A Dynamic Model of Taxation, Marital Status, Fertility, and Labor Supply

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Abstract

[PRELIMINARY AND INCOMPLETE, PLEASE DO NOT CIRCULATE]

1 Introduction

Marriage is a social institution that has profound implications for important economic issues as family structure, population growth, child development, poverty, and income distribution. Because of these connections, marriage has been the subject of numerous academic studies and policy decisions. Since the work of Becker (1973, 1974) economic incentives have been found to play a major role in the marriage decision (e.g., Montgomery and Sulak, 1989). The potential significance of taxes in marital status has been studied in static models (e.g. Alm and Whittington, 1999; Dickert-Conlin, 1999). The premisse in the static models of marriage is that individuals decide to marry if they expect higher utility from the union in comparison to remaining single.

The taxes affect the calculation because there may be subsidies or penalties associated with marriage. The original individual income tax in 1913 used the individual as the unit of taxation, which made the income tax "marriage neutral". In 1948, couples were allowed to divide their income regardless of relative earnings. Because of the progressive taxation, this change implied large "marriage subsidies" for many couples. In 1969, single individuals saw their tax liabilities decreased relative to those of married couples and, as a result, married couples paid a tax penalty. The changes in the tax code since then have changed the magnitude of the marriage penalty. They have also kept the marriage subsidy for some couples. The density of marriage penalty and subsidies for women who are 30 years-old and cohabiting or married is shown in Figure 1.

However, very little work has been done on the dynamic distortions of the marriage penalty in the choice of marital status. In fact, as Table 1 shows, couples who should pay higher penalties associated with marriage are more likely to cohabit before marrying. It is possible that the marriage penalty has induced couples to start a cohabitation before they engage in marriage. Bumpass and

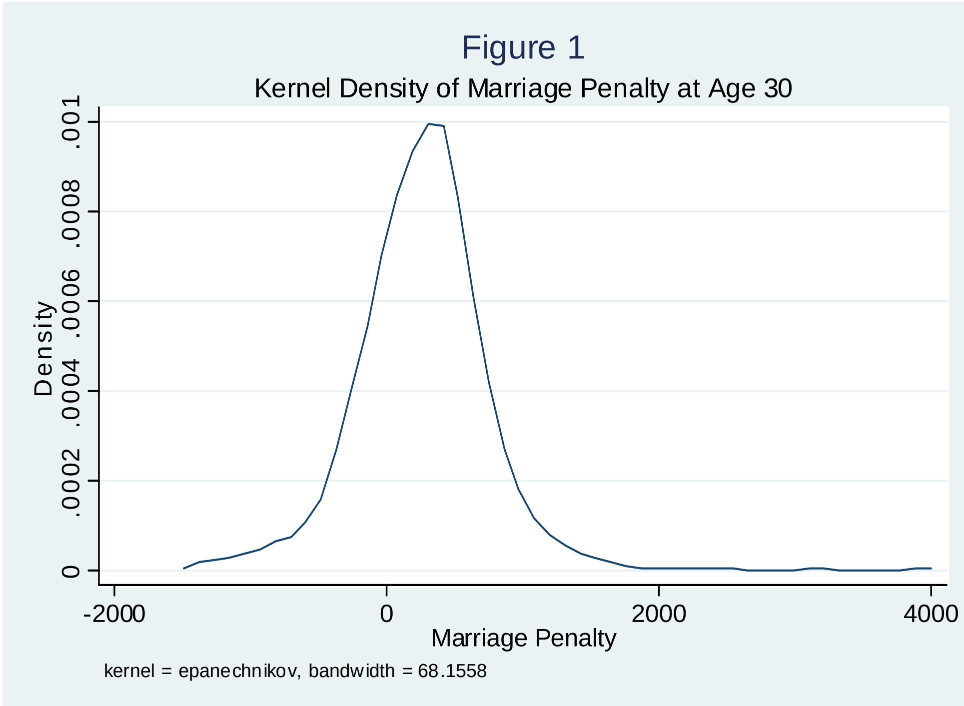

Figure 1:

Sweet (1989) show that 37% of the women born between 1960 and 1964 had lived in a nonmarital cohabitation by age 25. Bumpass, Sweet, and Cherlin (1991) show that, despite increases in the age of the first marriage that have been seen over the last few decades, individuals are still forming cohabiting relationships at about the same point in their lives. The evidence presented in Rindfuss and VandenHeuvel (1991) suggests that cohabitation relationships are shorter lived than traditional marriages. Furthermore, cohabiting couples exhibit different behavior than married couples in their fertility choices, as suggested by McLanahan (1994).

