Career and Family Decisions: Cohorts born 1935 – 1975

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Question: How marriage and divorce affected wages and employment of white US males and females born from 1930s to 1970s?

- Life-cycle decisions of five cohorts in a unified econometric framework applied to CPS data

- Data: aggregate, by cohort and marriage

- Household model: education, marriage, employment and fertility

- Exogenous changes by cohort: Parents’ education; marriage opportunities; divorce costs; wages; fertility control

- Estimation and Results: fit, parameters, answer the question

- Counterfactual: shift from joint to individual taxation
Labor Market Data for Married, Divorced and Single


Motivation
Employment Rates
Married Female Employment Increased
Non-Married Employment Fluctuates

Single Females: 7% to 19% of population
Divorced Females: 3% to 13% of population
Married Females: 79% to 63% of population

Single Males: 10% to 24% of population
Divorced Males: 2% to 9% of population
Married Males: 86% to 64% of population

Women
Men

Caucasian, 22–65
Unemployment Rates: non-married and married are different quality

Caucasian, 22–65
Female Employment Rates by Cohort

Married Female

Non-Married Female

Born 1925
Born 1935
Born 1945
Born 1955
Born 1965
Born 1975

Years 1962-2014. Proportion of women working 10+ weekly hours.
Male Employment Rates by Cohort
No Change by Cohort

Married Men
Non-Married Men

Years 1962-2014. Proportion of men working 10+ weekly hours.

Caucasian, 22–65
Annual Wages of Full–Time Workers: Married women become like men?

Women

Annual Growth Rate 1980–2014:
Married 2%
Divorced 1.5%
Single 1.2%

Men

Annual Growth Rate 1980–2014:
Married 1.1%
Divorced 0.8%
Single 0.9%

Full-time full-year workers with non-zero wages. 2006 Prices.
“Marriage Premium” by Cohort

“Marriage premium” for males is ~constant and for females is increasing. Selection into marriage has changed

\[
\ln(W) = \beta_0 + \beta_1 \exp_i + \beta_2 \exp_i^2 + \beta_3 HSG_i + \beta_4 SC_i + \beta_5 CG_i + \beta_6 PC_i + \beta_7 M_i + u_i
\]

Caucasian, 22–65
“Marriage Premium” by Cohort

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<table>
<thead>
<tr>
<th></th>
<th>1935</th>
<th>1945</th>
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<td>Women</td>
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<tr>
<td>Average Wages - Married</td>
<td>21.9</td>
<td>26.7</td>
<td>31.3</td>
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<td>Men</td>
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<td>Average Wages - Married</td>
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<td>Average Wages - Unmarried</td>
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<td>41.0</td>
<td>39.6</td>
<td>42.7</td>
<td>46.4</td>
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<td>Married/Unmarried Difference rate</td>
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<td>14.2%</td>
<td>18.0%</td>
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<td>19.4%</td>
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<tr>
<td>Marriage Premium</td>
<td>19.7%</td>
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</table>

\[ \ln(W) = \beta_0 + \beta_1 \exp_i + \beta_2 \exp_i^2 + \beta_3 HSG_i + \beta_4 SC_i + \beta_5 CG_i + \beta_6 PC_i + \beta_7 M_i + u_i \]
Literature

- Chiappori (1992, 1988); Mazzocco, M. C.Ruis and S. Yamaguchi (2007); Gemici and Laufer (2011)
- Keane and Wolpin (1997, 2010)
- Eckstein and Lifshitz (2011)
- Mulligan and Rubinstein (2006)
- Fernandez and Wong (2011); Voena (2011)
- Greenwood and Seshardi (2005)
What do we do?

✓ Assume preferences are the same across the five cohorts (35, 45, 55, 65, 75). How much of the change in work/wage, marriage/divorce, education and fertility across the five cohorts are due to shifts in five potential factors?

✓ distribution of potential partners conditional on education: data and estimation

✓ divorce laws (cost): exogenous and estimated

✓ parent’s education and individual talent: data and estimation

✓ the wage/job offer distribution that depends on experience and education: endogenous and estimated

✓ birth control technology: exogenous and estimated
Main Results

- Fit differences across all cohorts in: **education, marriage, divorce, work and fertility**

- All five factors have *significant contribution* for fit and change in above outcomes

- Family formation and unit of decision is *essential* for fit/understanding of: employment, wages, education and fertility

- Model account for 90% of the women’s “marriage premium”; 34% is due to “age” *bias estimate of experience* and 64% for *unobserved skills* of married women

- Counterfactual: shift from joint to individual taxation would increase employment of married women by 9% and the marriage rate by 8.1%

- Labour supply *elasticities*: High for married women (>1); Low for the others (<0.5)
The Model
Females ($f$) and males ($m$) make annual decisions from age ($t$) 16 to 65.

