An important feature of the wage process is the role of labor market experience. Everything else equal, an additional year of labor market experience increases wages by 1.7% for women and 1.3% for men. For workers the interpretation of this parameter is different from the standard estimate of the returns to experience because the specification includes lagged wages. In our specification, the experience coefficient for working individuals allows for increments in wages between periods that vary with experience. When the sample is used to estimate a standard earnings regression, the results are consistent with previous results in the literature.\footnote{See Heckman, Lochner and Todd (2003) and Mincer (1974).} Table 4 presents these estimates.

The second form of uncertainty in the model is uncertainty over the quality of the match. Match quality captures household heterogeneity that is not explicitly modeled. We expect the match quality of a marriage at \( t \) to depend on match quality at \( t - 1 \). For this reason, in each period after marriage match quality is drawn conditional on the match quality in the previous period using a Markov transition matrix. When two unmarried individuals meet for the first time, the value of match quality is drawn from the stationary distribution that corresponds to the transition matrix.

### 4.3 Fertility

Children should be considered in a realistic model of the household for at least two reasons. First, children are one of the main reasons for the existence of marriages. Second, the presence of children affects other aspects of household behavior. However, since the main goal of this research...
The project is to develop and analyze a unified model of labor supply, wealth accumulation, and marital decisions, we do not explicitly model fertility choices. Instead, following Brien, Lillard, and Stern (forthcoming) we assume that fertility choices can be characterized using a statistical process that matches the data. There are two possible ways to construct the fertility process. First, it may be assumed that the probability of having a child depends on individual decisions about saving, labor force participation, marriage, and children. This enables one to construct a fertility process that reflects the main features of the data: married women are more likely to have children; wealthier women have fewer children; women who participate in the labor market are less likely to have children. This treatment of fertility has one limitation: women will take into account that their labor supply and saving choices will affect the probability of having children. An alternative approach is to assume that fertility depends only on marital status and number of children. In this case women will try to marry to increase their chances of having a child, which is realistic, but women will not consider the fertility process when choosing saving and labor supply. We experimented with both specifications and decided to use the second one to avoid the limitation mentioned above. This approach for characterizing fertility significantly simplifies the simulation without making the unrealistic assumption that fertility has no effect on labor supply, saving, and marital choices. The generalization of the current model to an environment in which individuals are also allowed to choose when to have children is important, but it is left for future research.

The statistical process for fertility is estimated using a standard probit. The sample employed to estimate the probit includes married and unmarried women. An observation is a woman/year and the dependent variable is a dummy variable that takes on the value of one if the number of children in the household increases in the year following the current year.

Table 5 reports the estimates from the fertility probit. The most important predictor for fertility is marital status. Everything else equal, a married woman has a probit score that is higher by .644 standard deviations. Evaluated at the mean, this implies that a married woman has a 7.6 percentage point higher probability of having a child during a given year. This effect is large relative to the overall fertility rate in the sample of 10.1%. The current number of children in the household is also predictive. Relative to households without children, household with one child are more likely to give birth to a second child, whereas families with two or more children are less likely to give birth to an additional child.

Children also enter the model through the budget constraints. The costs of children are estimated separately from the central model using the following strategy. First, a measure of household expenditure is created that includes the key components of expenditure related to children. The CEX is used rather than the PSID because it provides more detailed expenditure information. The expenditure measure includes food at home, child care, boy’s clothing and shoes, girl’s clothing
and shoes, and infant clothing. We also experimented with a broader measure of expenditure, but it yielded a smaller estimate of the cost of children because households without children spend more on other components of expenditure like food consumed in restaurants. Second, expenditure is regressed on a vector of household characteristics including the number of children. Table 6 presents the estimates of the cost of children. They suggest that the cost of children is a concave function, with the first child costing more than subsequent children.

4.4 Household Production Function

In the theory section, we do not model household decisions that are related to domestic production. However, these choices may affect other aspects of household behavior. To consider these potential effects, we simulate the model using two different specifications.

In the first specification, we set the amount of time available in a year for each individual, $T^i$, equal to 4,200 hours. This is computed as 24 hours a day, minus 8 hours of sleep, minus 3 hours of exogenous household production, and by multiplying the outcome by 7 days a week times 50 working weeks a year.