Although taxes can affect fertility and labor force participation directly, we would expect to find an indirect effect through the marital choices. For these reasons, we build a dynamic model where marriage, fertility, and labor supply choices are made jointly by singles and prospective couples. We show identification of the model and estimate it using the NLSY/79 data. We estimate how marriage rates, fertility choices, and labor supply of women would change if different tax regimes were in place.

2 The Economic Environment

We consider a woman who makes decisions about her marital status, fertility choice, and labor supply. In our model, the periods are discrete and they last one calendar year. At each point in time, a woman draws a level of match quality b from a fixed distribution. If a woman is single or divorced, she decides whether to engage in a cohabitation relationship, a marriage, or remain single or divorced. A woman who is cohabiting or married, the current match quality evolves over time and there is uncertainty at the time of pairing about the future match quality. If she is cohabiting, upon observing the new level of the current match and the draw for a new match, she chooses whether to end the relationship and stay single, end the current relationship and start a new cohabitation with the new match, end the current relationship and marry the new match, continuing cohabiting with the current match, or marry her current partner. If she is married, she chooses whether to continue married with the current husband, end the current marriage and being divorced, end the current marriage and start a cohabitation with the new match, end the current marriage and start a marriage with the new match. There are costs associated with ending a relationship and we assume that the cost of ending a marriage is different than the cost of ending a cohabitation.

After marital status choices are made, women choose whether to have another child or not. The child is born in the same period she becomes pregnant. At the same time, she also chooses if she wants to work or not. If she participates in the labor market, she decides between working part-time or full-time. For simplicity, we assume that there are no assets markets, so there is no borrowing or lending.

2.1 Tastes

2.1.1 Single and Divorced Women

In what follows, let $a \in \{\underline{a}, ..., \bar{a}\}$ denote the woman's age. We use c_a to represent her consumption at age a. By n_a we denote the number of children she currently hasm, which includes the child she has chosen to have in the current period. Let $p_a = 1$ denote if she is pregnant when she is a years-old. Let $h_{f,a} = 1$ denote a woman who works full time when she is a years-old and $h_{f,a} = 0$ otherwise. A woman who works part-time is assigned the value $h_{p,a} = 1$ and $h_{p,a} = 0$ otherwise. Because a woman can only have one job at each age, we impose the restriction that $h_{f,a} + h_{p,a} = 1$ for every age a. Let $\kappa_{1,a}$ and $\kappa_{2,a}$ denote the number of cohabitations and marriages that woman has already ended. Let ϵ_a denote the preference shocks associated with fertility and labor supply decisions. The utility function for a single or divorced woman when she is a years-old is:

$$U_a = u\left(c_a, n_a, h_{f,a}, h_{p,a}, \epsilon_a\right) - \delta_1 \kappa_{1,a} - \delta_2 \kappa_{2,a}.$$

This formulation of the utility assumes that ending a cohabitation or a marriage induces a permanent reduction in utility. We assume that agents start their life with $\kappa_{1,a} = \kappa_{2,a} = 0$.

2.1.2 Cohabiting and Married Women

Let $d_a = 1$ if the woman is cohabiting and $d_a = 2$ if she is married. The utility for a cohabiting or married woman is:

$$U_a = u\left(c_a, n_a, h_{f,a}, h_{p,a}, \epsilon_a\right) + b_a + \gamma\left(d_a - 1\right) b_a - \delta_1 \kappa_{1,a} - \delta_2 \kappa_{2,a}$$

where b_a is the bliss from the current match. The parameter γ captures the marriage premium, which interacts with the bliss from the current match. If $\gamma > 0$, then the bliss from the current relationship is larger under marriage than under cohabitation.

2.1.3 Match Quality, Fertility, Experience, Relationship History

At each age a, a single or divorced woman draws a match quality b_a. We assume that b_a is normally distributed with mean μ_0 and variance σ_0^2 and evolves over time. Let b_{a-1} denote the match quality in the previous period. We assume that the match quality for a cohabiting or married woman evolves according to an AR(1) process described by:

$$b_a = (1 - \rho)\mu_1 + \rho b_{a-1} + \sigma_1 \sqrt{1 - \rho^2} \zeta_a \tag{1}$$

where ζ_a is normally distributed with mean zero and variance one. The mean value μ_1 is the long-run quality of the match, which may depend on observable characteristics of the pair. However, we keep this dependence implicit to simplify notation.