Choice variables:

- Schooling
- Employment: full time, part time, unemployment
- Married / Divorce
- Fertility
Start as single ($M = 0$) in school ($sc = 1$):  
- Schooling: $sc = 1$ if younger than 30 and single and not employed  
- Employment: $emp = 1$;  
- Hours of work, $h_{\uparrow j}$: full time ($h = 1$), part time ($h = 0.5$) or 0;  
- Leisure: $l_{\downarrow j} = 1 - h_{\uparrow j}$, $j = f, m$;  
- Married: $M = 1$;  
- Fertility: $p = 1$; female get pregnant

$\downarrow jt =$ state space for $j = f, m$
Value functions for married

\[ V_{t|M}(m_t, f_t) = \lambda V_{t|M}(f_t) + (1-\lambda) V_{t|M}(m_t) \]

Weighted average of individuals utilities (\( \lambda = 0.5 \)).

**Net Income:** 
\[ Y_{t|M} = G Y_{t|M} - \tau_{t|M} (w_{t|m} h_{t|m} + w_{t|f} h_{t|f}, N_{t}) \]

\[ G Y_{t|M} = (w_{t|m} h_{t|m} + w_{t|f} h_{t|f}) + b_{m} \]

\[ I[h_{t|m} = 0] + b_{f} I[h_{t|f} = 0] \]

where \( \tau_{t} \) is a function that calculate taxes according to the year and number of children, returning net wages. The function uses data from US tax system including deductions, exemptions and EICT rates.

\( b_{m} \) – unemployment benefit

**Consumption:** 
\[ C_{t|M} = (1 - \theta(N_{t})) Y_{t|M} \]
\[ V_{it}M (B_{ij}t) = \frac{1}{\alpha} (\psi C_{it}M)^{\alpha} + L(l_{it}j)^{\alpha} + \theta l_{it}M + \pi l_{it}M p l t + \lambda_{ij}M + Q(l_{it}f, l_{it}m, \psi C_{it}, M, N, t) + d E I M (m_{i+1}l_{i+1}M (B_{il}m_{i+1}, B_{il}f_{i+1})^{\alpha} (1-m_{i+1}l_{it}f_{ محاسبه‌ی ویژگی‌های \psi C_{it}M) \]

- \( \frac{1}{\alpha} (\psi C_{it}M)^{\alpha} \) – Consumption (\( \psi = 0.85 \))
- \( L(l_{it}j)^{\alpha} \) – Leisure (depends on health, education, new born and stochastic shock)
- \( \theta l_{it} \) – utility from marriage (function of education and health gap and stochastic shock)
- \( \pi l_{it}M p l t \) – utility from pregnancy (function of health, number of children, previous period pregnancy and stochastic shock)
- \( A\psi M Q \) – quality and quantity of children (function of parents’ leisure and consumption)
Where

$L(l_{jt}) = \beta_{jt} / \gamma (l_{jt})^\gamma + \mu_{jt} l_{jt}^\gamma$ – Value of Leisure

- $\beta_{jt}$ – tastes for leisure, depends on health$(H_{jt})$, education $(E_{jt})$ and pregnancy (for females)

- $\ln(\mu_{jt}) = \tau_{0j} + \tau_{1j} \ln(\mu_{jt} - 1) + \tau_{2j} p_{jt} - 1 + \epsilon_{jt}$ and $\epsilon_{jt} \sim iidN(0, \sigma_{\epsilon_{jt}^2})$

- $\mu_{jt}$ – marginal utility of leisure that increases with a new born and then slowly converge to the steady state value of $\tau_{1j}$ (ar(1)).
\[
V_{it}TM(\Theta_{ijt}) = \frac{1}{\alpha} (\phi_{it}TM)Ia + L(l_{itj})I + \theta_{it}TM + \pi_{it}TM pIe + A_{ij}TM Q(l_{itj}, l_{it}, V_{it}M, N_{it}) + \delta EV(\Theta_{ij}, t+1)
\]

\[
\theta_{it}TM = \text{utility from marriage:}
\]

\[
\theta_{it}TM = d_{1} + d_{2} \cdot I\left[ E_{it} = 3 \right] + d_{3} \cdot I\left[ E_{it} = 4 \right] + d_{4} \cdot I\left[ H_{it} = 3 \right] + \varepsilon_{it}TM
\]

