Does Marriage Make *Cents*?

(in progress)

URL: https://sites.google.com/site/wongyylsite/

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March 19, 2018

Abstract

I demonstrate marriage premium can arise with homogeneous agents and estimating an equilibrium model with correlated labor and marriage market feasible. I build a model that integrates a frictional labor market and a frictional marriage market, where meeting in the marriage market is non-random. Based on data from the Panel Study of Income and Dynamics Transition to Adulthood file (TA) 2005-11, I construct and document transition and wage patterns of a cohort of Millennials.

Results from maximum likihood estimation indicate that married people earn more than single people because differences in employment status affects the marriage market. In particular, more abundant contacts of and socialization among employed agents make employment more valuable in the marriage market. Single agents take a lower wage and make it up by gains from meetings in the marriage market. Further, insofar as being employed incurs costly relationship upkeep, married people take a higher base wage to offset those cost in the marriage market.

Evaluating among competing factors, I find that job search assistant policy promotes more wage inequality than dating subsidies by a factor of 3. Changes in preference or workplace policy on personal romance has trivial impact on inequality.

JEL Codes: J31, D83, E31

Keywords: Marriage Premium, Search and Matching, Employment Sorting

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1 Introduction

It is well-documented that earnings for married men significantly exceed that for single men. Even after controlled for a variety of covariates using different datasets across time, the estimated earning differential is daunting, ranging from 10 to 50%.[1] The standard explanation for the inequality is selection based on productivity differences as productive traits in the labor market are also valued in the marriage market.[2]

In this paper, I explore whether married people earn more when people are equally productive. To address this issue, I build a framework that encompasses both labor and marriage market and study its equilibrium implications, construct a cohort of young adults with complete labor and marriage market histories, and apply the framework to data to study competing factors in affecting the wage inequality between married and single agents.

I build a search and matching framework where the labor market and the marriage market are decentralized and convened sequentially, and where agents differ wrt employment and marital status only, and there is no specification within a married household. The labor market affects the marriage market but not vice versa. In particular, employment affects the marriage market in three ways. First, employed agents have higher chance than unemployed agents to contact other agents. Second, they also have a higher chance to meet other employed agents via socialization at work. I refer this as non-random meeting. Third, employed agents have disutility toward marrying unemployed partners.[3]

The three ingredients are driven empirically. The dating literature demonstrates that an increasing number of romantic relationships are created in workplace, and employed people are more attracted to other employed people.[4] In addition, it is well-established that unemployed people have lower marriage rate than employed people.[5]

[1] See, for example, Korenman-Neumark 1991, Loh 1996, Cornwell-Rupert 1997, Gray 1997, Stratton 2002, Antonovics-Town 2006, Juhn-Kim 2010

[2] Another view suggests that men are more productive in the labor market than women; household specialization in marriage makes married men more productive in the labor market. However, conclusions from Juhn and Kim (2010) reject this hypothesis.

[3] The literature posits that people prefer more productive marital partners. Since people have the same productivity, one way to incorporate the idea from the literature is to assume people have taste toward employment status.

[4] See, for example, Hortescu et al. (2007) and Fisman et al. (2009). Young (WSJ, 2017) documented that Millennials are (30 per cent) more likely than older generations to view workplace as a dating pool, and one out of five actually met their partners/spouses through work.

[5] See, for example, Schultz (1994), Ekert-Jaffe-Solaz (2001), Elias (2003), and Gutiérrez-Domènech (2008). William Julius Wilson (1987) proposed an explanation for the decline in marriage rates that has received a great deal of attention. According to Wilson, the decline in marriage rates among

Using IPUMS 1980-2000, I find that being unemployed is 40-52 per cent less likely to get married than being employed.[6] Using panel data (NLSY, PSID), I find that employment increases the hazard of marriage by 35 to 43 per cent. Further, employed agents make more contacts with others in general because of their access to institutions unavailable to unemployed people, who contact others in general environment only.

The model predicts that married people earn more than single people *not* because of differences between married and single people that affect the labor market. It is because of differences in employment status in affecting the marriage market. In particular, insofar as being employed (is valuable in the marriage market for single people) have more abundant contacts and socialization within their type, it raises their expected marriage surplus. Single people take a lower base wage, make it up from expected gains in the marriage market. Independently, insofar as being employed incurs costly relationship upkeep, married people take a higher base wage to offset those cost in the marriage market. These two effects stretch the wage spread between married and single people.

As the framework describes individuals' transition, I construct a sample of cohorts using data from the Panel Study of Income Dynamics Transition to Adulthood (PSID-TA) file. I focus on high-school graduated youths who were between 14 and 21 in 2005 and follow them through 2011. The main advantage of this data file is that it contains information on search starting time (job and marriage), which is often missing in data sets used to study the school-to-work transition. The sample indicates married agents earned about 12.8 per cent more than single agents.

I apply the above framework to the sample of Millennial cohorts by estimating the model structurally. Following the model and data structure, I estimate the model using maximum likelihood.

Estimation results indicate that meeting in the marriage market is significantly non-random, employed agents contact people significantly more, and disutility toward unemployed partners is insignificant. The results also indicate that the labor market is more active than the marriage market.

Further, employed agents are more selective toward partners of the same type than unemployed agents. The higher selectivity is mainly driven by a boost from more abundance contacts for employed agents. Despite being more selective, the expected surplus from marriage for employed agents is also higher for two reasons.

blacks is due primarily to declining black male employment.

[6] A result from a probit regression with covariates being age, age-squared, education level, an unemployment dummy, race, sex, and geography.

First, they meet partners more frequently. The second reason is related to non-random meeting. The majority of agents encounter employed partners as the share of employed agents is about 2/3 among the singles. On one hand, as employed agents meet unemployed partners rarely (with probability 0.31), the small surplus generated from these matches is inconsequential. On the other hand, unemployed agents meet the employed relatively frequently (with probability 0.59); this help raise their match surplus because they are less selective toward employed partners. But the net effect is that the expected marriage surplus for employed agents is higher. When agents earn their reservation wage, the earning differential between employed and unemployed agents in the model is governed by the net value of employment in the marriage market. The results indicate that being employed is more valuable than being unemployed in the marriage market, single agents take a lower wage and make it up by such gain in the marriage market. In addition, despite being more selective, employed agents have more than twice the propensity to marry than unemployed agents because employed people have a higher contact rate.

Evaluating among competing factors for wage inequality, I find that labor market policy in the form of job search assistance promotes wage inequality more than marriage market policy in the form of dating subsidies (think an easier assess to E-harmony), by a factor of 3. Changes in preference in the form of higher disutility from the employed toward unemployed partners or workplace policy on personal romance has trivial impact on inequality.

This paper is the first to integrate frictional labor and marriage markets in an equilibrium framework. A literature connecting the workhorse labor market model of Diamond (1982)-Mortensen (1982)-Pissarides (1984) with other markets with frictions has flourished recently. For example, Rocheteau-Wright (2013) and Berenstein-Menzio-Wright (2011) connect the labor market with the retail market, Pedrosky-Rocheteau (2013) study labor market and housing market, Pedrosky-Wasmer (2013) and Wasmer-Weil (2004) study labor market and financial market, Kaplan-Menzio (2013) study labor market and product market. Additionally, in many of these studies, agents' preferences and meeting technology are separable across markets, and the terms of trade are independent across markets. Rocheteau-Rupert-Wright (2007) demonstrate that when buyers' preferences interact with allocations or state variables in other markets, money holding is non-degenerate. This paper generates state-dependent terms of trade (wage, selection) when agents' meeting rate in the marriage market interacts with their status in the labor market. (LM affects MM, but not reverse)

This paper is also the first study that constructs transition data among two of the most studied markets: labor and marriage. Search literature that studies transition data typically focuses on one market: for the labor market, e.g. Wolpin (87), Eckstein and Wolpin (90,95), van den Berg and Ridder (98); for the marriage market, e.g. Wong (03a,b) and Seitz (03). Further, I particularly address the left-censoring issue in both markets that has not been attempted due to data limitation. Left-censoring occurs when the start of an event (job or companion search) is unknown. Two standard methods are used in the search literature: the minimum order statistics of the event (when employment or marriage occurred) or forward recurrence time (graduation date).[7] In this paper, the PSID-TA file provides an information advantage to the standard methods. For the labor market, the TA file contains retrospective employment data that allows me to get backward recurrence time information – before graduation or the start of employment. This information helps obtain more accurate time on the start of job search. For the marriage market, the TA file contains the number of years and months dating. This information let me know how long relationship had started before cohabitation or marriage occurred. Of course, one needs to search before dating. Having dating duration, nonetheless, helps give us more accurate search starting time.

Section 2 presents the model. Section 3 presents solves the equilibrium and characterize the equilibrium. Section 4 describes the data. Section 5 addresses estimation issues. Results are presented in section 6, to be followed by a conclusion.

2 Model

An infinite-horizon discrete-time economy is populated by two types of agents, workers and firms, who exchange goods and services – labor and a consumption object – while workers also exchange companionship among themselves. Workers and firms trade indivisible labor services in a decentralized labor market (LM) subject to search friction. The divisible consumption object is a numeraire good traded in a centralized market (CM). Companionship is traded in a decentralized marriage market (MM) with search frictions, where agents form or breach long-term relationships.

The measure of workers is normalized to one, and there is a large continuum of firms. Firms produce and pay out compensations; they are all identical. Workers work, get companions, and consume. There are four types of workers, given by

[7] In reference for some of the earliest studies, for example, Wolpin (87) uses the minimum order statistics in employment date to proxy for the start of job search. Wong (03a,b) uses the minimum order statistics from first marriage age as an estimator for marital search start. While Eckstein-Wolpin 90,95 (EW) and BKN (01) use forward recurrence time in the study of labor market transition.

indivisible employment and marital status, $e \in \{0,1\}$ and $m \in \{0,1\}$ respectively. Let the measure of type (e,m) workers be n_{em}, where $n_{00} = 1 - n_{01} - n_{10} - n_{11}$. Further, $n_{.m} = n_{0m} + n_{1m}$ is the measure of type m workers, and $n_{e.}$ is defined likewise.