At the beginning of age a, let n_{a-1} denote the number of children that the woman has. We remind the reader that a child is born immediately. Therefore, at the end of period a is:

$$n_a = n_{a-1} + p_a. \tag{2}$$

Labor market experience is also endogenous and varies according to the labor supply choices. Let x_a denote the labor market experience at the beginning of the period the woman is a years-old. Then, the experience next year is

$$x_a = x_{a-1} + 0.5 h_{p,a} + h_{f,a}. \tag{3}$$

Let $\kappa_{1,a-1}$ denote the number of cohabitation relationships a woman has ended. If she is currently in cohabitation and ends it at the beginning of the year she becomes a years-old, then we set:

$$\kappa_{1,a} = \kappa_{1,a-1} + 1. \tag{4}$$

The evolution of $\kappa_{2,a}$ proceeds similarly.

2.2 The Budget Constraint

Let $w_{f,a}$ and $w_{p,a}$ denote the hourly wage offers for a full-time and part-time job, respectively. Her pre-tax labor income when she is a years-old, y_a, is:

$$y_a = w_{p,a}h_{p,a} + w_{f,a}h_{f,a}. \tag{5}$$

We assume that the wage offer functions are functions of a woman's education, e_a, labor market experience, x_a, and skills, g_a:

$$\begin{array}{c} \ln w_{p,a} = \beta_{0,p} + \beta_{1,p}x_a + \beta_{2,p}x_a^2 + \beta_{3,p}e_a + \beta_{4,p}g_a + \varepsilon_{p,a} \\ \ln w_{f,a} = \beta_{0,f} + \beta_{1,f}x_a + \beta_{2,f}x_a^2 + \beta_{3,f}e_a + \beta_{4,f}g_a + \varepsilon_{f,a} \end{array} \text{ where } \begin{pmatrix} \varepsilon_{p,a} \\ \varepsilon_{f,a} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_p^2 & \sigma_{pf} \\ \sigma_{pf} & \sigma_f^2 \end{pmatrix}\right]. \tag{6}$$

2.2.1 Single and Divorced Women

Let $\tau_{s,t,l}(y_a)$ denote the labor income tax when she is single or divorced, is a years-old, lives in location l, and has labor income y_a. Let q denote the costs of rearing each child. The budget constraint is given by:

$$c_a + qn_a = (1 - \tau_{s,t,l}(y_a))\, y_a \tag{7}$$

2.2.2 Cohabiting Women

Women who are cohabiting receive an income transfer from her partner, but of them pays labor income taxes according to the rate for singles. Let $\tilde{y}_a$ denote the income of the partner when the woman is a years-old. The budget constraint facing a cohabiting woman reads:

$$c_a + qn_a = (1 - \tau_{s,t,l}(y_a))\, y_a + \alpha_1 (1 - \tau_{s,t,l}(\tilde{y}_a))\, \tilde{y}_a, \tag{8}$$

where α is the fraction of the partner income that is transferred to the woman.

2.2.3 Married Women

We assume that married couples file their taxes jointly. Let $\tau_{m,t,l}(y_a, \tilde{y}_a)$ denote the labor income taxes of a married couple, at the period t when the wife is a years-old, they live in location l, her income is y_a, and his income is $\tilde{y}_a$. The budget constraint is given by:

$$c_a + qn_a = (1 - \tau_{m,t,l}(y_a))\, y_a + \alpha_2 (1 - \tau_{m,t,l}(\tilde{y}_a))\, \tilde{y}_a \tag{9}$$

where α_2 is the fraction of the partner income that is transferred to the woman. We assume that the tax schedule evolves exogenously.