Where: \( I\left[ E_{it} = 3 \right] \) is an indicator function

**Education**: \( E = 1 \) if HSD, \( E = 2 \) if HSG, \( E = 3 \) if SC, \( E = 4 \) if CG, \( E = 5 \) if PC.

**Health**: \( H = 1 \) if Good, \( H = 2 \) if Fair, \( H = 3 \) if Poor.

\( \varepsilon_{it}TM \sim iid N(0, \sigma_{\varepsilon}TM) \) = stochastic shock to tastes for marriage.
\[ V_{ij}M (D_{ij}) = \frac{1}{\alpha} (\phi & C_{ij}T_M )^\alpha + L_i (L_{ij})^\gamma + \theta i e + \pi i e M p i e + A_{ij} & T_M Q (U_{ijT}, H_{ij}, V_{ijT}, N_{ijT}) \]

\[ + \delta E_{ij}(D_{ijT} + 1) \]

\[ \pi i e M p i e = \text{utility from pregnancy:} \]

\[ \pi i e = \pi i 1 m i t + \pi i 2 \text{Hi}+ \pi i 3 \text{N} + \pi i 4 \text{pi} - 1 + \epsilon i e + \exp (\epsilon i e u p) \]

\[ \epsilon i e p - \text{iid}(0,c i e p) \quad \epsilon i e u p - \text{iid}(p r,1) \]

\[ \pi i 1 = \text{fixed utility of pregnancy when married;} \]

\[ \text{Hi} = \text{mother’s health;} \]

\[ \epsilon i e p = \text{shock to tastes for pregnancy; joint taste.} \]

\textbf{Uncontrolled pregnancy:} \( \epsilon i e u p \) a positive shock to equation (6) of size \( p r \)
 Married person utility (cont.)

\[
V(t, j|\mu(t + 1), \pi(t + 1), \phi(j + 1)| \theta(t + 1), \nu(t + 1), A(t + 1), Q(t + 1)) = \frac{1}{\alpha} (\psi(j + 1)|\theta(t + 1), \nu(t + 1), A(t + 1), Q(t + 1)) + \delta_{\text{MAX}} (m(t + 1), t + 1, f(t + 1) + (1 - m(t + 1))V(t + 1, j + 1))
\]

\[
A(t + 1, j|\mu(t + 1), \pi(t + 1), \psi(t + 1), \phi(t + 1)| \theta(t + 1), \nu(t + 1), A(t + 1), Q(t + 1)) = \text{utility from quality and quantity of children:}
\]

\[
Q(t, f(t), m(t), \mu(t), \pi(t)) = (a_f(t)|l(t), \mu(t), \pi(t)|p + a_m(t)|l(t), \mu(t), \pi(t)|p + a_g(\theta(t)|l(t), \mu(t), \pi(t)|p + (1 - a_f(t) - a_m(t) - a_g(\theta(t)|l(t), \mu(t), \pi(t)|p))Y(t))
\]

\[
\theta(t)|l(t), \mu(t), \pi(t)|p = \text{spending per child;}
\]

\[
A^M = \text{a scale parameter allowed to differ in the single state.}
\]
The health transition probability is a multinomial Logit function:

\[
v_{tj}^{GOOD} = \chi_{1j}^{GOOD} \cdot I(H_{jt-1} = 1) + \chi_{2j}^{GOOD} \cdot I(H_{jt-1} = 2) + \chi_{3j}^{GOOD} \cdot I(H_{jt-1} = 3)
\]

\[
v_{tj}^{FAIR} = \chi_{1j}^{FAIR} \cdot I(H_{jt-1} = 1) + \chi_{2j}^{FAIR} \cdot I(H_{jt-1} = 2) + \chi_{3j}^{FAIR} \cdot I(H_{jt-1} = 3)
\]

\[
v_{tj}^{POOR} = 0
\]

\[
\Pr(H_{jt} = 1) = \frac{\exp(v_{tj}^{GOOD})}{1 + \exp(v_{tj}^{GOOD}) + \exp(v_{tj}^{FAIR})}
\]
Value functions for singles

Female: $U_{t,j} = \frac{1}{\alpha} (C_{t,j})^{\alpha} + \delta_{j} s_{t} e_{t} + \pi_{t,e} q_{t} + \alpha_{t} Q(0, Y_{t}, N_{t}, \lambda_{t})$