In the second specification, to take into consideration that the time devoted to household production varies across individuals, we allow $T^i$ to depend on individual characteristics like marital status, number of children, and labor market variables. To that end, we use the information available in the PSID for domestic production. During the 1984 to 1996 waves, the following question was asked to household heads and spouses: “About how much time do you spend on housework in an average week? I mean time spent cooking, cleaning, and doing other work around the house.” The answer to this question provides the amount of time that each household member dedicates to domestic production. We then employ this information with a standard OLS regression to characterize the quantity of domestic labor supply as a function of marital status, number of children, and labor market variables. The estimated coefficients, which are reported in table 7, are used in the simulation to impute domestic labor supply. $T^i$ can then be computed as 24 hours a day, minus 8 hours of sleep, minus the imputed domestic labor supply and then by multiplying the result by 7 days a week times 50 working weeks a year. This specification enables us to capture the effect of domestic production on household behavior, without explicitly modeling the corresponding choices. In particular, we can take into account that families with children not only pay additional financial costs, but have also to spend additional time in domestic production. The long term goal is to explicitly model household production, but this is left for future research.

A comparison of the two specifications will enable us to determine the effect of domestic labor supply on household behavior.
5 Model Implementation

This section discusses the choice of the parameters, grid, and other technical aspects of the simulation.

The parameters used in the simulation were chosen as follows. Mazzocco(2004c) estimates the intertemporal elasticity of substitution separately for men and women. He finds that $\gamma$ is 2.0 for men and 4.3 for women. These values are adopted in the simulation. In the PSID the consumption budget share is around .43 for both men and women. Accordingly, the Cobb-Douglas parameter for consumption, $\sigma$, is set equal to 0.43.

The parameter $\alpha$ describes the utility provided by children. Recall that in the model, children are costly but households derive utility from them. As described earlier, this utility is measured relative to the composite good $\bar{C}$. In particular, $\alpha Q + \xi$ represents the amount of composite good $\bar{C}$ required to provide the same level of utility as $Q$ children. In the simulations $\xi$, the normalization parameter, is set to the average value of the composite good $\bar{C}$ computed using the data with $\sigma$ equal to the consumption budget shares. The parameter $\theta$ characterizes the value of match quality in terms of the composite good $\bar{C}$. In the simulation, $\alpha$ and $\theta$ are chosen, jointly with the transition probabilities for match quality, to match average labor supply, average consumption, average wealth, and average labor force participation of single women, and two marriage moments: the percentage of married individuals and the divorce hazard. Using this criterium, the value of $\alpha$ is such that a new child provides a level of utility equivalent to a 33% increase in the composite good. The value of $\theta$ is such that a good match quality draw is equivalent to a 10% increase in $\bar{C}$.

In case of divorce, in the model household wealth must be divided between the two spouses. To determine the fraction that is allocated to the wife, we use divorce settlements from the National Longitudinal Study of the High School Class of 1972 (NLS-72), Fifth Follow-up (1986). The sample (n=1685) includes all first marriages that ended in legal divorce prior to 1986. The average percentage of wealth allocated to the wife is 0.496 with a standard deviation of 0.177, where household wealth is the total net value of all property including the house value and the value of other real estate. In the simulation we, therefore, assume that wealth is divided equally between the two spouses.

To simulate the model one has to decide which parent receives custody of the children in case of divorce. For smaller values of $\alpha$, the cost of children is large relative to the increase in utility that they provide. As a result, there are few marriages in the model because men prefer to remain single. For larger values of $\alpha$, the presence of children drives all household decisions. For example, the presence of children determines with certainty if households choose to divorce if they receive an unfavorable match quality. Similarly, if we use a larger value of $\theta$, match quality dominates every other aspects of household behavior.

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7We have experimented extensively with different values of $\alpha$ and $\theta$. For smaller values of $\alpha$, the cost of children is large relative to the increase in utility that they provide. As a result, there are few marriages in the model because men prefer to remain single. For larger values of $\alpha$, the presence of children drives all household decisions. For example, the presence of children determines with certainty if households choose to divorce if they receive an unfavorable match quality. Similarly, if we use a larger value of $\theta$, match quality dominates every other aspects of household behavior.
divorce. According to the United States Census, 85.1% of mothers are the custodial parent. Data
collected from the US Census also indicates that only 54.9% of fathers have either joint custody or
visitation rights. The standard arrangement in case of visitation rights is that the non-custodial
parents can spend 2 weekend days every two weeks with their children. This corresponds to around
the 15% of time for 54.9% of fathers. To be consistent with these facts, it is assumed that mothers
maintain custody of their children and that children spend 85% of their time with the mother and
the remaining 15% with the father. In the simulation, we implement this by multiplying the number
of children in the utility function of a divorce mother and a divorced father by, respectively, 0.85
and 0.15. To simplify the simulation, it is also assumed that in case of remarriage of one of the
two parents, the children spend 100% of their time with the mother and that the father does not
pay any child cost. This is equivalent to assuming that the utility provided by children to divorced
fathers in case of remarriage is equivalent to the utility provided by the quantity of composite good
\( \bar{C} \) that divorced fathers can purchase because they do not have to pay the cost of children.