The lifetime utility of agents is given by utility while unemployed, utility while being single, expected match quality while married, and consumption:

$$E\sum_{t=0}^{\infty}\beta^t[(1-e_t)\ell + (1-m_t)u + m_tQ_t + c_{mt}]$$

where $\beta = 1/(1+r) \in (0,1)$ is a discount factor, ℓ is the utility from leisure, u is the utility of singlehood, $Q_t \in \mathbb{R}_+$ is the expected match quality, and $c_{mt} \in \mathbb{R}$ is the consumption of the numeraire object in the CM (where $c_{mt} < 0$ represents production).

Markets open sequentially in each unit of time. The first market to open is the LM. The LM involves bilateral random matching between workers and firms and long-term relationships. Let M^i be the constant return to scale meeting technology in market i. It is increasing in both its arguments, concave, and homogeneous of degree 1. The measure of matches between vacant jobs v and unemployed workers $n_{0.}$ in the first market is $M^1(n_{0.}, v)$. The probability of that an unemployed worker matches with a vacancy is $M^1(n_{0.}, v)/n_{0.} = \lambda^1$, and $\theta = v/n_{0.}$ is the labor market tightness. An employed worker receives compensation in terms of the numeraire object, w_m, which is a bargaining outcome. This compensation is paid in the CM and potentially varies with the worker's marital status. An unemployed worker receives b units of the numeraire object, $0 < b < w_m$. Workers cannot borrow or save across time. A firm consists of one job, vacant or filled. A vacant job has probability $M^1(n_{0.}, v)/v = \alpha^1$ of finding workers. Each filled job produces $x > 0$ units of divisible goods that can be stored for one unit of time costlessly. A job-match terminates with probability δ^1.

The next market to open is the MM. Agents (workers) form or breach long-term relationships among each other. Single agents come together through a constant return to scale matching function $M^2(n_{.0}, n_{.0}) = \lambda^2 n_{.0}$, where λ^2 is the probability at which each single agent contacts another single agent. Sex plays no role in the MM.

While the MM does not directly affect the LM, the LM affects the MM directly in three ways. The first employment effect is that contacts for employed people may be more abundant. Employed agents contact potential partners at probability $\lambda^2\gamma$, where $\gamma > 1$. The contact probability for unemployed agents is λ^2. The parameter γ captures relative abundance of contacts for employed agents because they contact people from non-working as well as working environments.

The second employment effect affects meeting. Given contacts, a type e agent encounters a type e' agent with an intensity depending on his employment status. In particular, an employed agent has a higher chance to encounter another employed agent because of additional socialization brought by employment. Let the probability that employed agents socialize only with the same type be σ. With probability $1-\sigma$, they sample partners randomly. The probability that an employed agent encounters an employed partner from random sampling is the fraction of employed agents sampling partners randomly, $(1-\sigma)n_{10}$, out of the total pool of agents who sample partners randomly, $(1-\sigma)n_{10}+n_{00}$. Let the probability of agent e meeting agent e' be $\pi_{ee'}$ where

$$\begin{array}{ll} \pi_{11} = \sigma + (1-\sigma)\frac{(1-\sigma)n_{10}}{(1-\sigma)n_{10}+n_{00}}, & \pi_{10} = (1-\sigma)\frac{n_{00}}{(1-\sigma)n_{10}+n_{00}} \\ \pi_{01} = \frac{(1-\sigma)n_{10}}{(1-\sigma)n_{10}+n_{00}}, & \pi_{00} = \frac{n_{00}}{(1-\sigma)n_{10}+n_{00}} \end{array}$$

For example, the probability of an employed agent meeting another employed agent, π_{11}, is given by the non-random chance, σ, and the random chance $(1-\sigma)(1-\sigma)n_{10}/[(1-\sigma)n_{10}+n_{00}]$.

The third employment effect is on marriage payoff. When two single agents meet, each agent observes a realization of a match-specific random variable q, which is i.i.d. across meetings and time. Match quality is distributed according to $F(q)$ on $[\underline{q},\overline{q}]$, $\overline{q}<\infty$, and is continuous and differentiable. Match quality is payoff-relevant and is not shared by spouses. The LM affects payoff when an employed agent is matched with an unemployed partner, as match quality will be reduced by disutility $\tau>0$. Agents have a reservation value depending on his and his partner's employment status, $R_{ee'}$. A match is acceptable iff $q \geq R_{ee'}$. Otherwise, the two single agents part and continue to look for partners. A match dissolves exogenously with probability δ^2.[8] Firms play no role in the MM.

The last market to open is the CM. The CM is a settlement market. Employed workers receive wage compensation, while unemployed workers receive unemployment benefit. Workers decide how much to consume. Consumption varies with agents' martial status. When single, an agent consumes c_0 units of private goods. While married, c_1 becomes a public good. A firm with a filled job sell outputs and pay out wages. A firm with a vacancy decides whether or not to enter the LM next period. It does so by incurring hiring and screening cost $k>0$. The CM is frictionless and perfectly competitive.

[8] Note that match quality can be discovered through experience, or married agents can search for other partners. These complications provide a richer framework, and none of the results presented in the sequel are particularly sensitive to them.

Agents discount at rate β between the centralized market and the next market, but not among other markets. In what follows, I describe each market backward starting with the centralized market. The value function for agents in each market is $V_{em}^{i}(q)$, where $i = 1, 2, 3$ denotes the stages within a unit of time; the value function for firm is W_e^i. I focus on the steady state.

3 Markets and Equilibrium

I first describe the payoffs in each market, and then define the equilibrium.

The Centralized Market $(i = 3)$ The value of an agent in the CM with employment status e, marital status m, and match quality q is

$$\begin{aligned} V_{em}^{3}(q) &= \max_{c_m \geq 0} c_m + \beta V_{em}^{1}(q) \\ \text{s.t. } c_m &\leq ew_m + (1-e)b + m[e'w' + (1-e')b] + 2^m T \end{aligned}$$

An agent chooses consumption to maximize his lifetime utility subject to a budget constraint. The second term on the first line is the continuation value to the next LM. The right side of the budget constraint is the agent's income associated with his employment status, partner's income, and gross transfer T. The nominal price in consumption is normalized to 1. Substituting c_m from the budget equation into the objective function above, I get

$$V_{em}^{3}(q) = \{ew_m + (1-e)b + m[e'w' + (1-e')b] + 2^m T\}/2^m + \beta V_{em}^{1}(q) \qquad (1)$$

The value of a firm with a filled-job is

$$W_1^3(x; w_m) = x - w_m + \beta W_{1,+1}^{1} \qquad (2)$$

where x is the outputs from the previous LM, w_m is the wage bill in CM goods, and $W_{1,+1}^{1}$ is the firm's continuation value.

A firm with a vacancy has no revenue or wage bill. However, it can pay $k > 0$ to enter the LM next period with a vacancy, which allows a probability of matching. The value of a firm with a vacancy is

$$W_0^3(0) = \max\{0, -k + \beta W_{0,+1}^{1}\}$$

Free-entry of firms implies that the cost of opening a vacancy must equal to the expected profits: $k = \beta W^1_{0,+1}$.

The Marriage Market ($i = 2$) The value of an agent who is single and has employment status e is

$$\begin{aligned} V^2_{e0}(0) &= u + \lambda^2\gamma^e\{\pi_{e1} E\max[V^3_{e1}(Q_{e1}), V^3_{e0}(0)] + \pi_{e0} E\max[V^3_{e1}(Q_{e0}), V^3_{e0}(0)]\} \\ &\quad +\{1 - \lambda^2\gamma^e[1 - \pi_{e1}F(R_{e1}) - \pi_{e0}F(R_{e0})]\}V^3_{e0}(0) \qquad (3) \end{aligned}$$

The first term is the utility when single, which is bounded from above, $u < \overline{q}$, to support the existence of the MM, the next term in $\{.\}$ is the expected match benefit given contact arrives with probability $\lambda^2\gamma^e$. The last term is the value when no matching occurs. A match does not occur either because one meets no one or meets someone with $q < R_{ee'}$ and remains single, where $R_{ee'}$ is defined as the quality at which an agent is indifferent between accepting and rejecting a potential partner of employment status e', and he accepts: $V^3_{e1}(R_{ee'}) \equiv V^3_{e0}(0)$. The value of a married agent is

$$V^2_{e1}(q) = q - e(1 - e')\tau + \delta^2 V^3_{e0}(0) + (1 - \delta^2)V^3_{e1}(q) \qquad (4)$$

The first two terms are utility from marriage, which depend on the agent and the partner's employment status. With probability δ^2 the match breaks up and the agent becomes single, while with probability $1 - \delta^2$ the match remains.

Firms make no transaction in the MM, and $W^2_e(y; w_m) = W^3_e(y; w_m)$.

The Labor Market ($i = 1$) The lifetime expected utility for an unemployed agent with marital status m and match quality q is

$$V^1_{0m}(q) = \ell + \lambda^1 V^2_{1m}(q) + (1 - \lambda^1)V^2_{0m}(q) \qquad (5)$$

The first term in (5) is the utility from leisure. The second term indicates that conditional on finding a job with probability λ^1, the agent provides labor services to the firm, generating a value $V^2_{1m}(q)$. With probability $(1 - \lambda^1)$, the agent remains unemployed until next LM where he will have a chance to find a job again. Similarly, the expected utility of an employed agent is

$$V^1_{1m}(q) = \delta^1 V^2_{0m}(q) + (1 - \delta^1)V^2_{1m}(q)$$

where δ^1 is the job-match destruction probability.