Male: $U_{t,m} = \frac{1}{\alpha} (C_{t,j})^{\alpha} + L_{t} + \delta_{j} m_{t} e_{t} + A_{t} Q(0, Y_{t}, N_{t}, \lambda_{t})$

$\delta_{j} s_{t} e_{t} = $ utility from school: $\delta_{j} = \delta_{0,j} + TC / (E(t) > HSG) + \delta_{1,j} PE / \mu_{j, W}$

Where: $PE$ – Parents Education; $TC$ – college tuition; $\mu_{j, W}$ – skill endowment

Income: $Y_{t,j} = Y_{t} = GY_{t,j} - \tau_{t} S(w_{t,j}, h_{t,j}, N_{t})$

$GY_{t,j} = w_{t,j} h_{t,j} + b_{j} - j h_{t,j} = b_{j} + cb_{t} (N_{t} > j = j, N_{t} > 0)$: $cd$: child benefit

Budget constraint $C_{t,j} = (1 - \theta(N_{t})) Y_{t,j}$
Wage equation:

\[ \ln w_{e,t,j} = \omega_1 e_{j} + \omega_2 e_{j} X_{t} - \omega_3 e_{j} X_{t}^2 + \epsilon_{j,t,W} \]

Where: \( X_t \) is work experience (in years) and \( e \in \{HSD, HSG, SC, CG, PC\} \)

\[ \epsilon_{j,t,W} = \mu_{j,W} (PE) + \epsilon_{j,t,W} \]

\[ \sim iidN(0,\sigma_{\epsilon,W}) \]

\( \epsilon_{j,t,W} \) has permanent and transitory elements - \( \mu_{j,W} \) - skill endowment

Job offers: each period (year) a person can receive offers: only full time; only part time; both full and part time and no offer; with a probability depending on previous period employment, \( E_{j,t} \); \( X_{j,t} \); \( H_{j,t} \) - standard logit function; different for men and female.
Marriage offer is a product of two probabilities:

1. Prob. for singles to get marriage offers, function of age and whether in school

2. Potential partner's education, a multinomial Logit probability function:

\[ \begin{align*}
\psi(j,t|C) &= \eta(j|C) + \eta_1(j|C) \cdot I[edm - edf = 2] + \eta_2(j|C) \cdot I[edm - edf = 1] + \epsilon(j,t|C) \\
&= \eta(j|SC) + \eta_1(j|SC) \cdot I[edm - edf = 1] + \epsilon(j,t|SC)
\end{align*} \]

Where: \( ed = 0 \) for HS and HSD; \( ed = 1 \) for SC; \( ed = 2 \) for CG and PC

3. Marriage offer for a female consists of the vector (same age):

\[ M(j,t|f) = (E(j|m), H(j|m), X(j|m), N(j|m), P(m)e(j|m), h(j,t) - 1(m), \mu(j|m,l), \mu(j|m|W), \epsilon(j,m,t|W), \epsilon(j,t|M)) \]
Marriage decision problem

**Marriage:** Given $M_{ft}$, the woman maximizes $V_{t \uparrow f} (\downarrow ft)$ and $V_{t \uparrow f M} (\downarrow ft)$

The potential male does the equivalent

If there is at least one set of choices at the period of the match that satisfies

$V_{t \uparrow f M} (\downarrow ft) > V_{t \uparrow f} (\downarrow ft)$ and $V_{t \uparrow m M} (\downarrow mt) > V_{t \uparrow m} (\downarrow mt)$, then marriage is formed.

If there is more than one, we choose the one that maximize the weighted values.

**Divorce** occurs if:

$$V_{t \uparrow j M} (\downarrow ft, \downarrow mt, \downarrow p_t | \Upsilon_{mt}, \Upsilon_{ft}) \geq V_{t \uparrow j} (\Upsilon_{ft}, \downarrow m_j t)$$

where $\Delta_{j t}$ is the cost of divorce; $\Delta_{j t} = \alpha_{4j} + \alpha_{5j}$.
Estimation

- DP problem is solved recursively – Age 65 to 17 with terminal value
- Estimate by simulated GMM and Identification is based on exogenous variations as in Heckman (1974) – wages; health; taxes; benefits; age
- CPS data (moments) of the cohorts of: 1945 (1943-1947); 1955; 1965
- Untargeted Cohorts: 1935; 1975
- Estimate model on unified sample 1945-55-65
- Keep all preferences parameters as estimated for the unified sample
- Estimate exogenous process for each cohort separately
161 Parameters (unified sample)