The state space has been chosen to reflect the features of the sample that will be used in the
simulation. We start with a description of the grid for the three sources of uncertainty. First,
the grid for wages is constructed following proposition 1 in Kennan (2004), which shows that the
best \( n \)-point approximation to a given distribution has equally weighted support points given by
\( \frac{2i - 1}{2n} \), where \( n \) denotes the number of support points and \( i \) indexes each point. In the simulation
we set \( n \) equal to 3 and we use wages that corresponds to the 1/6th, 3/6th, and 5/6th points in
the empirical distribution. The corresponding grid for women is $2.93, $4.70, and $7.91. The grid
for men is $3.96, $6.60, and $10.72. Wages change over time according to the estimates of the
wage process described earlier. Second, the grid for children is composed of 4 points, starting with
zero children and ending with 3 children. The number of children varies according to the fertility
process illustrated in a previous section. Third, it is assumed that match quality is drawn from
a two-point distribution, which implies that the evolution of this feature of household behavior is
characterized by a two by two Markov Transition Matrix.

The decision variables labor supply, saving, and relative decision power, \( M \) are also discretized.
The grid for labor supply is chosen to reflect part-time, full-time work, and over-time work. In
particular, a four-point distribution is used with values 0, 1000, 2000, and 3000. Wealth is described
using an equally-spaced 13-point grid varying between -$4,000 and $44,000 for singles and between
-$8,000 and $88,000 for married individuals. This range is chosen to reflect the distribution of total
wealth minus home equity and the value of vehicles in the PSID, where about 5.2% of households
report a wealth level below our range and 10.7% above. We have experimented with using a larger
range for wealth, particularly on the high end and we have found that few households choose
to accumulate such high levels of wealth. To a large degree, this is driven by the fact that the
simulation ends after 25 periods and households dissave in the last periods of the simulation. If we were to extend the simulation to include a retirement period households would save more. This is left for future research. The grid for relative decision power includes 21 points .01, .05, .10, ..., .90, .95, and .99. We have tested the robustness of the simulation with respect to changing the number of grid points for the Pareto weight and we have found that it is important to include a reasonably fine grid. With a grid that is too coarse, there may be mutually beneficial marriages that do not occur because the grid does not contain any points within the range of Pareto weights for which the marriage is sustainable.

The grid for experience requires a separate discussion. This grid can be constructed in two different ways. A first possibility is to choose a number of points in the grid that is equal to the number of periods in the simulation. Then if an individual works more than 500 hours in a given year, her experience increases by one. Since this approach is computationally demanding, we adopt a different strategy that generates similar results. The grid for experience is described using a two-point distribution, 0 and 25 years. Experience then increases according to the following law of motion. If an agent works over 500 hours in a given period, she has a 1 in 25 chance of increasing to the high experience state. Thus, the expected increase in experience for such an individual is equivalent to the expected increase in the first approach and equal to 1. This mechanism allows us to capture the effect of working on human capital accumulation without using such a fine grid that the simulation becomes excessively time consuming. The robustness of these results to richer specifications of experience has been tested and the results do not change substantially.

The model is simulated for 25 periods. They represent the years 1984 to 2009. The rate of return on saving is allowed to change over time. In particular, for 1982-2004 the 20-year municipal bond rate is used as the rate of return on saving.\(^8\) For 2005-2009 the interest rate is assumed to remain unchanged at the 2004 level. The rate of time preference is assumed to be constant and equal to .97. We have experimented with alternative values for the rate of time preference including .95 and .99. The overall level of savings increases with the rate of time preference, but the shape of the transitions is not sensitive to the choice.

We solve the problem using backward induction. Consider an arbitrary period. Each agent enters the period as either single or married. If the agent is single, she draws a potential spouse from the distribution of available spouses. For each agent, we evaluate first the level of utility associated with being single. Afterwards, we compute the level of utility associated with being married to the current spouse if already married or to the potential spouse if single at the given relative decision power, from this point in time forward. The level of utility conditional on marital status is computed by checking all possible alternatives for consumption, labor supply, and saving.

\(^8\)The rates are obtained from Bloomberg.
and selecting the choice that yields the highest level of utility. At the current relative decision power, each married or potential couple can be in one of the following three regimes: (i) both agents prefer being single; (ii) both agents prefer being married; (iii) one agent prefers being single and the other is better off as married. In the first two cases the marital choice is straightforward. In the third case, the couple renegotiates the current allocation of resource to make the spouse that prefers being single just indifferent between the outside option and staying in the household. This goal is achieved by shifting relative decision power, and accordingly the allocation, until this indifference condition is satisfied. If at new allocation both agents prefer being married, the couple stay married or get married. Otherwise the marriage does not generate any additional surplus and the agents will divorce or stay single.