The expected profits for a firm with a vacancy is

$$W_0^1 = \alpha^1[\frac{n_{01}}{n_{0.}} W_1^2(0; w_1) + \frac{n_{00}}{n_{0.}} W_1^2(0; w_0)] + (1 - \alpha^1)W_0^2 \tag{6}$$

The first term is the expected profit from production, and the next term is the value of the vacancy if no meeting occurs. The expected profit of a filled job with output x is

$$W_1^1(x; w_m) = \delta^1 W_0^2 + (1 - \delta^1)W_1^2(x; w_m)$$

If a job-match dissolves, the firm disposes of possible inventory and enters the MM with nothing. If a job-match remains, the firm brings outputs along and sell them in the CM. Wages are determined when firms and workers meet. Since utility is linear, Nash or Kalai or strategic bargaining yields the same outcome.[9]

LM Tightness The tightness of the LM, θ, is consistent with the firm's optimal vacancy creation strategy (free-entry condition) if and only if it is equal to

$$\begin{aligned} \theta &= 0 && \text{if} \quad k > \beta[\tfrac{n_{01}}{n_{0.}} W_1^2(x; w_1) + \tfrac{n_{00}}{n_{0.}} W_1^2(x; w_0)] \\ &= (\alpha^1)^{-1}(\frac{k}{\beta[\frac{n_{01}}{n_{0.}} W_1^2(x; w_1) + \frac{n_{00}}{n_{0.}} W_1^2(x; w_0)]}) && \text{if} \quad k \le \beta[\tfrac{n_{01}}{n_{0.}} W_1^2(x; w_1) + \tfrac{n_{00}}{n_{0.}} W_1^2(x; w_0)] \end{aligned}$$

If the cost of creating a vacancy, k, is strictly greater than the expected value of an additional worker to the firm, the tightness of the LM is zero. If k is smaller than the expected value of a job-match, the tightness of the market is positive. In fact, firms continue to create new vacancies until the tightness of the LM is high enough, and the probability of filling a vacancy is low enough so that the cost and the benefit of an extra vacancy offset each other.

Steady State Consider first the measure of employed and single workers at the opening of the LM in period t, $n_{10,t-1}$. During the LM, the employed and single worker becomes unemployed with probability δ^1, while an unemployed and single worker becomes employed with probability λ^1. Thus, the measure of employed and single workers at the opening of the MM market in period t is given by $n'_{10,t}$,

$$n'_{10,t} = n_{10,t-1}(1 - \delta^1) + n_{00,t-1}\lambda^1$$

In the beginning of the MM, the employed and single worker becomes married with probability $\lambda^2(\pi_{e1}\overline{F}_{e1} + \pi_{e0}\overline{F}_{e0})$, where $\overline{F} = 1 - F(R)$. While an employed and married worker becomes single with probability δ^2. Thus, the measure of employed

[9] See Wright-Wong (15) for illustrations.

and single workers at the opening of the CM market in period t is given by the right side of (7),

$$n_{10,t} = n'_{10,t}[1 - \lambda^2(\pi_{e1}\overline{F}_{e1} + \pi_{e0}\overline{F}_{e0})] + \ n_{11,t-1}\delta^2 \tag{7}$$

Clearly, this is also the measure of employed and single workers at the opening of the LM in period $t + 1$. Let the transition probability of a type (e, m) agent to a type (e', m') be given by $h_{em,e'm'}$

$$\begin{aligned} h_{0m,1m} &= \lambda^1 \\ h_{e1,e0} &= \delta^2 \\ h_{1m,0m} &= \delta^1 \\ h_{00,01} &= \lambda^2(\pi_{01}\overline{F}_{01} + \pi_{00}\overline{F}_{00}) \\ h_{10,11} &= \lambda^2\gamma(\pi_{11}\overline{F}_{11} + \pi_{10}\overline{F}_{10}) \end{aligned}$$

One can express the measure of agents as follows:

$$n_{10,t} = [n_{10,t-1}(1 - h_{10,00}) + n_{00,t-1}h_{00,10}](1 - h_{10,11}) + \ n_{11,t-1}h_{11,10} \tag{8}$$

$$n_{00,t} = [n_{00,t-1}(1 - h_{00,10}) + n_{10,t-1}h_{10,00}](1 - h_{00,01}) + \ n_{01,t-1}h_{01,00} \tag{9}$$

$$n_{01,t} = [n_{01,t-1}(1 - h_{01,11}) + n_{11,t-1}h_{11,01}](1 - h_{01,00}) + \ n_{00,t-1}h_{00,01} \tag{10}$$

and $n_{11,t} = 1 - (n_{10,t} + n_{00,t} + n_{01,t})$. At steady state all measure of workers is stationary, and is given by solving equations (8)-(10), setting $n_{em,t} = n_{em,t-1}$.

Equilibrium A steady state equilibrium is a list $(\{V^i_{em}\}, \{W^i_{em}\}, w_m, R_{ee'}, v, n_{em})$, for $i = 1, 2, 3$, $e, m = 0, 1$, that satisfies:

(i) Optimization: $\{V^i_{em}\}$ and $\{W^i_e\}$ solve the Dynamic Programming equations, $\{w_m\}$ solves bargaining problems;

(ii) Reservation match strategy and joint acceptance: $\{R_{ee'}\}$ satisfy $V^3_{e1}(z, R_{ee'}) \equiv V^3_{e0}(z, 0)$; and $(q_{ee'}, q_{e'e})$ such that $q_{ee'} \geq R_{ee'}$ and $q_{e'e} \geq R_{e'e}$;

(iii) Free-entry: the measure of vacancy v satisfies the free-entry condition; and

(iv) Steady-State: the measure $\{n_{em}\}$ satisfies (8)-(10) where $n_{em,t} = n_{em,t-1}$.

In equilibrium, one must be acceptable to one's partner. As shown in Burdett-Wright (1998), the equilibrium contact rate becomes $\pi'_{ee'} = \pi_{ee'}[1 - F(R_{e'0})]$.

Existence requires positive job-creation, $v > 0$, and positive companionship creation given by $R_{ee'} \in (\underline{q}, \overline{q})$, for $e = 0, 1$ and $e = e'$. Positive job-creation can be achieved when the cost of creating a vacancy is smaller than the expected value of a job-match. The RHS of (13 or 14) is decreasing and the LHS is increasing in $R_{ee'}$, so there is at most one solution for agents of each type of employment status. Two types of equilibria are possible. One is a mixing equilibrium that contains an interior equilibrium, $R_{ee'} \in (\underline{q}, \overline{q})$, for $e, e' = 0, 1$. A sufficient condition for its existence is that the best possible marriage yields higher payoffs than being single, which in turn has higher payoff than the worst possible marriage. The other type of equilibrium is a segregation equilibrium in which only agents of the same employment type match (see next Corollary).

Uniqueness in selection requires F to be log-concave (Burdett-Wright 1998). Then I have

Proposition 1 *There exists an equilibrium with $v > 0$ and $R_{ee'} \in (\underline{q}, \overline{q})$, for $e = 0, 1$ and $e = e'$. The equilibrium is unique when F is log-concave.*

Terms of Trade: Selection The utility maximizing search strategy is to accept any partner who generates match quality at least as high as the reservation match level $R_{ee'}$. Using integration by parts and simplify, equation (3) can be re-expressed as

$$V_{e0}^2(0) = u + \frac{\lambda^2 \gamma^e}{r + \delta^2} \{\pi'_{e1} \int_{R_{e1}} [1 - F(q)] dq + \pi'_{e0} \int_{R_{e0}} [1 - F(q)] dq\} + V_{e0}^3(0)$$

To economize notation, define the expected match surplus to be $S_e^2 \equiv \frac{\lambda^2 \gamma^e}{r+\delta^2} \{\pi'_{e1} \int_{R_{e1}} [1- F(q)] dq + \pi'_{e0} \int_{R_{e0}} [1 - F(q)] dq \}$.

To solve for the reservation match quality, consider first an unemployed agent, $e = 0$. Expanding (1), the value function for an unemployed single agent is

$$V_{00}^3(0) = b + T + \beta\ell + \beta\lambda^1[u + S_1^2 + V_{10}^3(0)] + \beta(1 - \lambda^1)[u + S_0^2 + V_{00}^3(0)] \qquad (11)$$

Similarly, the value function for an unemployed married agent is

$$V_{01}^3(R_{0e^*}) = [b+T+me'w'+m(1-e')b]/2+\beta\ell+\beta R_{0e^*}+\beta[\lambda^1 V_{11}^3(R_{0e'})+(1-\lambda^1)V_{01}^3(R_{0e'})] \qquad (12)$$

Equating (11) and (12) and simplifying, the reservation match for an unemployed agent is

$$R_{0e'} = u + \lambda^1 S_1^2 + (1 - \lambda^1) S_0^2 - [e' w_1 + (1 - e') b + T]/\beta \qquad (13)$$

Equation (13) equates the value of matching a partner at the researvation quality to the cost of marriage, given by the utility while single and the opportunity cost – which is the expected return to continued search for a better partner, $\lambda^1 S_1^2 + (1 - \lambda^1) S_0^2$, – net of consumption gain contributed by the partner (the term in the squared bracket).

The last component reflects a substitution effect: for an unemployed agent, marriage raises his consumption relative to his private consumption when single; he is willing to be less selective to speed up matching, substituting more consumption later for a lower average match quality.

For an employed agent, $e = 1$, similar procedures yield

$$R_{1e'} - (1 - e')\tau = u + \delta^1 S_0^2 + (1 - \delta^1) S_1^2 - [e'(w_1 - z) + (1 - e')b + T]/\beta \tag{14}$$

Equation (14) has similar interpretation as (13). Note, however, that when agents earn reservation wage, $R_{0e'}$ and $R_{1e'}$ will have to be solved from the first principal, which will take on different expressions from equations (13) and (14) (see Section 5.1).