<table>
<thead>
<tr>
<th>moment</th>
<th># of moments 1945</th>
<th># of moments 1955</th>
<th># of moments 1965</th>
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<td>30**</td>
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<tr>
<td>Unmarried Women Employment</td>
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<tr>
<td>Married Men Employment</td>
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<tr>
<td>Unmarried Men Employment</td>
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<td>Unmarried Men Full Time</td>
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<tr>
<td>Married with Children Women Employment</td>
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<tr>
<td>Married no Children Women Employment</td>
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<tr>
<td>Unmarried with Children Women Employment</td>
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<td>Unmarried no Children Women Employment</td>
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<td>30**</td>
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<tr>
<td>Men Schooling Distribution – 5 groups</td>
<td>5 X 14***</td>
<td>5 X 14***</td>
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<tr>
<td>Women Schooling Distribution – 5 groups</td>
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<td>Marriage Rate</td>
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<td>30**</td>
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<tr>
<td>Divorce Rate</td>
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<td>Women # of Children by Age</td>
<td>24****</td>
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<td>24****</td>
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<tr>
<td>Married Women # of Children by Age</td>
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<tr>
<td>Men Wage</td>
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<td>Assortative Mating</td>
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<td>Wage by education level – women only</td>
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<td>5 X 30**</td>
<td>5 X 30**</td>
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<tr>
<td>Employment by education level – women only</td>
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<td>5 X 40*</td>
<td>5 X 30**</td>
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<tr>
<td>Women Health distribution</td>
<td>3 X 44*****</td>
<td>3 X 44*****</td>
<td>3 X 44*****</td>
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<tr>
<td>Men Health distribution</td>
<td>3 X 44*****</td>
<td>3 X 44*****</td>
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</tbody>
</table>
Model Fit and Parameters
Benchmark Model: estimated on unified sample of 45–55–65 cohorts where only mother’s education and health transition process differs by cohort. mother’s education affects: tastes for school and ability type (cohort: college rate: 35:6%, 45:6%, 55:11%, 65:20%, 75:27%)

Adjusted Model by cohort: preferences parameters as estimated in Benchmark Model; But the 4 exogenous processes are per cohort:
- Marriage Market: parameters of the marriage market matching function and Divorce Costs by gender and number of children
- Labor Market: wage offer functions and the job offer probabilities.
- Birth Control Technology
Model Fit

- We fit well the moments of: (simple chi-square tests)
  - Employment and wages for married/unmarried: Fit increase in wages of married females above non-married in recent cohorts
  - Education distribution
  - Assortative matching matrix
  - Marriage and divorce rates
  - # of children for married/unmarried

- For the cohorts of:

- All exogenous changes by cohort were needed
We fit the Education Distribution for both men and women for all cohorts.

The distribution is mainly effected by the increase in mother’s education and by the rise in return to education in the wage function.
• We fit the marriage and divorce rates for all cohorts
• The marriage rate is mainly effected by the increase in mother’s education that postpone marriages
• The divorce rate is mainly effected by the decrease in the women’s divorce cost
• **Women’s divorce cost by estimated parameter:**  
<table>
<thead>
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<th>Year</th>
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<tbody>
<tr>
<td>Cost</td>
<td>-2.93</td>
<td>-2.14</td>
<td>-1.80</td>
<td>-1.47</td>
<td>-1.57</td>
</tr>
</tbody>
</table>
• We fit the number of children for married and single household
• The number of children in younger cohorts is mainly effected by the SBTC – the increase in return to education and experience
• The number of children in early cohorts (1935,1945) is mainly effected by the lack of contraception and the random shock.
• Higher mean of the positive shock in the utility from pregnancy function represent unexpected pregnancies by size of mean:

<table>
<thead>
<tr>
<th>Year</th>
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<th>1965</th>
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</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.80</td>
<td>0.39</td>
<td>0.06</td>
<td>0.02</td>
<td>0.02</td>
</tr>
</tbody>
</table>
• We fit employment for married/ non married
• The employment is mainly effected by the SBTC – the increase in return to education and experience by education
• In early ages, it is also effected by the availability of oral contraception
### Wage Parameters