It is worth discussing in more detail the mechanism by which potential spouses are drawn. Individuals are characterized by experience, wage, wealth, number of children, relative decision power, and match quality. For potential spouses experience and wage are drawn from a uniform distribution and then discretized. Wealth is similarly drawn at random, but each individual can only draw a potential spouse with a wealth level that is one point below or above his level in the wealth grid. This restriction is imposed to capture the fact that people search for their spouses in similar circles. With regard to children, it is assumed that single men draw only women with no children. We make this assumption for two reasons. First, men in the age range considered in our simulation marry mostly women with no children. Second, in our model men derive utility from children independently of whether the children were conceived during or before the marriage. This implies that, if we do not make this assumption, single men search for single women with children to increase their utility after marriage, which is unrealistic. As discussed in the theory section, the initial relative decision power, $M$, is the one that corresponds to the Nash Bargaining solution to avoid generating heterogeneity that is not explained by economic variables. Finally match quality is drawn from the stationary distribution derived from the transition matrix.

The solution of the model is characterized by a policy function. For every state of the world the policy function returns the optimal choices for marital status, consumption, labor supply and saving. In addition, for couples the policy function includes relative decision power. As described above, this variable may or may not be the same as the variable at the beginning of the period.

Finally, the solution is used to simulate the model for the group of individuals available in the 1984 wave of the PSID that satisfy the selection restrictions mentioned above. For each individual in the 1984 wave we match her wage, experience, wealth, marital status, and number of children to the point on the grid that most closely approximates each of the characteristics observed in the data. For married individuals there are two state variables that are not observed: relative decision power and match quality. It is assumed that individuals that are married in the 1984 wave
have the relative decision power that corresponds to the Nash Bargaining solution. After the first period of the simulation, relative decision power is optimally computed. For married individuals in 1984, it is also assumed that their marriage is characterized by good match quality. Since the couple is still married this is the best prediction we can make. The model is then simulated for 1984-2009. Because we want these simulated individuals to follow a rich set of paths, we simulate multiple possible paths for each individual. This is done by sampling with replacement from the 1984 sample in the PSID 10,000 times.

It is worth describing how individuals are followed in the simulation. In the simulation there are three types of agents. First, individuals that are in the 1984 wave and are tracked by the PSID. These are individuals in households that belong to the original 1968 PSID sample and that are tracked by the PSID even if there is a split-off. There are two main reasons for a split-off: a child in one of the original families forms her own household; a couple in the original sample or one of their children divorces. We will refer to these individuals as tracked agents. Given the age range used in this paper, all our tracked agents are children of families in the original sample. Second, individuals that are in the 1984 wave, but are not tracked by the PSID. If there is a split-off, these agents vanish from the PSID. Third, agents that appear in the simulation as potential or actual spouses of the tracked agents. To illustrate the different treatment of these types of individuals in the simulation, consider the case of a track agent who is single in the initial period. In this period this individual meets a potential spouse. If the couple decides not to marry, then the potential spouse does not appear again in the simulation. If the couple marries, then the individual will remain in the sample until the couple gets a divorce. After a divorce this individual does not appear again in the simulation. For individuals who are initially married, only one of the two individuals is the tracked agent, the other individual is dropped from the simulation if the household ever decides to divorce.

The next section presents the simulated results. They are used to replicate the tables and figures reported in section 2. For consistency, the simulated tables and figures are constructed using only the first two types of individuals generated by the simulation.

6 Results

Table 8 presents the results of the simulation and compares them to the data. The model does a reasonable job of matching the pattern of labor supply observed in the data. First, married men work more than unmarried men whereas unmarried women work more than married women. In the model this behavior is explained primarily by the presence of children in the household. Children affects individual labor supply in two different ways. First, the presence of children transfers
bargaining power from the husband to the wife, leading married men to increase and married women to decrease labor supply. The magnitude of the transfer depends on the value of children, \( \alpha \). In particular, lowering \( \alpha \) decreases the bargaining power of women in marriage. At the same time, lowering \( \alpha \) decreases the marriage rate and increases the divorce rate. Second, children affect the amount of time that individuals devote to household production. Our estimates of the domestic production function suggest that children increase the time that the wife allocates to domestic work by more relative to the husband. Everything else equal, this implies that it is more costly for the wife to supply labor on the market. Children have also an indirect effect on individual labor supply. Since their presence reduces the wife’s labor supply and increases the husband’s, married women accumulate less human capital relative to married men. Therefore the couple’s efficient allocation of resources requires an additional increase in the husband’s labor supply and an additional reduction in the wife’s labor supply.