Note, the reservation policy indicates that $V_{e1}^3(R_{e0}) = V_{e1}^3(R_{e1})$, which addresses the selection relationship toward partners of different employment status. Upon simplification, the equality becomes

$$R_{10} = R_{11} + \tau + (w_1 - b)/\beta \tag{15}$$

$$R_{00} = R_{01} + (w_1 - b)/\beta \tag{16}$$

respectively for employed and unemployed agents. An employed agent will be more picky toward an unemployed partner, $R_{10} > R_{11}$, requiring a compensating differential of $\tau > 0$ to offset disutility and of $(w_1 - b)/\beta > 0$ to offset consumption loss from marrying a jobless partner, w_1/β is the amount consumption loss if the agent married an employed partner, and b/β is the consumption obtained from marrying an unemployed partner. While an unemployed agent will be less picky toward an employed partner, $R_{01} < R_{00}$, by an amount equivalent to the consumption gain from marrying up.

Note that when employed agents are not too selective over unemployed partner, or when unemployed agents are reasonably selective over employed partners, preferring an employed partner who yields a match quality at least as high as an agent's singlehood utility, then agents of any employment types match. In other words, when (i) $R_{10} = R_{11} + \tau + w_1/\beta \leq \overline{q}$, or equivalently, $R_{11} \leq \overline{q} - \tau - w_1/\beta$, and (ii) $R_{01} = R_{00} - w_1/\beta \geq u > \underline{q}$, or equivalently, $R_{00} \geq u + w_1/\beta$, a mixing equilibrium occurs such that matches between unemployed and employed agents exist. When neither (i) or (ii) is satisfied, only agents with the same employment type match with each other.

Corollary 1. *A mixing equilibrium, where agents of any employment types match* *with each other, exists when $R_{11} \leq \overline{q} - \tau - w_1/\beta$ and $R_{00} \geq u + w_1/\beta$. When neither conditions is satisfied, a segregation equilibrium exists.*

Terms of Trade: Wages The bargaining outcome is a wage with η as the bargaining power of workers and threat points equal to continuation values. The surplus of workers is $V^2_{1m}(q) - V^2_{0m}(q)$, and the surplus of firms is $W^2_1(0, w_m)$. Simplifying, the wage for single workers is

$$w_0 = \{\eta x[1 - \beta(1 - \delta^1 - \lambda^1)] + (1 - \eta)[1 - \beta(1 - \delta^1)](b + \beta\ell + S^2_0 - S^2_1)\}D_0^{-1} \quad (17)$$

where $D_0 = \eta[1 - \beta(1 - \delta^1 - \lambda^1)] + (1 - \eta)[1 - \beta(1 - \delta^1)]$. The wage is the weighted average of the firm's marginal product and the worker's reservation wage. Reservation wage is made up of unemployment benefit, b, utility of leisure when unemployed, z, and the net value of being unemployed in the MM, $S^2_0 - S^2_1$. This net value equals the difference between the expected surplus of entering the MM unemployed instead of employed. It is affected by socialization and preference directly and/or indirectly through reservation match quality. When $S^2_0 - S^2_1 < 0$, entering the MM employed is beneficial.

The wage for married workers is

$$\begin{aligned} w_1 \quad = \quad & \{\eta[1 - \beta(1 - \delta^2)(1 - \delta^1 - \lambda^1)][1 - \beta(1 - \delta^1)]x \\ & +(1 - \eta)[1 - \beta(1 - \delta^1)(1 - \delta^2)][1 - \beta(1 - \delta^1)](b + \beta\ell) \\ & -\delta^2\eta\beta(1 - \delta^1 - \lambda^1)[1 - \beta(1 - \delta^1)(1 - \delta^2)](x - w_0)\}\{[1 - \beta(1 - \delta^1)]D_1\}^{-1} \end{aligned}$$

where $D_1 = \eta[1 - \beta(1 - \delta^2)(1 - \delta^1 - \lambda^1)] + (1 - \eta)[1 - \beta(1 - \delta^1)(1 - \delta^2)]$. The first two lines are the usual weighted average components. The third line is worker's surplus from being single conditional on the divorce shock. Simplifying,

$$w_1 = \{\eta Ax + (1 - \gamma)[B\beta\ell + Cb + D(S^2_0 - S^2_1)]\}(D_0 D_1)^{-1} \quad (18)$$

where

$$
\begin{aligned}
A &= D_0[1-\beta(1-\delta^2)(1-\delta^1-\lambda^1)] \\
&\quad -\delta^2\beta(1-\delta^1-\lambda^1)(1-\eta)[1-\beta(1-\delta^1)(1-\delta^2)] \\
B &= [1-\beta(1-\delta^1)(1-\delta^2)]\{\eta[1-\beta(1-\delta^2)(1-\delta^1-\lambda^1)]+(1-\eta)[1-\beta(1-\delta^1)]\} \\
C &= [1-\beta(1-\delta^1)(1-\delta^2)]\{\eta[1-\beta(1-\delta^2)(1-\delta^1-\lambda^1)] \\
&\quad +(1-\eta)[1-\beta(1-\delta^1)]+\delta^2[1-\beta(1-\delta^1)(1-\eta)]\} \\
D &= m\delta^2\eta\beta(1-\delta^1-\lambda^1)[1-\beta(1-\delta^1)(1-\delta^2)]
\end{aligned}
$$

Equation (18) is a weighted average of firm's productivity x and worker's reservation wage, all appropriately capitalized. Married workers need to be minimally compensated by the utility while unemployed ℓ, unemployment benefit b, and the net value of being unemployed in the MM $S_0^2 - S_1^2$ conditional on being divorced.

When workers have all the bargaining power, $\eta = 1$, he earns his productivity x, which is the same for all workers by construction, and $w_1 = w_0$. As $\eta < 1$, part of workers' earning is based on their reservation wage, which differs between married and single workers. When $\eta \to 0$,

$$w_1 - w_0 = S_1^2 - S_0^2$$

Marriage premium is positive when there is a net gain of employment in the MM – equaling a positive difference between the value of entering the MM employed instead of unemployed. Intuitively, when being employed promotes marriage because it raises the chance to meet other (employed) agents, single agents are willing to take a lower reservation wage. It is a substitution effect: expected gain(cost) from the MM pegs to the employment status of workers, who in turn trade off such gain (cost) for a lower (higher) wage.

Proposition 2 *Marriage premium requires $\eta < 1$. As $\eta \to 0$, marriage premium exists iff $S_1^2 - S_0^2 > 0$.*

It is simple to show that $1 > \partial R_{10}/\partial\tau > 0$, $-1 < \partial R_{11}/\partial\tau < 0$, and $\partial(S_1^2 - S_0^2)/\partial\tau < 0$, $\partial R_{11}/\partial\gamma > 0$, and $\partial R_{11}/\partial\sigma$, $\partial R_{01}/\partial\sigma$, and $\partial(S_1^2 - S_0^2)/\partial\sigma$ unclear. Because selection, wages, and sorting are equilibrium outcomes, any comparative statics requires a full solution in a complicated nonlinear way. For instance, factors affecting wages (e.g. ℓ, b) also affect the job creation condition, so they affect v, the job-finding rate, the measure of unemployed worker, which influences the encounter rates in the MM, selection, and in turn affects wages via S_1^2 and S_0^2. Therefore, it is difficult to evaluate the properties of the equilibrium except through numerical calculations.

4 Data

The model describes agents' marriage and employment transitions and assumes agents are populated in a common labor and marriage market. The appropriate structure of dataset for analysis is one that follows homogeneous individuals over time from longitudinal sampling (in oppose to cross-sectional sampling). I follow the liteature of transition from school to work to construct a sample of identical agents.

Specifically, I use the PSID Transition to Adulthood (TA) file 2005-2011. The TA file contains young adults who are linked to the core sample of the PSID. These youths have been surveyed biannually since 2005. This data file records young adult's marriage and work histories. IN particular, the TA file contains youth's employment status, job history up to five jobs, non-employment status retrospectively on monthly basis, income and debt, marriage and cohabitation history, duration of dating, and demographic information such as education attainment, occupation, etc. However, the file does not contain basic information such as age, sex, and race. To obtain this information, I link the sample to the 'individual files' of the PSID each year.

I extract youths whose age were between 14 and 21 in 2005, and follow these youths through the 2011 interview. I do not believe the marriage market and the labor market are the same for all schooling groups, race, and sex. Bowlus and Wong (2017) find that racial difference in job search is statistical insignificant. Thus, I focus on market transitions of newly graduated high-school males.

In what follows, I describe sample construction issues and then sample characteristics.

4.1 Sample Construction

4.1.1 Employment and Marital History

Time is denominated in months in the TA files. I construct respondents's employment history based on: the start month and year of the recent five jobs, interview month and year, current employment status, and retrospective information on non-employment spells. The TA file collects respondents's unemployment and out of the labor force status each month retrospectively for 24 months since 2007 and for 12 months in the 2005 survey. In addition, it collects job history by asking respondents the start and stop month and year of the most five recent jobs held. The five jobs recorded have no particular chronological order, and can be missing from one interview to another. For each job, start and end year and month were recorded. Together with the 24-month retrospective non-employment record, we know the start of job search (backward recurrence time is available) and are able to construct a respondent's employment history.[10]

The TA file collects marriage history by asking respondents the start and stop month and year of marriage or cohabitation. In addition, the number of years and months of each dating history was recorded.

4.1.2 Labor Market Transition

I do not distinguish between unemployment and out of the labor force.[11] Non-employment duration is the elapsed time between the start of job search and the end of it when a job is found. Non-employment duration can only be partially observed because the start of job search is unknown (left-censoring), and/or the end of it is unknown (interval- or right-censoring).

When the start of job search is unknown, it is the classic initial condition problem. There are three ways in which the literature that studies transition from school to work handles this problem. One uses the sample minimum order statistics as an estimate of the start of job search, e.g. Wolpin (87) uses 61 weeks prior to graduation as that was the longest duration a respondent held a job while in school. The second relates to graduation time, e.g. EW (90, 95). In the sample used by EW, a fair fraction of agents obtained their job at graudation. EW assigned these agents a search time of one, and search duration for those who got a job after graduation are updated by one (90) and not updated (95). The third includes only agents who found jobs after graduation and assumes agents start of job search right at graduation e.g. BKN (01), i.e. they consider only forward recurrence times.