<table>
<thead>
<tr>
<th>Year</th>
<th>HSD</th>
<th>HSG</th>
<th>SC</th>
<th>CG</th>
<th>PC</th>
<th>HSD</th>
<th>HSG</th>
<th>SC</th>
<th>CG</th>
<th>PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935</td>
<td>9.22</td>
<td>9.30</td>
<td>9.72</td>
<td>9.99</td>
<td>10.07</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>1945</td>
<td>9.28</td>
<td>9.59</td>
<td>9.83</td>
<td>10.17</td>
<td>10.16</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>1955</td>
<td>9.39</td>
<td>9.56</td>
<td>9.80</td>
<td>10.08</td>
<td>10.38</td>
<td>0.02</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
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<tr>
<td>1965</td>
<td>9.22</td>
<td>9.50</td>
<td>9.73</td>
<td>10.12</td>
<td>10.19</td>
<td>0.03</td>
<td>0.05</td>
<td>0.06</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>1975</td>
<td>9.24</td>
<td>9.42</td>
<td>9.59</td>
<td>10.17</td>
<td>10.41</td>
<td>0.02</td>
<td>0.06</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Convergence in men and women return to education and experience by education

- Large SBTC for both men and women by cohorts
Model Fit: Wages

Married Women

Unmarried Women

Married Men

Unmarried Men
- We fit Wages for married/ non married, women and men
- We fit the increasing wage of married compared to unmarried, even though the wage equation is the same for married/unmarried
Simulated Annual Wages by Education level and years of Experience

Cohort of 1935

Cohort of 1975
“Marriage Premium”: Data vs. Model’s simulated data
**Marriage Premium**

### Men

<table>
<thead>
<tr>
<th>Year</th>
<th>1935</th>
<th>1945</th>
<th>1955</th>
<th>1965</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>20%</td>
<td>19%</td>
<td>20%</td>
<td>20%</td>
<td>18%</td>
</tr>
<tr>
<td>Fitted</td>
<td>13%</td>
<td>14%</td>
<td>14%</td>
<td>14%</td>
<td>14%</td>
</tr>
</tbody>
</table>

70% –75% of men premium is captured by the model: Other factors?

### Women

<table>
<thead>
<tr>
<th>Year</th>
<th>1935</th>
<th>1945</th>
<th>1955</th>
<th>1965</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>–9%</td>
<td>–7%</td>
<td>–2%</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>Fitted</td>
<td>–8%</td>
<td>–6%</td>
<td>–1%</td>
<td>2%</td>
<td>4%</td>
</tr>
</tbody>
</table>

- 14% change from 1935 to 1975
- Model explains 90% of the marriage premium and the change for females
- Married women of recent cohorts have much higher observed and unobserved skills compared both to unmarried women and the married women of past cohorts
### AGE (OLS) vs. EXPERIENCE (MODEL)

<table>
<thead>
<tr>
<th>Year</th>
<th>HSD</th>
<th>HSG</th>
<th>SC</th>
<th>CG</th>
<th>PC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>Model</td>
<td>OLS</td>
<td>Model</td>
<td>OLS</td>
</tr>
<tr>
<td>1935</td>
<td>0.04</td>
<td>0.02</td>
<td>0.01</td>
<td>0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>1945</td>
<td>0.01</td>
<td>0.03</td>
<td>0.00</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>1955</td>
<td>0.00</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>1965</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>1975</td>
<td>0.00</td>
<td>0.02</td>
<td>0.02</td>
<td>0.06</td>
<td>0.05</td>
</tr>
</tbody>
</table>

- OLS using *age* as proxy to experience **underestimate** the return to experience. Especially when employment rates are low.
- The bias is high in earlier cohorts where women’s employment rates were lower.
- The bias is smaller for men
Model explained 90% of the 14% increase in marriage

- 34% of the increase in marriage premium is due to the increase in women’s employment (experience) over time
- 64% of the increase is due to the increase in unobserved ability (selection)
Men Marriage Premium

- Predicted marriage Premium is 71% of Actual marriage premium
- 60% of the marriage premium is explained by the fact that married men work more
- 40% is explained by selection into marriage of men with higher unobserved ability
The Impact of changes in Exogenous Factors on Life-Cycle outcomes: 1935 cohort vs. 1975 cohort
Compare outcome of 1935 to 1975 using alternating exogenous factors

4 experiments to measure impact: each experiment we re-estimated group of parameters to fit 1935 moments, but the rest of the parameters are those of the 1975 cohort:

1: mother's education: simulate the 1935 cohort moments using 1975 parameters but 1935 mother's education

2: marriage market: re-estimate with the marriage market parameters of 1935 cohort all other parameters of 1975 cohort

3: labor AND marriage market: re-estimate the labor market AND marriage market parameters of 1935 holding all other parameters of 1975

4: pregnancy shock – re-estimate the labor market AND marriage market parameters AND pregnancy shock of 1935 holding all other parameters of 1975
How much of the change is due to the increase in mother’s education?