3 Decision Rules

We start by describing the state space. Let $\Omega(t,a)$ denote the state vector at period t when the woman becomes a years-old. Let $\vec{\tau}_{j,t,l}$ denote the parameters that characterize the tax schedule $\tau_{s,t,l}(.)$. Then, the state vector is:

$$\Omega(t,a) = [n_{a-1}, \kappa_{1,a-1}, \kappa_{2,a-1}, d_a, x_{a-1}, e_a, g_a, \varepsilon_a, \varepsilon_a, \vec{\tau}_{s,t,l}, \vec{\tau}_{m,t,l}, \tilde{y}_a.]$$

Let $V_0(t,a,b'_a,\Omega(t,a))$ denote the expected lifetime utility of a single woman who is a years-old and has just drawn a match quality b'_a. Likewise, let $V_1(t,a,b_a,b'_a,\Omega(t,a))$ denote the expected lifetime utility of a woman who is in a cohabitation relationship with match quality b_a and has just drawn a potential new match with quality b'_a. Similarly, let $V_2(a,b_a,\Omega(t,a))$ denote the expected lifetime utility of a woman whose marriage has a match quality b_a and has just drawn a potential new match with quality b'_a. The single woman chooses to marital status that maximizes expected lifetime utility:

$$V(t,a,b^*_a,\Omega(t,a)) \geq \max\{V_0(t,a,\Omega(t,a)), V_1(t,a,b'_a,\Omega(t,a)), V_2(a,b'_a,\Omega(t,a))\}.$$

The cohabiting and married women chooses:

$$V(t,a,b^*_a,\Omega(t,a)) = \max\left\{\begin{array}{c} V_0(t,a,\Omega(t,a)), \\ V_1(t,a,b_a,\Omega(t,a)), V_2(a,b_a,\Omega(t,a)), \\ V_1(t,a,b'_a,\Omega(t,a)), V_2(a,b'_a,\Omega(t,a)) \end{array}\right\}.$$

Given the marital status choice, the problem of the single or divorced woman is to solve:

$$V_0(t,a,\Omega(t,a)) = \max\left\{\begin{array}{c} U_a = u(c_a,n_a,h_{f,a},h_{p,a},\epsilon_a) - \delta_1\kappa_{1,a} - \delta_2\kappa_{2,a} + \\ \beta E\left[V\left(t+1,a+1,b^*_{a+1},\Omega(t+1,a+1)\right)\middle|\,\Omega(t,a),m_a\right] \end{array}\right\}$$
$$\text{subject to (2), (4), (3), (5), (6), and (7),}$$

where we denote by $m_a = 0$ if the woman is single at age a or $m_a = 3$ if she is divorced at age a. The problem of the cohabiting woman is:

$$V_1(t,a,b_a,\Omega(t,a)) = \max\left\{\begin{array}{c} U_a = u(c_a,n_a,h_{f,a},h_{p,a},\epsilon_a) + b_a - \delta_1\kappa_{1,a} - \delta_2\kappa_{2,a} + \\ \beta E\left[V\left(t+1,a+1,b^*_{a+1},\Omega(t+1,a+1)\right)\middle|\,\Omega(t,a),m_a=1\right] \end{array}\right\}$$
$$\text{subject to (1), (2), (4), (3), (5), (6), and (8),}$$

where $m_a = 1$ denotes a woman who is cohabits at age a. The problem of the married woman is:

$$V_2\left(t, a, b_a, \Omega\left(t, a\right)\right) = \max \left\{ \begin{array}{l} U_a = u\left(c_a, n_a, h_{f,a}, h_{p,a}, \epsilon_a\right) + \left(1+\gamma\right) b_a - \delta_1 \kappa_{1,a} - \delta_2 \kappa_{2,a} + \\ \beta E\left[V\left(t+1, a+1, b^*_{a+1}, \Omega\left(t+1, a+1\right)\right) \middle| \, \Omega\left(t, a\right), m_a = 2 \right] \end{array} \right\}$$

$$\text{subject to (1), (2), (4), (3), (5), (6), and (8),}$$

where $m_a = 2$ denotes a woman who is married at age a.