The simulation also does reasonably well matching the patterns of consumption and wealth observed in the PSID. Table 8 shows that saving of single men is greater than saving of single women and saving of couples is more than twice saving of unmarried men and women. However, the saving levels in the simulation tend to be lower overall than the levels observed in the data. The simulated data for consumption show a similar pattern. Consumption of single men is greater than consumption of single women and consumption of couples is less than twice consumption of single men. However, we overpredict consumption for unmarried men and for married couples. This high level of consumption and low level of saving is because the simulation ends after 25 periods. If we were to extend the simulation to include a retirement period, households would save more.

Figure 5 describes the labor supply pattern for women as they enter marriage. As before, an index is used where 0 denotes the first year of a transition between marital states. In Figure 3 about the PSID, women’s labor supply decreases starting three years prior to marriage and continues to gradually decrease during the first five years of marriage. Moreover, at the time of marriage women’s labor supply is between the average labor supply of married women and the average labor supply of single women. The simulated data display a similar pattern. The average labor supply of women at the time of marriage is above the average labor supply of married women and below the average labor supply of single women. Then in the first few years after marriage, average labor supply converges gradually to labor supply of the average married woman. A notable difference between the PSID data and the simulation is that the decline of labor supply starts three years before marriage in the PSID and at the time of marriage in the simulation. The gradual decline of labor supply for married women after marriage is explained by the presence of children and by the differential accumulation of human capital between wife and husband. During these years married women tend to work less and less as their bargaining power in the marriage increases as a result
of the presence of children. This causes married women to accumulate less human capital relative to married men. For the household it is therefore optimal to further increase specialization in the household, reducing the wife’s labor supply and increasing the husband’s labor supply even more.

Figure 6 describes the labor supply pattern for men as they enter marriage and may be compared to Figure 4 that describes the pattern for men in the PSID. In both the simulation and the data, the overall trend in labor supply is opposite of the trend for women. In the data, men tend to increase labor supply two years prior to marriage and then continue to increase their labor supply throughout marriage. In the simulation, men increase their labor supply throughout the transition to marriage. As for women, these changes in labor supply are a result of changing bargaining power within the marriage. The presence of children in the household decreases the bargaining power of men thus causing them to work more. This behavior is reinforced as the husband increases human capital and household specialization becomes increasingly optimal.

Figure 7 describes women’s labor supply before and after divorce. Both this figure and the analogous figure from the PSID, Figure 1, describe a steady increase in labor supply beginning several years prior to divorce. In the model this behavior is mostly explained by couples in which the husband’s value of divorce and therefore his decision power is high relative to the wife. Labor supply of this group of marriage women increases before divorce for two reasons. First, women in this group work more because of their low decision power. Second, these women tend to have low wages, low labor market experience, and therefore an unfavorable set of outside options. Since couples make efficient decisions, these couples will choose the allocation of resources that maximizes the weighted average of individual lifetime utilities. To increase the lifetime utility of the wife, the household has to improve her outside options. The couple can achieve this in two different ways: (i) by increasing household saving, which will be split at the time of divorce; (ii) by increasing the wife’s labor supply and therefore her human capital. The first alternative decreases the lifetime utility of the husband, since for each dollar saved today, tomorrow he will receive half of it multiplied by the gross interest rate. If the dollar is consumed today, however, the husband will receive more than half. The second alternative improves the lifetime utilities of both spouses, since an increase in labor supply of the wife improves the distribution from which she will draw future wages, but also the total amount of household resources. The wage distribution improves for two reasons. First, the mean of the future conditional distribution increases if the wife decides to work today. This effect is capture by the positive coefficient on labor force participation in the wage equation. Second, the mean shifts up because the wife accumulates experience. The couple will therefore chose to increase labor supply of the wife and to decrease household saving.

Figure 8 describes the labor supply pattern for men before and after divorce. This figures may be compared to Figure 2 that describes the same pattern in the PSID. In the PSID, there are large
fluctuations in labor supply during this transition. Although the PSID includes a large number of households, only 2% of married couples tend to divorce in a given year so the figures describing the transition to divorce have relatively small samples, particularly many periods before divorce and many periods after divorce. The small sample is particularly evident for men because labor supply tends to fall within a fairly narrow range to begin with. In the simulation labor supply decreases substantially during the years leading up to a divorce and then levels off in the years after divorce. This can be rationalized using the results for women before divorce. Since married women work more before divorce, men can decrease their labor supply.