- 29% of the increase in the rate of CG women
- 11% of the increase in the rate of CG men
- 55% of the decrease in marriage rate
- 20% of the decrease in married women fertility
- 10% of the increase in married women’s employment and 7% for unmarried
- 12% of the increase in Married Women’s wages vs. 6% for unmarried (minor effect on men’s wages)

Different effect for Married/Unmarried – due to Selection!
2: Marriage Market Effect

- How much of the change is due to the change in marriage market?

  - Experiment 2: re-estimate with the marriage market parameters of 1935 holding all other parameters at 1975 values

  - 35% of the increase in the rate of CG women
  - 22% of the increase in the rate of CG men
  - 30% of the decrease in marriage rate
  - 75% of the increase in divorce rate
  - 30% of the decrease in married women fertility
  - 7% of the increase in married Women’s wages vs. 2% for unmarried

- Different effect for married/unmarried – Selection!
3: Labor Market Effect

- How much of the change is due to the change in labor market (both wages and job offers)?
- Experiment 3: re-estimate the labor market AND marriage market parameters of 1935 holding all other parameters at 1975 values
  - 32% of the increase in the rate of CG women
  - 67% of the increase in the rate of CG men
  - 30% of the decrease in married women fertility
  - Above 90% of the increase in men and unmarried women’s wages vs. 75% for married women
- Different effect for Married/Unmarried – Selection!
How much of the change is due to the Pill?

Experiment 4: re-estimate the labor market AND marriage market parameters AND pregnancy shock of 1935 holding all other parameters at 1975 values

- 50% of the decrease in married women fertility vs. 80% for unmarried
- 25% of the increase in Married Women’s employment vs. 10% for unmarried
- Above 4% of the increase in married women’s wages vs. 2% for unmarried women

Different effect for Married/Unmarried – Selection!
What accounts for the change in married women wages?

- Mother’s education: 6%
- Marriage market: 22%
- Labor market: 52%
- Contraception: 20%

<table>
<thead>
<tr>
<th>Women’s Wages</th>
<th>1935</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>21k</td>
<td>39k</td>
</tr>
<tr>
<td>Unmarried</td>
<td>23k</td>
<td>37k</td>
</tr>
<tr>
<td>Marriage Premium</td>
<td>−8%</td>
<td>+4%</td>
</tr>
</tbody>
</table>
Necessary and Sufficient

- The changes in:
  - Mother education
  - Marriage market
  - Labor market
  - Contraception

- are “Necessary and Sufficient” to explain **all** the changes from 1935 to 1975

- Necessary – We had to change all 4 to explain the change
- Sufficient – We didn’t need to change **ANY** of the preferences parameters!
### Implementing Individual Taxation of Income for 1965 cohort

<table>
<thead>
<tr>
<th>Gross Wages (Thousands of $)</th>
<th>Fitted</th>
<th>Ind. Tax taxes fixed</th>
<th>percentage change</th>
<th>1965</th>
<th>Ind. Tax revenue neutral</th>
<th>percentage change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married Women</td>
<td>41.9</td>
<td>42.4</td>
<td>1.3%</td>
<td></td>
<td>42.4</td>
<td>1.2%</td>
</tr>
<tr>
<td>Unmarried women</td>
<td>42.0</td>
<td>42.3</td>
<td>0.6%</td>
<td></td>
<td>42.3</td>
<td>0.7%</td>
</tr>
<tr>
<td>Married Men</td>
<td>63.4</td>
<td>63.3</td>
<td>-0.2%</td>
<td></td>
<td>63.3</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Unmarried Men</td>
<td>47.6</td>
<td>47.7</td>
<td>0.0%</td>
<td></td>
<td>47.7</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Married Women</td>
<td>0.65</td>
<td>0.70</td>
<td><strong>8.3%</strong></td>
<td></td>
<td>0.71</td>
<td>9.0%</td>
</tr>
<tr>
<td>Unmarried women</td>
<td>0.75</td>
<td>0.76</td>
<td><strong>8.9%</strong></td>
<td></td>
<td>0.76</td>
<td>9.2%</td>
</tr>
<tr>
<td>Married Men</td>
<td>0.89</td>
<td>0.89</td>
<td>0.6%</td>
<td></td>
<td>0.89</td>
<td>0.9%</td>
</tr>
<tr>
<td>Unmarried Men</td>
<td>0.76</td>
<td>0.76</td>
<td>-0.1%</td>
<td></td>
<td>0.76</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Family moments</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Marriage Rate</td>
<td>0.68</td>
<td>0.73</td>
<td><strong>8.0%</strong></td>
<td></td>
<td>0.73</td>
<td>8.1%</td>
</tr>
<tr>
<td>Divorce Rate</td>
<td>0.12</td>
<td>0.12</td>
<td>-4.3%</td>
<td></td>
<td>0.12</td>
<td>-4.1%</td>
</tr>
<tr>
<td>Married Women # of Children</td>
<td>1.66</td>
<td>1.60</td>
<td>-3.9%</td>
<td></td>
<td>1.59</td>
<td>-4.0%</td>
</tr>
<tr>
<td>UnMarried Women # of Children</td>
<td>0.40</td>
<td>0.40</td>
<td>-1.1%</td>
<td></td>
<td>0.40</td>
<td>-1.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Women's CG+PC rate</td>
<td>0.24</td>
<td>0.25</td>
<td><strong>4.2%</strong></td>
<td></td>
<td>0.25</td>
<td>4.2%</td>
</tr>
<tr>
<td>Men's CG+PC rate</td>
<td>0.26</td>
<td>0.26</td>
<td>0.0%</td>
<td></td>
<td>0.26</td>
<td>0.0%</td>
</tr>
</tbody>
</table>
Labour Supply Elasticities