I use both forward and backward recurrence time. Information on backward recurrence time is possible due to the retrospective non-employment record. Over two third of the sample contains no backward recurrent info (non-response); out of those who searched prior to graduation, the majority (73 per cent) searched one to five months, and over 90 per cent searched twelve months or less.

[10] Knowledge of backward recurrence time is rare in panel dataset in the labor and marriage market. The availablility of this information makes this dataset important.

[11] Among those who did not get a job right after graduation, over half reported three unemployment spells within the 24-month retrospective job history in the first wave of the interviews, interspersed by out of the labor force. A few respondents reported relatively high frequency of transition. For example, 4 respondents reported a total of 7 unemployment spells, interspersed by being out of the labor force, within 24 months. Separating unemployment from out of the labor force may add noise to duration estimation.

Besides adding more accuracy to spell length, backward recurrence time also helps recover transition info when employment occurred before graduation. There are 38 cases initial employment (at graduation). Using backward recurrence time, I obtain 17 cases with an initial unemployment spell. For those who were unemployed at graduation, backward recurrence time data add unemployment duration to 88 cases. When backward recurrence time info is unavailable, job search starts at graduation.

I accept observations with jobs started less than a year before graduation, was held longer than two months afterward, and satisfied the 'real' job definition (see below). This helps rule out summer jobs and temporary jobs held while in school and jobs that may be accepted with quite different educational qualifications.

Right-censoring Right-censoring occurred when non-employment spells are incomplete, i.e. no 'real' job was found at the end of the survey. A 'real' job – coined in Wolpin (87) – is defined as when respondents worked at least 20 hours/week and employment lasted at least 3 months (e.g. Wolpin (87) and EW (90, 95)).[12]

Employment Duration Employment duration is the elapsed time between the start of a job and the end of it. Although we define a 'real' job as lasted at least 3 months, we have employment spells lasted shorter than that. This occurs because of right-censoring: employment occurred fewer than three months prior to the last interview date.

Similar to non-employment, employment duration can be partially observed because the end of it can be unknown (interval- or right-censoring). Where spells are complete, we record whether jobs ended in job-to-job transition or other reasons. Few cases had job-to-job transition (Table 2) because a job was ended either in unemployment spell or with another job which was a part-time job (<20 hours), which we do not count as a real job.

4.1.3 Marriage Market Transition

Consistent with the labor market, I do not distinguish between people who are not active in the marriage market and those who are actively searching: all unmatched agents are single. Singlehood duration is the elapsed time between the start of spousal search and the end of it when a marriage or cohabitation occurred. Singlehood

[12] Many labor studies use 35 or 30 hours/week as the minimum hours qualified for a full-time status. In this sample, many respondents did not report hours-worked and some were not consistent in reporting. As a means to retain a reasonable amount of observations, we accept respondents who worked at least 20 hours/week.

duration can only be partially observed because the start of spousal search is unknown (left-censoring), and/or the end of it is unknown (interval- or right-censoring).

The TA file contains backward recurrence time info wrt marriage history: dating duration. The survey question asks, "How long did you date your partner before you got married/began living together?" The number of years dating is between 1 and 8. One-third of the married sample had no dating info. The age range that respondents started dating is between 16 and 25. Unlike the labor market where graduation is a natural job search starting time when backward recurrence time info is unavailable, in the marriage market, when dating info is unavailable, there is no natural mate search starting time. Similar to Wolpin (87) in the labor market and Wong (03) in the marriage market, I use the minimum order statistics as partner search start time: age 16.

Right-censoring occurred when singlehood spells are incomplete, i.e. no 'real' companionship was found at the end of the survey. To be consistent with the labor market data construction, I define a 'real' companionship to be one that lasted at least one year.

Marriage duration is the elapsed time between the start of marriage or cohabitation and the end of it. I define end of marriage as min{separation,divorce}. Marriage duration can be partially observed because the end of it can be unknown (interval- or right-censoring). About 20 per cent of the sample has complete spell (divorce or separation occurred).

Start of search Agents need to start their search at the same time in both market. Only three cases where dating occurred two years before graduation, and those cases are not 'real' marriage nonetheless. I use the max of both markets search starting time, which happens to be 16. Note that I admit agents whose job search took place at most one year prior to graduation.

4.1.4 Wages

For each job reported, earning information is also available. In 2005, information on current and last year's earning, time unit of paid, hours and weeks worked of each job were collected. Since then, this information was reported as values from last year and the year before last year.[13] Respondents who reported as farmers or self-employed

[13] Respondents who got jobs in 2011 had no wage record. We use additional data from the 2013 survey to circumvent this problem. Ideally, the 2013 survey should contain the entire earning, hours, and weeks worked history of the respondent if the respondent held five or fewer jobs and if perfect recall occurred. But we cross-check earnings across surveys to guard against mis-information, and use the record that was closest to the time when employment occurred.

agents are removed from the sample as they are not salary workers.

Among respondents with non-missing earnings, reports contained extreme pay rates. For example, one respondent reported an annual earning of $20, while another reported $170,000. I handle the extreme earning reports by cross-checking time and pay rate responses against upper and lower bounds (5th and 95th percentile) collected for respondents of the same age range and education groups who worked full-time, and the same year when jobs started, from the Current Population Surveys (CPS), see Appendix Table 1. Observations with wages out of the CPS wage bound are treated as missing, as an effort to retain the number of observations. Out of all non-employment spells that transitioned to employment and all employment spells at graduation), 21.37 per cent was out of CPS wage bound and 9.8 per cent with missing wage.

Earnings are categorized according to six time units: hourly, daily, weekly, bi-weekly, monthly, and annually. We standardize earnings into month to be consistent with the duration data. Earnings are in constant (2000) dollars.

4.2 Sample Characteristics

The sample contains 14 per cent of respondents who did not experience any market transitions, i.e. jobless and mateless; 33 per cent experienced labor market transitions only, 20 percent marriage market transitions only, 16 per cent experienced first labor market and than marriage market transition, the rest experienced the reverse pattern. For those who first experienced labor market transition, they either got a marriage partner while holding the same job or left the job while still being single. Similarly, for those who experienced marriage market transition first, they either found a job or separate and became single and jobless.

Table 1 shows summary statistics. On average, unemployment duration is 12 months, job duration is 20 months, while singlehood duration is 52 months, and marriage duration is 32 months.[14] While unemployed respondents eventually found jobs, with a relatively small censoring rate of 0.26, about two third of respondents remained single at the end of the survey. The 'short' job and marriage duration is due to the short panel. For marriage duration, the censoring rate is high, 83 per cent of marriages remained intact by the last interview.

[14] Average job duration is less than two years, much shorter those in other datasets, e.g. NLSY79. In the NLSY sample, respondents were allowed to complete schooling within five years from 1979-84, while respondents in the PSID sample completed schooling until 2010, which is also five years. However, unless those who completed schooling in 2010 and got a job quickly, job duration is bound to be shorter as the panel ends in 2011 (with only few cases ended in the first quarter of 2012). The length of studies using the NLSY typically lasted 14 years, whereas it is 7 years in this study.

The sample shows that 77 per cent of employed respondents married with an employed partner. For unemployed respondents, all their partners were employed. After adjusting for tenure, mean wage for married respondents is 12.8 per cent higher than mean wage for single respondents.

5 Estimation Issues

I follow the model and the data structure and estimate a likelihood function. The model does not admit analytical solutions, but can numerically be solved in a straightforward manner. The estimation strategy involves solving the model for reservation quality and steady state measures of individuals, and then maximizing a likelihood function given the numerical solutions of the model.

In what follows, I describe the likelihood function construction, then discuss identification issues and issues related to solving for reservation quality.

5.1 Likelihood Function

In the spirit of the search literature, estimation is done on the first two spells experienced by agents. Consider a sample of I individuals, some of whom have no transition, some have one market transition, and others two market transitions (no ties). Let there be five groups of individuals, and I_j is the corresponding number of agents in group j, $\sum_{j=1}^{5} I_j = I$:

I_1 : no transition

I_2 : transitions in the LM only

I_3 : transitions in the MM only

I_4 : transition first in the LM, then the MM

I_5 : transition first in the MM, then the LM

Let T_u be the duration of unemployment, T_s the duration of singlehood, T_e the duration of employment, and T_m the duration of marriage. Define $Z = 1$ if $e' = e$, and $Z = 0$ otherwise. The probability that a type e agent matches with the same type partner is given by $\Pr(Z = 1|e)$:

$$\begin{aligned}
\Pr(Z &= 1|e = 1) = \frac{\pi_{11}\overline{F}_{11}}{\pi'_{10}\overline{F}_{10} + \pi'_{11}\overline{F}_{11}} \\
\Pr(Z &= 1|e = 0) = \frac{\pi_{00}\ \overline{F}_{00}}{\pi'_{00}\ \overline{F}_{00} + \pi'_{01}\ \overline{F}_{01}}
\end{aligned}$$

The likelihood contribution to sorting is binomial:

$$\begin{aligned}
\Pr(Z &= 1|e=1)^{e'=1}[1-\Pr(Z=1|e=1)]^{e'=0} \\
\Pr(Z &= 1|e=0)^{e'=0}[1-\Pr(Z=1|e=0)]^{e'=1}
\end{aligned}$$

The likelihood contribution for each group of agents are described as follows, suppressing individual subscript.