Figure 9 describes saving patterns for women before and during marriage. The pattern is similar to the pattern described in Table 2 for the PSID. Because wealth is only elicited every five years in the PSID there are not enough observations to construct a figure analogous to figure 9. There are a couple of points worth noting. First, in the simulation in the years prior to marriage women increase saving relative to unmarried women as a whole – though the increase is small in magnitude. Table 2 shows that in the PSID during the year before marriage individuals tend to save slightly more than unmarried women as a whole. Second, after marriage, in the simulation wealth gradually increases until it reaches the average level of saving of married couples. Table 2 shows that in the PSID newly married couples have low levels of wealth relative to married couples as a whole. No figures describing saving patterns for men are presented because the patterns are similar to the patterns for women except for the level of saving of single men is higher than the level of saving for single women.

Figure 10 describes saving patterns for women before and after divorce. The pattern is consistent with the evidence from the PSID. In particular, in the period before divorce women tend to save substantially less than married women as a whole. In our model households tend to reduce savings before a divorce because for an agent with high bargaining power it is better to consume than save. To see this note that for each dollar saved today each agent receives half of it multiplied by the gross interest rate. If the dollar is consumed today, however, the spouse with strong bargaining position will generally receive more than the fraction allocated at divorce, because of his high decision power.

7 Conclusions

This paper proposes a unified model of labor supply, saving, and marital decisions. The model is simulated using the 1982-1996 waves of the PSID. The results indicates that the model captures the main features of labor supply, wealth, and marriage decision displayed by the PSID data.
References


“Cohabitation, Marriage, and Divorce in a Model of Match Quality,” with Michael Brien and Lee Lillard, March 2004


A. Figures

Figure 1: PSID 1982-1996, Women’s Labor Supply Before and After Divorce.

Figure 2: PSID 1982-1996, Men’s Labor Supply Before and After Divorce.
Figure 3: PSID 1982-1996, Women’s Labor Supply Before and After Marriage.

Figure 4: PSID 1982-1996, Men’s Labor Supply Before and After Marriage.
Figure 5: Simulation, Women’s Labor Supply Before and After Marriage.

![Simulation Results: Women's Labor Supply Before and During Marriage](image)

Figure 6: Simulation, Men’s Labor Supply Before and After Marriage.

![Simulation Results: Men's Labor Supply Before and During Marriage](image)
Figure 7: Simulation, Women’s Labor Supply Before and After Divorce.

Figure 8: Simulation, Men’s Labor Supply Before and After Divorce.
Figure 9: Simulation, Women’s Wealth Before and After Marriage.

Figure 10: Simulation, Women’s Wealth Before and After Divorce.
B. Tables

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</table>

<table>
<thead>
<tr>
<th>Labor Force Participation:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>unmarried women</td>
<td>.93</td>
<td>.26</td>
</tr>
<tr>
<td>unmarried men</td>
<td>.97</td>
<td>.18</td>
</tr>
<tr>
<td>married women</td>
<td>.81</td>
<td>.39</td>
</tr>
<tr>
<td>married men</td>
<td>.98</td>
<td>.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Hours Worked if Working:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>unmarried women</td>
<td>1824</td>
<td>(669)</td>
</tr>
<tr>
<td>unmarried men</td>
<td>2094</td>
<td>(711)</td>
</tr>
<tr>
<td>married women</td>
<td>1534</td>
<td>(736)</td>
</tr>
<tr>
<td>married men</td>
<td>2281</td>
<td>(622)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>After-Tax Hourly Wage:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>unmarried women</td>
<td>6.75</td>
<td>(4.12)</td>
</tr>
<tr>
<td>unmarried men</td>
<td>7.53</td>
<td>(4.59)</td>
</tr>
<tr>
<td>married women</td>
<td>5.60</td>
<td>(4.57)</td>
</tr>
<tr>
<td>married men</td>
<td>8.13</td>
<td>(5.77)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wealth:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>unmarried women</td>
<td>20,415</td>
<td>(43,130)</td>
</tr>
<tr>
<td>unmarried men</td>
<td>31,252</td>
<td>(91,767)</td>
</tr>
<tr>
<td>married couples</td>
<td>89,831</td>
<td>(274,182)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wealth Excluding Home Equity and Vehicles:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>unmarried women</td>
<td>8,180</td>
<td>(28,597)</td>
</tr>
<tr>
<td>unmarried men</td>
<td>14,149</td>
<td>(78,329)</td>
</tr>
<tr>
<td>married couples</td>
<td>49,732</td>
<td>(257,622)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumption:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>unmarried women</td>
<td>6,522</td>
<td>(2,698)</td>
</tr>
<tr>
<td>unmarried men</td>
<td>7,927</td>
<td>(3,283)</td>
</tr>
<tr>
<td>married couples</td>
<td>10,847</td>
<td>(3,246)</td>
</tr>
</tbody>
</table>