- Marshallian labour supply elasticities by gender, marital status, age and cohort.
- Simulating permanent 5% increases in offer wages in all states

<table>
<thead>
<tr>
<th>Elasticities</th>
<th>1935</th>
<th>1945</th>
<th>1955</th>
<th>1965</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married Women - Ages 25-34</td>
<td>1.80</td>
<td>1.84</td>
<td>1.27</td>
<td>1.25</td>
<td>1.13</td>
</tr>
<tr>
<td>Married Women - Ages 35-44</td>
<td>1.12</td>
<td>1.32</td>
<td>1.13</td>
<td>1.12</td>
<td>1.18</td>
</tr>
<tr>
<td>Married Women - Ages 45-54</td>
<td>1.20</td>
<td>1.10</td>
<td>1.04</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Unmarried women - Ages 25-34</td>
<td>0.21</td>
<td>0.23</td>
<td>0.19</td>
<td>0.18</td>
<td>0.22</td>
</tr>
<tr>
<td>Unmarried women - Ages 35-44</td>
<td>0.19</td>
<td>0.28</td>
<td>0.21</td>
<td>0.21</td>
<td>0.17</td>
</tr>
<tr>
<td>Unmarried women - Ages 45-54</td>
<td>0.16</td>
<td>0.16</td>
<td>0.20</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>Married Men - Ages 25-34</td>
<td>0.15</td>
<td>0.15</td>
<td>0.20</td>
<td>0.17</td>
<td>0.19</td>
</tr>
<tr>
<td>Married Men - Ages 35-44</td>
<td>0.14</td>
<td>0.17</td>
<td>0.20</td>
<td>0.15</td>
<td>0.17</td>
</tr>
<tr>
<td>Married Men - Ages 45-54</td>
<td>0.16</td>
<td>0.19</td>
<td>0.20</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Unmarried Men - Ages 25-34</td>
<td>0.16</td>
<td>0.16</td>
<td>0.20</td>
<td>0.18</td>
<td>0.23</td>
</tr>
<tr>
<td>Unmarried Men - Ages 35-44</td>
<td>0.17</td>
<td>0.20</td>
<td>0.21</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>Unmarried Men - Ages 45-54</td>
<td>0.21</td>
<td>0.18</td>
<td>0.16</td>
<td>0.22</td>
<td></td>
</tr>
</tbody>
</table>
Summary and Conclusions

- The change in household formation is **essential** for understanding labor supply, education and fertility.

- **Married women of recent cohorts** have much **higher** observed and unobserved skills compared both to unmarried women and the married women of past cohorts.

- The marriage matching selection is an important factor in explaining individual outcomes of wages, employment, education and fertility.
Potential Extensions

- Add Blacks and Hispanics for aggregate analysis
- Savings and retirement? Need faster/stronger computer processors
- How important is assortative mating for household inequality?
- Forecast macro changes in the socio-demographic structure into the future cohorts
Thanks
• We fit Wages for married/ non married, women and men
• We fit the increasing wage of married compared to unmarried, even though the wage equation is the same for married/unmarried