1. Group 1. Since no one got a job or a mate, $T_u = T_s = T$; all observations are censored. The likelihood is

$$\begin{aligned}
\mathcal{L}_1 &= [\Pr(m=0|e=0)\Pr(e=0)]^T \\
&= [(1-\lambda^2[\pi'_{01}\overline{F}(R_{01})+\pi'_{00}\overline{F}(R_{00})])(1-\lambda^1)]^T
\end{aligned}$$

2. Group 2: $T_s > T_u$. In this case, an agent was unemployed for $T_u - 1$ periods, then got a job which lasted T_e periods if censoring occurs. If there is no censoring, i.e. job lost occurrd, the job lasted $T_e - 1$ periods. The likelihood is given by

$$\begin{aligned}
\mathcal{L}_2 &= [\Pr(m=0|e=0)\Pr(e=0)]^{T_u-1}\Pr(e=1)[\Pr(m=0|e=1)(1-\delta^1)]^{T_e c} \\
&\quad \times [\Pr(m=0|e=1)(1-\delta^1)]^{(T_e-1)(1-c)}\delta^1 \\
&= [(1-\lambda^2[\pi'_{01}\overline{F}(R_{01})+\pi'_{00}\overline{F}(R_{00})])(1-\lambda^1)]^{T_u-1}\lambda^1 \\
&\quad \times [(1-\lambda^2\gamma[\pi'_{11}\overline{F}(R_{11})+\pi'_{10}\overline{F}(R_{10})])(1-\delta^1)]^{T_e c} \\
&\quad \times [(1-\lambda^2\gamma[\pi'_{11}\overline{F}(R_{11})+\pi'_{10}\overline{F}(R_{10})])(1-\delta^1)]^{(T_e-1)(1-c)}\delta^1
\end{aligned}$$

where $c = 1$ if right-censoring occurred.

3. Group 3: $T_s < T_u$. In this case, an agent was single for $T_s - 1$ periods, then got married. Immediate after the transition to the marriage market is the realization of whom the agent is sorted with in terms of employment status. Marriage lasted T_m periods if censoring occurs. If there is no censoring, marrige would last $T_m - 1$ periods. This likelihood is given by

$$\begin{aligned}
\mathcal{L}_3 &= [\Pr(m=0|e=0)\Pr(e=0)]^{T_s-1}\Pr(m=1)\Pr(Z=1|e=0)^{e\prime=0}[1-\Pr(Z=1|e=0)]^{e\prime=1} \\
&\quad \times [\Pr(e=0|m=1)(1-\delta^2)]^{T_m c}[\Pr(e=0|m=1)(1-\delta^2)]^{(T_m-1)(1-c)}\delta^2 \\
&= [(1-\lambda^2[\pi'_{01}\overline{F}(R_{01})+\pi'_{00}\overline{F}(R_{00})])(1-\lambda^1)]^{T_s-1}\lambda^2[\pi'_{01}\overline{F}(R_{01})+\pi'_{00}\overline{F}(R_{00})] \\
&\quad \times \left(\frac{\pi'_{00}\ \overline{F}_{00}}{\pi'_{00}\ \overline{F}_{00}+\pi'_{01}\ \overline{F}_{01}}\right)^{e\prime=0}\left(\frac{\pi'_{01}\ \overline{F}_{01}}{\pi'_{00}\ \overline{F}_{00}+\pi'_{01}\ \overline{F}_{01}}\right)^{e\prime=1} \\
&\quad \times[(1-\lambda^1)(1-\delta^2)]^{T_m c}[(1-\lambda^1)(1-\delta^2)]^{(T_m-1)(1-c)}\delta^2
\end{aligned}$$

4. Group 4: $T_s > T_u$. In this case, an agent was unemployed for $T_u - 1$ periods, then got a job. While employed, the agent got married, and realized with whom he was sorted. This likelihood is given by

$$\begin{aligned}
\mathcal{L}_4 &= [\Pr(m=0|e=0)\Pr(e=0)]^{T_u-1}\Pr(e=1)[\Pr(m=0|e=1)(1-\delta^1)]^{(T_e+T_u-T_s+1)} \\
&\quad \times \Pr(m=1|e=1)\Pr(Z=1|e=0)^{e\prime=0}[1-\Pr(Z=1|e=0)]^{e\prime=1} \\
&= [(1-\lambda^2[\pi'_{01}\overline{F}(R_{01})+\pi'_{00}\overline{F}(R_{00})])(1-\lambda^1)]^{T_u-1}\lambda^1[(1-\lambda^2[\pi'_{11}\overline{F}(R_{11})+\pi'_{10}\overline{F}(R_{10})])(1-\delta^1)]^{(T_e+T_u-} \\
&\quad \times \lambda^2\gamma[\pi'_{11}\overline{F}(R_{11})+\pi'_{10}\overline{F}(R_{10})]\left(\frac{\pi'_{10}\ \overline{F}_{10}}{\pi'_{10}\ \overline{F}_{10}+\pi'_{11}\ \overline{F}_{11}}\right)^{e\prime=0}\left(\frac{\pi'_{11}\ \overline{F}_{11}}{\pi''_{10}\ \overline{F}_{10}+\pi'_{11}\ \overline{F}_{11}}\right)^{e\prime=1}
\end{aligned}$$

5. Group 5: $T_s < T_u$. In this case, an agent was single for $T_s - 1$ periods, then got married, and realized with whom he was sorted. While married, the agent got a job. This likelihood is given by

$$\begin{aligned}
\mathcal{L}_5 &= [\Pr(m=0|e=0)\Pr(e=0)]^{T_s-1}\Pr(m=1)\Pr(Z=1|e=0)^{e\prime=0}[1-\Pr(Z=1|e=0)]^{e\prime=1} \\
&\quad \times [\Pr(e=0|m=1)(1-\delta^2)]^{(T_m+T_s-T_u+1)}\Pr(e=1) \\
&= [(1-\lambda^2[\pi'_{01}\overline{F}(R_{01})+\pi'_{00}\overline{F}(R_{00})])(1-\lambda^1)]^{T_u-1}\lambda^2[\pi'_{01}\overline{F}(R_{01})+\pi'_{00}\overline{F}(R_{00})] \\
&\quad \times \left(\frac{\pi'_{00}\ \overline{F}_{00}}{\pi'_{00}\ \overline{F}_{00}+\pi'_{01}\ \overline{F}_{01}}\right)^{e\prime=0}\left(\frac{\pi'_{01}\ \overline{F}_{01}}{\pi'_{00}\ \overline{F}_{00}+\pi'_{01}\ \overline{F}_{01}}\right)^{e\prime=1}[(1-\lambda^1)(1-\delta^2)]^{(T_m+T_s-T_u+1)}\lambda^1
\end{aligned}$$

The full likelihood function is:

$$\mathcal{L} = \Pi_j(\mathcal{L}_j)^{I_j}$$

5.2 Specification and Identification

I now discuss specification and identification of the parameters given a sample of new entrants to both labor and marriage markets. The parameters are: β, $F(q)$, η, b, λ^1, δ^1, δ^2, λ^2, γ, u, σ, τ, ℓ, x, k, and α_1. Table 1 provides a summary of the following exposition.

The economy-wide parameter is the discount rate β. The time unit is one month so I set $\beta = 0.999$ to reflect the U.S. historical annual rate of four per cent. I specify match quality to have a uniform distribution, $q\tilde{}U(0,2)$.

Workers' bargaining power is typically assummed to be 0.5. However, a recent study finds evidence that young new entrants who have less than college degree typically receive their reservation wage on their first job (e.g. Brenzel et.al 2013). So I set workers' bargaining power $\eta = 0$. Further, the sample shows that over 96 per cent of respondents received no unemployment benefit or any form of social insurance during unemployment. This fact is not surprising given that almost all respondents had no job experience and hence were ineligible for unemployment benefits. I set $b = 0$.

Unemployment and employment duration respectively identify λ^1 and δ^1, while singlehood duration of employed and unemployed agents identifies λ^2 and γ respectively (γ affects employed agents only). Marriage duration typically identifies δ^2. However, the severity of right-censoring makes such identification unconvincing. So, I use the estimated probability of divorce obtained by fitting a logit model using IPUMS 2010, with covariates including age, age-squared, employment status, work-hours, and a children dummy.[15] I set $\delta^2 = 0.009$.

Socialization and the distaste parameter – σ and τ – can be identified by the fraction of marrage type in terms of the couple's employment status. In particular, the probability of an unemployed agent matching a partner with employment status e^* is used to identify σ because this probability is independent of τ. The probability of an employed agent matching a partner with employment status e^* depends on both σ and τ. Given an estimate of σ, this latter probability identifies τ.

The mean wage for married agents is $w_1 = \beta\ell$ and can be used to identify the utility of non-employment ℓ. Uitlity of singlehood, u, is not identifiable because, unlike the labor market, there is no price in the marriage market.[16]

Neither can the demand-side parameters (of the labor market) – productivity x, entry/recruiting cost k, and worker finding rate α_1, respectively – be identified from the sample. Following to the macro literature, I normalize x; I set $x = 2$. Average output is proxied by the average monthly real wage at the 90-th percentile for males who worked at least 20 hours per week using the March CPS from 2004-2011 (the 95-th percentile wages are often subject to outliers), which is \$3776. I choose the 90-th percentile of wage because according to the model, the only way workers are paid their productivity (highest paid) is when they have all the bargaining power. Because many studies have shown severe monopsony power, despite at the 90-th percentile, these workers may still not be getting paid their productivity. So, the average output proxy is best viewed as a lower-bound value. Next, I normalize wages in my sample by dividing them by average output and then multiplying by two.

I obtain α_1 given the estimate of λ^1 and the identity $\lambda^1 = \alpha_1\theta$, where θ represents market tightness. According to the St.Louis Fed (see Figure 1), average market

[15] I fit a logit model to high-school graduated males with covariates including age, age-squared, experience, employment status, race dummies, occupation dummies, and a children dummy.

[16] When agents are heterogeneous and when one is willing to assume that the utility of singlehood is given by agents' type – not an unreasonable assumption – one can address the utility of singlehood. See, for example, Wong (2003 a,b).