Note: The PSID is a longitudinal study of a representative sample of U.S. individuals. The sample is from the 1982-1996 waves and the 1984, 1989 and 1994 Wealth Supplement Files. The Latino and Immigrant Samples have been excluded along with the 1968 low-income Census oversample. The sample is restricted to include only household heads and wives, not sons, daughters or other household members, unless they have started their own household. After these exclusions there are 29,594 total individual-year observations, or, about 2000 individual-year observations per year. Each survey wave records extensive individual-level information on labor supply and wages. Annual hours worked is constructed as the typical number of hours worked at each of up to three jobs multiplied by the number of weeks during the year worked at each job. Wages are calculated as annual individual labor market income divided by total annual hours worked. After-tax wages are adjusted for federal and state income tax using the NBER’s TAXSIM using household income, year, state of residence, marital status, and number of children.
Table 2: Average Wealth Levels in the PSID.

<table>
<thead>
<tr>
<th>Type of Household</th>
<th>Average Wealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married couples</td>
<td>$49,732</td>
</tr>
<tr>
<td>Unmarried individuals</td>
<td>$11,161</td>
</tr>
<tr>
<td>Married couples the year before divorce</td>
<td>$18,471</td>
</tr>
<tr>
<td>Individuals the year before marriage</td>
<td>$11,499</td>
</tr>
<tr>
<td>Just married couples</td>
<td>$19,798</td>
</tr>
<tr>
<td>Just divorced individuals</td>
<td>$8,385</td>
</tr>
</tbody>
</table>

Note: The transitions are described over the last year. For example, “married couples just before divorce” are currently married but will not be married next year and “just married couples” are currently married but were not married last year. The wealth measure excludes wealth in housing and cars.

Table 3: Wage Process Estimates

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lagged wage × lagged labor force participation</td>
<td>.530</td>
<td>(.012)</td>
</tr>
<tr>
<td>lagged labor force participation</td>
<td>.287</td>
<td>(.035)</td>
</tr>
<tr>
<td>experience</td>
<td>.017</td>
<td>(.002)</td>
</tr>
<tr>
<td>constant</td>
<td>.252</td>
<td>(.033)</td>
</tr>
<tr>
<td>variance of wage equation</td>
<td>.718</td>
<td>(.007)</td>
</tr>
<tr>
<td>log likelihood</td>
<td>-9178.5</td>
<td></td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lagged wage × lagged labor force participation</td>
<td>.503</td>
<td>(.010)</td>
</tr>
<tr>
<td>lagged labor force participation</td>
<td>-.160</td>
<td>(.064)</td>
</tr>
<tr>
<td>experience</td>
<td>.013</td>
<td>(.002)</td>
</tr>
<tr>
<td>constant</td>
<td>1.02</td>
<td>(.063)</td>
</tr>
<tr>
<td>variance of wage equation</td>
<td>.639</td>
<td>(.006)</td>
</tr>
<tr>
<td>log likelihood</td>
<td>-7163.8</td>
<td></td>
</tr>
</tbody>
</table>

Note: The dependent variable is log hourly wage deflated to reflect year 1984 prices. Lagged wage is also in logs.
Table 4: Returns to Education and Experience in the PSID, 1982-1996

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th></th>
<th>Men</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HLT 2003</td>
<td>OLS</td>
<td>FE</td>
<td>OLS</td>
</tr>
<tr>
<td>education</td>
<td>.129</td>
<td>.168</td>
<td>.146</td>
<td>.0002</td>
</tr>
<tr>
<td></td>
<td>(.0002)</td>
<td>(.007)</td>
<td>(.006)</td>
<td></td>
</tr>
<tr>
<td>experience</td>
<td>.130</td>
<td>.107</td>
<td>.103</td>
<td>.097</td>
</tr>
<tr>
<td></td>
<td>(.0001)</td>
<td>(.010)</td>
<td>(.009)</td>
<td>(.008)</td>
</tr>
<tr>
<td>experience squared</td>
<td>-.0023</td>
<td>-.0011</td>
<td>-.0017</td>
<td>-.0020</td>
</tr>
<tr>
<td></td>
<td>(.000)</td>
<td>(.000)</td>
<td>(.000)</td>
<td>(.000)</td>
</tr>
<tr>
<td>constant</td>
<td>6.89</td>
<td>5.63</td>
<td>8.04</td>
<td>7.12</td>
</tr>
<tr>
<td></td>
<td>(.003)</td>
<td>(.124)</td>
<td>(.062)</td>
<td>(.097)</td>
</tr>
</tbody>
</table>

Note: The dependent variable is annual labor earnings in logs. The first column reports coefficients from the 1990 census for white males reported by Heckman, Lochner and Todd (2003). The next four columns report coefficients from the PSID. Following Heckman, Lochner and Todd (2003), experience is calculated in 1982 as age minus education minus 6. Experience is then updated for the years 1983-1996, increasing by one in years in which the individual works 500 or more hours.