Table 1
Marriage Penalty and Marital Status
Probit Models, Dependent Variable: 0 if Cohabiting and 1 if Married

Panel A

	Single at Age 20, Married or Cohabiting Between Age 21 and 24	Single at Age 21, Married or Cohabiting Between Age 22 and 25	Single at Age 22, Married or Cohabiting Between Age 23 and 26	Single at Age 23, Married or Cohabiting Between Age 24 and 27	Single at Age 24, Married or Cohabiting Between Age 25 and 28
Marriage Penalty	-3.183	-3.097	-2.963	-3.365	-2.316
	-2.360	-2.640	-2.900	-3.030	-1.870
Age	0.086	0.055	0.059	0.058	0.157
	2.540	1.770	2.160	2.130	5.810
Respondent's Income	0.050	0.059	0.068	0.062	0.045
	1.910	2.670	3.610	3.360	2.320
Partner's or Spouse's Income	-0.007	-0.019	0.007	0.010	0.015
	-0.300	-0.870	0.430	0.540	0.770
Female's Education	0.102	0.121	0.124	0.123	0.127
	3.440	4.560	4.830	4.620	4.550
Male's Education	0.019	0.031	0.028	0.019	0.038
	1.270	2.250	2.180	1.470	2.810
AFQT	-0.057	-0.032	-0.007	-0.028	-0.042
	-1.790	-1.120	-0.280	-1.000	-1.420
Locus of Control	0.026	-0.006	-0.024	0.013	0.047
	0.940	-0.260	-1.010	0.510	1.690
Self-Esteem	-0.018	0.049	0.048	0.042	0.018
	-0.600	1.810	1.880	1.600	0.650
Observations	3407	3994	4441	4034	3480

Panel B

	Single at Age 25, Married or Cohabiting Between Age 26 and 29	Single at Age 26, Married or Cohabiting Between Age 27 and 30	Single at Age 27, Married or Cohabiting Between Age 28 and 31	Single at Age 28, Married or Cohabiting Between Age 29 and 32	Single at Age 29, Married or Cohabiting Between Age 30 and 33
Marriage Penalty	-1.634	-2.154	0.000	0.580	1.490
	-1.340	-1.870	0.000	0.580	0.870
Age	0.189	0.175	0.153	0.075	0.074
	6.440	5.050	3.950	1.570	1.320
Respondent's Income	0.052	0.083	0.052	0.053	0.023
	2.500	3.500	2.060	1.930	0.620
Partner's or Spouse's Income	-0.043	-0.062	-0.055	-0.058	-0.063
	-2.330	-3.700	-3.580	-3.560	-1.930
Female's Education	0.190	0.228	0.173	0.082	0.062
	5.920	6.280	4.160	1.660	1.050
Male's Education	0.043	0.061	0.047	0.041	0.015
	2.910	3.700	2.410	1.750	0.570
AFQT	-0.049	-0.039	-0.009	-0.072	-0.145
	-1.470	-0.980	-0.200	-1.360	-2.210
Locus of Control	0.040	0.009	-0.013	0.033	0.106
	1.320	0.240	-0.330	0.710	1.910
Self-Esteem	-0.034	0.032	0.050	0.068	-0.011
	-1.070	0.850	1.170	1.360	-0.180
Observations	2810	2038	1544	1039	723

Note: We include dummies for race, geographic location, urban vs. non-urban residence, religion, and cohort.

	Coef.	Std. Err.	Z	P>$\lvert Z \rvert$
marriage penalty	1.370181	1.171256	1.17	0.242
wage income	0.032727	0.019067	1.72	0.086
schooling	0.099113	0.028683	3.46	0.001
spouse/partner income	-0.0387	0.019015	-2.04	0.042
spouse/partner edu	0.027159	0.014548	1.87	0.062
black	0.053411	0.112843	0.47	0.636
white	-0.02934	0.081804	-0.36	0.72
northeast	0.011877	0.089418	0.13	0.894
northcentral	0.158447	0.085659	1.85	0.064
south	0.202786	0.080747	2.51	0.012
protestant	-0.11031	0.165589	-0.67	0.505
baptist	-0.14381	0.108417	-1.33	0.185
episcopalian	-0.11275	0.195367	-0.58	0.564
lutheran	0.024107	0.141772	0.17	0.865
methodists	-0.11968	0.132809	-0.9	0.367
presbyterian	-0.14812	0.163019	-0.91	0.364
catholic	-0.05208	0.101738	-0.51	0.609
jewish	0.161697	0.251913	0.64	0.521
atheist	-0.08404	0.155909	-0.54	0.59
AFQT	0.005401	0.029603	0.18	0.855
urban	-0.01343	0.070306	-0.19	0.848
Number of Obs	2,685			
Log likelihood	-7142.5389			
Prob > chi2	0.0000			

* Year_dummies are present in the regression.