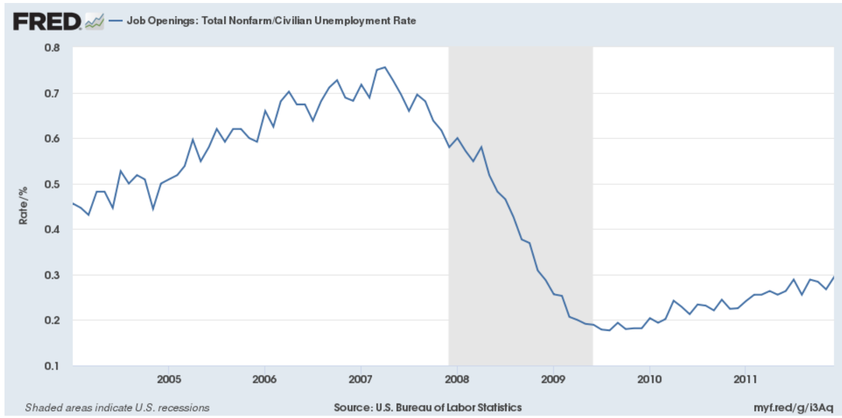

Figure 1: Labor Market Tightness

tightness between 2004:1 and 2011:12 is $\theta = 0.45$, so $\alpha_1 = \lambda^1/0.45$.[17]

The literature uses various metrics for recruiting cost (e.g. hours per hire). The recruiting cost in this paper refers to average vacancy cost per output, which is the ratio of total recruiting cost per output and the number of vacancies. I use Andolfatto's (1996) estimate of total recruiting cost per output of 0.01. This value may be an upper bound value as technological change is likely to reduce the cost per output. However, as vacancy is higher for the sample period than the estimated vacancy for the period 1953-1990 studied in Andolfatto, this estimate can be a lower bound. The average recruiting cost per output is $k = 0.01/v = 0.01 \times \alpha_1/(\lambda^1 u) = 0.01/(0.45u)$, where u is given by $n_{0.}$, endogenously determined in the model.

Lastly, equations (13) and (14) describe a general form for $R_{0e'}$ and $R_{1e'}$ with an interior bargaining power. When workers earn reservation wage, I solve R_{00} and R_{11} from first principle and get

$$R_{00} = u + \frac{\lambda^2}{r+\delta^2}\{\pi_{01}\int_{R_{01}}[1-F(q)]dq + \pi_{00}\int_{R_{00}}[1-F(q)]dq\} \quad (19)$$

$$R_{11} = u + \frac{\lambda^2\gamma}{r+\delta^2}\{\pi_{11}\int_{R_{11}}[1-F(q)]dq + \pi_{10}\int_{R_{10}}[1-F(q)]dq\} - w_1/\beta \quad (20)$$

6 Results

I estimate the logarithm of a profile likelihood function, varying the value of u. Table 2 contains estimates of λ^2 at different values of u. The value of the log likelihood

[17] See, https://fred.stlouisfed.org/graph/?g=2myo#0

function stabilizes as u increases. Using likelihood ratio as the criterion, the optimal choice of u is 0.35. The only parameter that changes non trivially is λ^2 and γ. As u gets larger, reservation quality increases, which in turn reduces the acceptance probability. The estimate of λ^2 and γ need to compensate such change by having a larger value. At levels of u beyond the optimal choice, the difference in λ^2 and γ across u is insignificant.

6.1 Parameter Estimates

Results are somewhat sensitive to the initial parameter values. Table 3 contains estimates of the model and the corresponding standard deviations obtained using bootstrap for $u = 0.35$. The result indicates that meeting in the marriage market is significantly non-random ($\sigma > 0$), employed agents contact people significantly more ($\gamma > 1$), and disutility toward unemployed partners, τ, is insignificant. The results also indicate that job offer arrives faster than marriage proposal ($\lambda^1 > \lambda^2$); job match also terminates quicker ($\delta^1 > \delta^2$). In other words, the labor market is more active than the marriage market.

Given the parameter estimates, I compute reservation match quality, marriage hazard, and the expected gains from marriage. Table 4 shows the ranking of reservation match quality is $R_{01} < R_{11} < R_{00} < R_{10}$. Despite having a higher contact rate due to $\gamma > 1$, employed agents are less selective towards the likes than unemployed agents because employed agents compensate lower quality matches with more consumption when marrying another employed agent.

Employed agents have higher propensity to marry than unemployed agents (more than doubled). This occurs because the employed get a boost from more abundance contacts ($\gamma > 1$) and they are less selective than unemployed agents.

Employed agents also have higher expected gains from marriage $S_1^2 > S_0^2$, about 71 per cent. Similar to the higher hazard rate, employed agents contact potential partners more often, which promotes a higher expected surplus. In addition, non-random meeting plays a role. On one hand, with a sizable in-group socialization factor, σ, the majority of employed agents meet their own type, $\pi_{11} = 0.69$. They are much less selective toward their own type than unemployed partners. This helps boost the expected marriage surplus. On the other hand, unemployed agents meet their own type about a third of the time, $\pi_{00} = 0.32$ and are much more selective toward their own type than employed partners. This helps reduce their overall expected surplus relative to employed agents.

Figure 1 graphs the survivor functions for unmatched search, along with the

Kaplan-Meier estimates. The top panel shows the survivor functions in the labor market, the bottome panel shows the survivor function in the marriage market. The predicted and actual distributions line up reasonably well in the top panel. The fit is clearly superior for the labor market. As another indication, I calculated the χ^2 statistic for the comparison of predicted frequencies of unemployment durations and actual frequencies. Because there are empty cells (out of 84 months there are 37 empty cells, months in which no individual completed a spell in the labor market), I calculated the statistics by aggregating monthly data roughly as quarterly data. Alternatively, I calculated the statistics by admitting the first 50 months for job search, taken as monthly data in which there are no empty cells for the labor market. I also include respondents only when they graduated prior to 2007 so that their labor market experience was less subject to the Great Recession. Results indicate that none of these specifications passes the fit test. I presented the alternative fitness indications for the labor market only because there are many empty cells for the marriage market, where severe right-censoring for partner-search is indicative of it.

<insert Figure 1>

Next I compute the probability that an employed agents match with an employed partners, and the corresponding probability for unemployed matched with unemployed agents; they are respectively 0.845 and 0.534. Comparing to the data, the model slightly over-predicts the chance of assortative matching for employed agents and under-predicts that for unemployed agents. Wage predictions indicate that earning for married agents is more than triple of single agents', substantially higher than the sample value 10.7. Such large prediction is due to a large net gain of employment in the MM, $S_1^2 - S_0^2$.

Fitting an unrestricted model for job search, e.g. fitting a spline, undoubtedly yields excellent fitness results, yet it has almost no effect on wages. The reason being that transition parameters in the labor market have no direct effect on wages when agents receive reservation wage. The indirect effect of λ^1 changes the measure of unemployed agents, but by itself has little to no effect on $S_1^2 - S_0^2$ because it is the relative share that affects the speed of meeting in the marriage market, not the level. As to be seen in the next section, λ^1 has little effect on selection, sorting, and marrige premium. Fitting a spline for marital search improves fitness a lot more than the job search parameter.

6.2 Counterfactuals

Given the parameter estimates of the equilbrium model, I simulate the impact of alternative policies and preference on selection, marriage hazard, and wage inequality between married and single agents. Results are shown in Table 5.

Workplace policy When personal romance is forbidden at workplace, the segregation parameter becomes $\sigma = 0$. Even employed people have advantage in contacting other agents ($\gamma > 0$), meeting partners of specific types is now random. This policy would change agents' selection slightly, with employed being less selective, and unemployed more selective. Marriage hazard would basically be unchanged. As unemployed agents became more selective, their expected marriage surplus would fall, while the reverse would happen to employed agents. Thus, the expected marriage surplus (and hence wage inequality) between the two groups would become more compressed.

Marriage market policy Subsidizing online dating services, such as E-Harmony, raises the meeting rate. This policy can potentially help single agents to get marital partners more quickly if meeting dominates selection. How it affects inequality depends on its impact on S_1^2 and S_0^2. Suppose λ^2 is 20 per cent higher than the benchmark estimate. Both employed and unemployed agents would become more selective, more so for the former group. This policy would not alter the share of employed agents who are single, nor affect socialization among the employed. Despite being more stringent in selection, agents would marry much faster: marriage hazard would change by about 8.5 per cent.

Even the ratio of S_1^2 and S_0^2 would remain almost the same, the difference in level would increase by .02 – driven by a larger increase in S_1^2 – thus reducing the wage for single agents by 10 percent. Consequently, the wage ratio would increase, by 11 per cent.

Labor market policy Policy in the form of job search assistance may affect wage inequality because it alters the share of employed agents in the market. Suppose λ^1 is 20 per cent higher than the benchmark estimate. Employed agents would be more selective, while unemployed agents less so. More important, this policy would create a larger share of employed agents, making employed partners much easier to meet, from 0.69 to 0.72 for the employed and from 0.59 to 0.63 for the unemployed. As unemployed would become less selective and meet employed partners more often, S_0^2 would be higher. Even the employed would become a little more selective, since they would meet other employed partners more often – on a bigger magnitude than changes in selection – S_1^2 also increases, much more so than S_0^2. Their difference would also be larger, promoting more wage inequality, by 30 per cent.

Preference This case studies the situation where employed people have severe disutility from unemployed partners in the MM. Would this experiment predict substantial increase in inequality similar as that perceived in the literature? Suppose disutility is 20 per cent higher. As the literature suggests, wage inequality deepens, but by only 2 per cent. But it is not driven by selection, as the change is small. The slight increase in inequality is driven by a larger fall in S_0^2 than in S_1^2. As the employed would be less likely to marry unemployed partners, unemployed agents would receive fewer marriage proposals from them and lose the would have been larger surplus from marrying up.

6.3 Extensions

The benchmark model assumes employment affects the marriage market for single agents. It predicts that when agents earn reservation wage, wage inequality between married and single agents is driven purely by the presumed employment effects: a net gain from being employed in the marriage market for single agents reduces their reservation wage from what is otherwise identical to married agents.

In what follows, I extend the model to include employment effects for married agents. One way to encompass employment effects for married agents is to suppose marriage to be costly to maintain. Employed agents spend on gifts or entertainment, while unemployed agents spend time and engage in home production. Employment status thus affect married agents differentially, which in turn can have implications on wages.