Table 5: Estimates of Fertility Process (Probit).

<table>
<thead>
<tr>
<th>dependent variable</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>one child currently at home</td>
<td>.076</td>
</tr>
<tr>
<td></td>
<td>(.029)</td>
</tr>
<tr>
<td>two children currently at home</td>
<td>-.635</td>
</tr>
<tr>
<td></td>
<td>(.030)</td>
</tr>
<tr>
<td>three or more children currently</td>
<td>-.290</td>
</tr>
<tr>
<td></td>
<td>(.043)</td>
</tr>
<tr>
<td>married</td>
<td>.753</td>
</tr>
<tr>
<td></td>
<td>(.056)</td>
</tr>
<tr>
<td>constant</td>
<td>-1.73</td>
</tr>
<tr>
<td></td>
<td>(.055)</td>
</tr>
<tr>
<td>n</td>
<td>11180</td>
</tr>
</tbody>
</table>

Note: The dependent variable is a dummy equal to one if during the current year the household gives birth to a child.
<table>
<thead>
<tr>
<th>dependent variable</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>cost for first child</td>
<td>486.0</td>
<td>(16.2)</td>
</tr>
<tr>
<td>cost for second child</td>
<td>370.8</td>
<td>(17.0)</td>
</tr>
<tr>
<td>cost for additional children</td>
<td>287.3</td>
<td>(9.98)</td>
</tr>
</tbody>
</table>

Note: The dependent variable is a measure of annual expenditure that includes food at home, child care, boy’s clothing and shoes, girl’s clothing and shoes, and infant clothing. The sample includes households with the head with ages 20 to 40. All dollar values have been deflated to reflect year 1984 dollars. Coefficients for after tax income, age of the household head, education of the household head, race and marital status are omitted. The regression includes 29,961 observations and the $R^2$ is .36.
Table 7: Household Production Regression, OLS

<table>
<thead>
<tr>
<th>Category</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>single woman</td>
<td>-13.4</td>
<td>(24.8)</td>
</tr>
<tr>
<td>married woman</td>
<td>224.8</td>
<td>(22.3)</td>
</tr>
<tr>
<td>married man</td>
<td>-29.1</td>
<td>(20.3)</td>
</tr>
<tr>
<td>one child</td>
<td>26.1</td>
<td>(19.3)</td>
</tr>
<tr>
<td>two children</td>
<td>62.4</td>
<td>(17.8)</td>
</tr>
<tr>
<td>three or more children</td>
<td>119.9</td>
<td>(20.7)</td>
</tr>
<tr>
<td>one child × woman</td>
<td>203.2</td>
<td>(28.2)</td>
</tr>
<tr>
<td>two children × woman</td>
<td>319.1</td>
<td>(26.1)</td>
</tr>
<tr>
<td>three or more children × woman</td>
<td>455.4</td>
<td>(30.3)</td>
</tr>
<tr>
<td>working 500+ hours annually</td>
<td>-238.5</td>
<td>(20.2)</td>
</tr>
<tr>
<td>wage if working</td>
<td>-0.011</td>
<td>(.017)</td>
</tr>
<tr>
<td>labor supply</td>
<td>-0.094</td>
<td>(.009)</td>
</tr>
<tr>
<td>constant</td>
<td>835.6</td>
<td>(23.0)</td>
</tr>
</tbody>
</table>

Note: The dependent variable is reported annual hours spent on household production. The variable is derived from answers 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 sample is the same as described in the descriptive statistics. The excluded category is single men. The $R^2$ is .22.
Table 8: Simulation Results.

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual Hours at Work:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unmarried women</td>
<td>1,824</td>
<td>1,880</td>
</tr>
<tr>
<td>unmarried men</td>
<td>2,094</td>
<td>2,014</td>
</tr>
<tr>
<td>married women</td>
<td>1,534</td>
<td>1,643</td>
</tr>
<tr>
<td>married men</td>
<td>2,281</td>
<td>2,350</td>
</tr>
<tr>
<td><strong>Consumption:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unmarried women</td>
<td>6,522</td>
<td>6,229</td>
</tr>
<tr>
<td>unmarried men</td>
<td>7,927</td>
<td>13,885</td>
</tr>
<tr>
<td>married couples</td>
<td>10,847</td>
<td>20,521</td>
</tr>
<tr>
<td><strong>Wealth:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unmarried women</td>
<td>8,180</td>
<td>6,472</td>
</tr>
<tr>
<td>unmarried men</td>
<td>14,149</td>
<td>8,202</td>
</tr>
<tr>
<td>married couples</td>
<td>49,732</td>
<td>30,932</td>
</tr>
</tbody>
</table>