I also consider marriage effects on the labor market that would have implications for agents earning more than their reservation wage. One possibility is to consider firms's bias in favor of married workers. According to the Sociology literature, some firms perceive married people are easier to retain, while others simply see married people to work harder because they have to raise a family. When casting firms's bias as a taste aspect, firms consider married people more productive. However, when workers have no bargaining power, firms's taste does not affect wages. To have productivity affecting wages is synonymous to giving workers some bargaining power. By letting agents earn more than reservation wage, labor market policy can have a direct impact on wage inequality.

Both of the above circumstances can lead to more interesting competing explanations to wage inequality.

6.3.1 Marriage Maintainence

Marriage or relationship is costly to maintain. Employed agents incur a cost of $\phi > 0$ in terms of the CM goods, while unemployed agents use time as inputs to maintain relationship.[18] This added feature changes only the CM description. Now, the value of an agent in the CM with employment status e, marital status m, and match quality q is

$$\begin{aligned} V^3_{em}(q) &= \max_{c_m \geq 0} c_m + \beta V^1_{em}(q) \\ \text{s.t. } c_m &\leq ew_m + (1-e)b + m[e'w' + (1-e')b - e'\phi - e\phi] + 2^m T \end{aligned}$$

Solving the model for reservation quality, equation (19) for unemployed agents is unchanged, while equation (20) for employed agents becomes

$$R_{11} = u + \frac{\lambda^2\gamma}{r+\delta^2}\{\pi_{11}\int_{R_{11}}[1-F(q)]dq + \pi_{10}\int_{R_{10}}[1-F(q)]dq\} - \frac{w_1-\phi}{\beta} \tag{21}$$

where $R_{10} = R_{11} + \tau + (w_1 - \phi)/\beta$. Now employed agents get less consumption from marrying another employed agent when marriage is costly to maintain; they will be more selective than those in the benchmark framework. The upper bound for R_{11} is obtained from the relation (15), where $R_{10} = R_{11} + \tau + (w_1 - \phi)/\beta < \overline{q}$ for a mixing equilibrium to occur. This implies $R_{11} < \overline{q} - \tau - (w_1 - \phi)/\beta$. The lower bound for R_{00} is the same as that given in the benchmark framework.

Solving the model for wages, I get

$$w_1 - w_0 = (1-\delta^2)\phi + S_1^2 - S_0^2$$

It is possible that ϕ is high and $S_1^2 - S_0^2 < 0$ and $w_1 > w_0$.

The additional parameter ϕ is identifiable from the wage data. Note that $w_1 = \beta\ell + (1-\delta^2)\phi$ and $w_0 = \beta\ell + S_0^2 - S_1^2(\phi)$. Substitute out $\beta\ell$ in w_1 using the wage expression from w_0 yields $w_1 = w_0 + S_1^2(\phi) - S_0^2 + (1-\delta^2)\phi$. An estimate for ϕ is obtained from $\phi = h^{-1}(w_1 - w_0 + S_0^2)$, where $h(\phi) = S_1^2(\phi) + (1-\delta^2)\phi$.

Results show that the optimal choice of u is 0.25. It is 0.1 lower than the one

[18] Alternatively, one may let unemployed agents choose to allocate time for leisure and relationship maintainence. However, the two activities are not distinct, and data are unavailable to shed light on this issue. One can also model endogenous relationship capital for married people.

in the benchmark framework. It may appear to be counter-intuitive in the first brush: one may think that if marrige is costly to maintain, then agents may enjoy singlehood more. As shown from (21), both u and ϕ raise R_{11}. A higher u makes one more selective; but a higher ϕ also makes one selective because when employed agents get less consumption from marriage (due to maintainence cost), they require a compensating differential of higher match quality. Further, reservation quality is more responsive to ϕ than u because ϕ not only directly affects R_{11}, but it also indirectly affects R_{11} via R_{10} (it raises the expected match surplus by being less picky to unemployed partners). As $\phi > 0$, the estimate for u need to go down so that R_{11} will not get out of bound.

The parameter estimates are similar to those in the bechmark framework in general (Table 3). Most noticeable change comes from the meeting technology parameters: λ^2, γ, and σ become smaller.

Given the parameter estimates, I compute reservation match quality. Reservation match quality ranks the same as the benchmark framework. Despite having a lower contact rate due to a smaller γ and a smaller consumption gain when marriage occurs due to costly marriage maintainence, employed agents remain to be less selective towards the likes than unemployed agents because there is still a net gain to consumption when married. Similar to the benchmark framework, employed agents have a higher propensity to marry than unemployed agents. But now, unemployed agents also marry faster.

(to be continued)

7 Conclusion

In this paper, I study wage inequality between married and single agents in an economy where frictional labor and marriage markets interact and agents are homogeneous. The key friction emulates from the marriage market where the frequency of contact is higher for employed agents and meeting is non-random. I show that equilibrium exists generically and the equilibrium is unique. I also demonstrate that marriage premium can arise in equilibrium where agents are paid their reservation wage.

I construct a sample of newly high-school graduates using data from the Panel Study of Income Dynamics Transition to Adulthood (PSID-TA) file. I apply the above framework to the sample of Millennial cohorts by estimating the model structurally. I develop an identification procedure to estimate the preference parameter for singlehood.

Estimation results indicate that meeting in the marriage market is significantly non-random, employed agents contact people significantly more, and disutility toward unemployed partners is insignificant. The results also indicate that the labor market is more active than the marriage market. The main result indicates that non-random meeting and more abundant contact for employed single agents make employment to be more valuable in the marriage market. Single agents take a lower wage and make it up by such gain in the marriage market. Further, insofar as being employed incurs costly relationship upkeep, married people take a higher base wage to offset those cost in the marriage market.

Evaluating among competing factors for wage inequality, I find that labor market policy in the form of job search assistance promotes wage inequality more than marriage market policy in the form of dating subsidies (think an easier assess to E-harmony), by a factor of 3. Changes in preference in the form of higher disutility from the employed toward unemployed partners or workplace policy on personal romance has trivial impact on inequality.

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	mean	Standard deviation
Unemployment duration (months)	12.10	10.70
Fraction of censored unemployment spells	0.26	
Job durations (months)	19.70	15.31
Fraction of censored job spells	0.25	
Singlehood duration (months)	52.42	29.59
Fraction of censored singlehood spells	0.70	
Marriage duration (months)	32.21	20.41
Fraction of censored marriage spells	0.83	

Table 1: Sample Statistics

u	λ^2	std dev λ^2	γ	std dev γ	Log L
0.05	0.054	0.0099	1.368	0.2141	-1586.2
0.15	0.062	0.0098	1.371	0.2177	-1559.8
0.25	0.069	0.0098	1.373	0.2179	-1536.5
0.35	0.074	0.0098	1.374	0.2174	-1528.1
0.45	0.076	0.0098	1.374	0.2174	-1526.9
0.55	0.077	0.0098	1.375	0.2174	-1524.6
0.65	0.078	0.0098	1.375	0.2174	-1522.1

note: standard deviation of estimates are bootstrapped values.

Table 2. Variation in the Utility of Singlehood

parameter	estimate	std dev	estimate	std dev
λ^1	0.068	0.0075	0.068	0.0075
δ^1	0.032	0.0003	0.032	0.0003
λ^2	0.074	0.0098	0.062	0.0099
γ	1.378	0.2860	1.315	0.3054
σ	0.247	0.1055	0.212	0.1016
τ	0.074	0.0981	0.074	0.0977
ϕ	--	--	0.138	0.0205

Note: standard deviation of estimates are bootstrapped values.

Table 3. Parameter Estimates

	Benchmark	Marriage maintainence
R10	1.6916	1.4545
R11	0.8889	0.8020
R00	1.0886	1.1186
R01	0.3600	0.3900
Marriage Hazard (employed)	0.0257	0.0405
Marriage Hazard (unemployed)	0.0118	0.0409
S1/S0	1.7147	1.4733
Pi-11	0.6904	0.6864
Pi-00	0.3196	0.3979

Table 4: Equilibrium Outcomes

	Workplace policy, $\sigma=0$	Marriage market policy, $2\lambda^2$	Labor market policy, $2\lambda^1$	Preference 2τ
△R11	-1.34	5.52	1.37	-0.10
△R00	0.92	1.84	-0.91	-0.92
△Marriage Hazard (employed)	0.00	8.56	3.11	-0.39
△Marriage Hazard (unemployed)	-2.54	8.47	3.48	-0.85
△S1/S0	-2.19	-0.13	2.40	0.65
△w1/w0	-9.57	11.08	29.79	2.10

Note: entry values are in percentage

Table 5: Counterfactuals, benchmark model

Appendix

Table A1: CPS hourly nominal wage bounds

		<HS		**HS**		**some College**	**College**		
year	nominal minimum wage	5-th %	95-th %	5-th %	95-th %	5-th %	95-th %	5-th %	95-th %
2005	5.15	5	12	5	13	4	13	6	16
2006	5.15	5	10.5	5.75	15	5.15	13	5.5	11
2007	5.85	5.15	11	6	18	5.5	17	6.13	22
2008	6.55	5.35	12.5	6.25	17.27	5.85	17.25	7.5	25
2009	7.25	6	13	6.65	18	3.5	19	8	32
2010	7.25	7	13	7.25	17.6	5.75	16.5	8	30
2011	7.25	7	14.25	7.25	18	7.25	18	8	31

The criteria for earning to be acceptable are:

1. If the pay unit is coded as hourly, earning must fall within the bounds in Table 2 for a given year and education status;
2. If the pay unit is coded as daily, earning must fall within the bounds that are multiplied by 8;
3. If the pay unit is coded as weekly, earning must fall within the lower bound times 30 and the upper bound times 50;
4. If the pay unit is coded as biweekly, earning must fall within the bounds in condition 3 multiplied by 2;
5. If the pay unit is coded as monthly, earning must fall within the bounds in condition 3 multiplied by 4.3; and
6. If the pay unit is coded as annually, earning must fall within the bounds in condition 3 multiplied by 52.